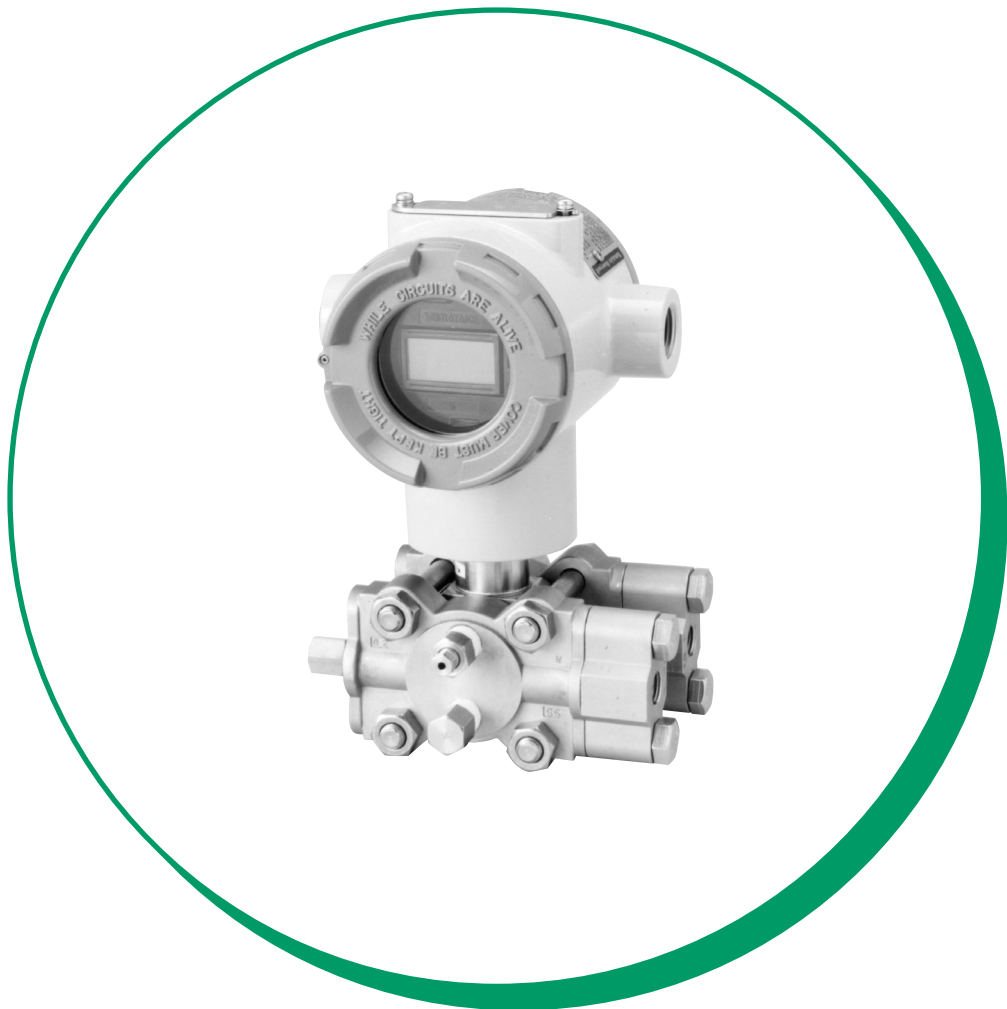


**ST3000 Smart Transmitter Series900
Differential Pressure/Pressure Transmitter
with FOUNDATION™ fieldbus
Models: STD, STG, STA, STC,
STE, STR, STH and STU**

User's Manual



Yamatake Corporation

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Safety

Instructions

Preface

Correct installation and periodic maintenance are essential to the safe use of your differential pressure transmitters.

Read the safety instructions provided in this manual carefully and understand them fully before starting installation, operation, and maintenance work.

Inspection

On delivery, make sure that the specifications are correct and check for any damage that may have occurred during transportation. This equipment was tested under a strict quality control program before shipment. If you find any problem in the quality specifications, please contact your Yamatake Corporation representative immediately, providing the model name and serial number.

The name plate is mounted on the top of the enclosure.

Precautions

The following symbols are used in this manual to ensure user safety.

WARNING

This symbol is used to warn of hazards where failure to observe a safety instruction may result in death or serious injury.

CAUTION

This symbol is used to warn of hazards where failure to observe a safety instruction may result in injury or physical damage.

To ensure safe operation, be sure to observe the safety instructions provided on the next page.

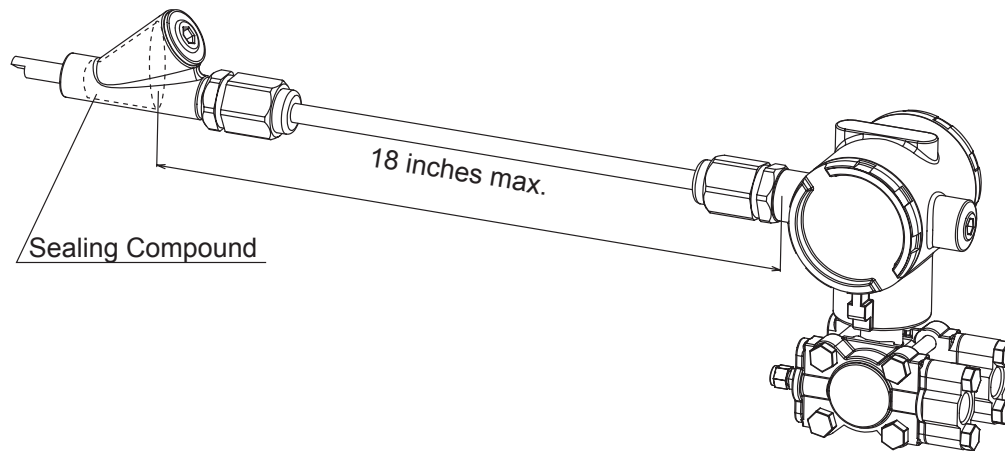
Yamatake Corporation will assume no responsibility, or offer any guarantee for any failure resulting from violation of these safety instructions.

Explosion protected Models

FM Explosionproof/Dust -ignitionproof Apparatus (in accordance with NEC)

CAUTION

-
- Install the apparatus only in areas for which the apparatus has been approved.
 - Seal each conduit entering the apparatus enclosure within 18 in.(457mm) from the enclosure.
 - Do not open the apparatus enclosure when an explosive atmosphere is present.
-



1. Class I, Division 1 locations

1.1 Wiring methods

- **Threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable with termination fittings approved for the location, can be employed**
- **Threaded joints** must be made up with at least five threads fully engaged.

1.2 Sealing

- **Each conduit entering the apparatus enclosure is required to be sealed within 18 in. (457 mm) from the enclosure.**
- The sealing of each conduit can be provided with a **sealing fitting approved for class I locations.**
- **Sealing compound must be approved** and must not have a melting point of less than 93 ° (200 °F).
- The minimum thickness of the sealing compound should not be less than the trade size of the conduit and, in no case, less than 5/8 in.(16 mm).
- Splices and taps cannot be made in the fittings.

2. Class I, Division 2 locations

2.1 Wiring methods

- **Threaded rigid metal conduit, threaded steel intermediate metal conduit, enclosed gasketed busways, or Type PLTC cable** in accordance with the provisions of remote-control, signaling, and power-limited circuits (see NEC, Article 725), or **Type ITC cable** in cable trays, in raceways, supported by messenger wire, or directly buried where the cable is listed for this use; **Type MI, MC, MV, or TC cable with approved termination fittings** can be employed.

2.2 Sealing

- Each conduit entering the apparatus enclosure is required to be sealed as shown in 1.1.2.

3. Class II, Division 1 locations

3.1 Wiring methods

- **Threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable with termination fittings approved for the location**, can be employed.

3.2 Sealing

- Where a **raceway** provides communication between the apparatus enclosure and an enclosure that is not required to be dust-ignitionproof, suitable means must be provided to prevent the entrance of dust into the former enclosure through this raceway. One of the following means can be used: (1) a permanent and effective seal; (2) a horizontal raceway not less than 10 ft (3.05 m) long; or (3) a vertical raceway not less than 5 ft (1.52 m) long and extending downward from the dust-ignitionproof enclosure.
- Seals are not required to be explosionproof.

4. Class II, Division 2 locations

4.1 Wiring methods

- Rigid metal conduit, intermediate metal conduit, electrical metallic tubing, dust-tight wireways, or Type MC or MI cable with approved termination fittings, or Type PLTC in cable trays, or Type ITC in cable trays, or Type MC or TC cable installed in ladder, ventilated trough, or ventilated channel cable trays in a single layer, with a space not less than the larger cable diameter between the two adjacent cables, can be employed.

4.2 Sealing

- Sealing means must be provided as shown in 1.3.2.

5. Class III, Division 1 locations**5.1 Wiring methods**

- Rigid metal conduit, rigid non-metallic conduit, intermediate metal conduit, electrical metallic tubing, dust-tight wireways, or Type MC or MI cable with approved termination fittings, can be employed.

5.2 Sealing

- Sealing means are not required.

6. Class III, Division 2 locations**6.1 Wiring methods**

- Wiring methods must comply with 5.1.

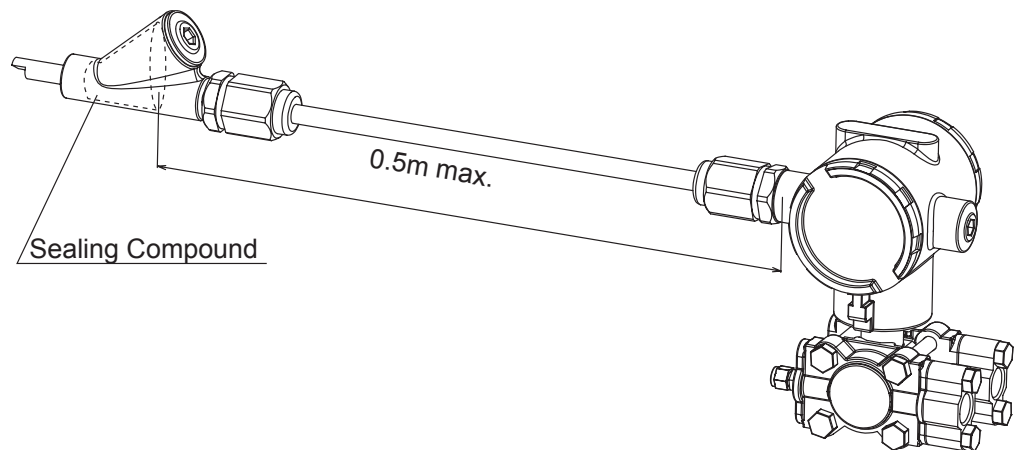
6.2 Sealing

- Sealing means are not required.

CSA Explosionproof / Dust-ignitionproof Apparatus (in accordance with CEC)

CAUTION

-
- Install the apparatus only in any hazardous (classified) locations for which the apparatus has been approved.
 - Seal each conduit entering the apparatus enclosure within 500 mm of the enclosure according to the test report.
 - Do not open the apparatus enclosure when an explosive atmosphere is present.
-



1. Class I, Division 1 locations

- 1.1 (a) **Threaded rigid metal conduit** or (b) **cables approved for hazardous locations with associated cable glands approved for the particular hazardous locations**, can be used.
- 1.2 **Threaded joints** must have **at least five full threads** fully engaged.
- 1.3 **Seals must be provided in conduit or cable systems** to prevent passage of gases, vapours or flames.
- 1.3.1 **The seal is located in each run of conduit entering the apparatus enclosure** as close as practicable to and **in no case more than 500 mm from the enclosure**.
- 1.3.2 The seal can be made in a **sealing fitting** approved for the location.
- **Sealing compound** must be approved for the purpose.
 - The melting point of the sealing compound should not be less than 93°C (200°F).
 - The minimum thickness of the sealing compound should not be less than the trade size of the conduit and in no case, less than 5/8 in. (16 mm).
 - Splices and taps are not made in the fittings.

2. Class I, Division 2 locations

- 2.1 (a) **Threaded metal conduit**, or (b) **cables approved for hazardous locations with associated cable glands approved for the particular location**, or (c) **Type TC cable** installed in cable tray, or (d) **Type ACWU cable with associated cable glands approved for the particular location**, can be used.
- 2.2 **Seals must be provided in conduit or cable systems** to prevent passage of gases, vapours or flames.
- 2.2.1 **The seal is located** in each run of **conduit** entering **the apparatus enclosure** as close as practicable to and **in no case more than 450 mm from the enclosure**;
- 2.2.2 **The sealing in Class I, Division 2 locations** conforms to **1.3.2**.

3. Class II, Division 1 locations

- 3.1 (a) **Threaded rigid metal conduit**, or (b) **cables approved for hazardous locations with associated cable glands approved for the particular hazardous location**, can be used.
- 3.2 Where a **raceway** provides communication between the apparatus enclosure and an enclosure that is not required to be dust-tight, the entrance of dust into the former enclosure through this raceway must be prevented by (a) a permanent and effective seal, or (b) a horizontal section not less than 3 m long in the raceway, or (c) a vertical section of raceway not less than 1.5 m long and extending downward from the dust-tight enclosure.

4. Class II, Division 2 locations

- 4.1 (a) **Threaded metal conduit**, or (b) **cables approved for hazardous locations with associated cable glands approved for the particular location**, or (c) **Type TC cable** installed in cable tray, or (d) **Type ACWU cable with associated cable glands approved for the particular location**, can be used.
- 4.2 **Sealing of raceways** conforms to **3.2**.

5. Class III, Division 1 locations

5.1 Wiring methods

- (a) **Threaded rigid metal conduit** or (b) **cables approved for hazardous locations with associated cable glands approved for the particular hazardous locations**, can be used.

5.2 Sealing

Sealing means are not required.

6. Class III, Division 2 locations

6.1 Wiring methods

The wiring methods in Class III, Division 2 locations conform to 5.1 except that in sections, compartments, or areas used solely for storage and containing no machinery. (In such sections, compartments, or areas, open wiring methods conforming to the rules for non-hazardous locations may be used.)

6.2 Sealing

Sealing means are not required.

FM /CSA Nonincendive Apparatus

CAUTION

-
- **The nonincendive apparatus** can be installed only in **Division 2** hazardous (classified) locations for which the apparatus has been approved.
 - **Tampering and replacement of any components within the nonincendive apparatus** may impair safe use of the apparatus.
-

Installation requirements

1. Wiring of the nonincendive circuit is permitted using **any of the methods suitable for wiring in ordinary (unclassified) locations.**

~Note *Nonincendive apparatus is composed of all nonincendive circuits in which any arc or thermal effect produced **under normal operating conditions of the apparatus** is not capable of igniting the explosive atmospheres. This protection technique is permitted for apparatus in those **Class I, Division 2, Class II, Division 2, and Class III locations.** Nonincendive apparatus looks like intrinsically safe apparatus but are not, require associated apparatus (ex. shunt diode barriers).*

2. **In any raceway, junction box, or similar fitting,** the conductors of the nonincendive circuit cannot be placed with the conductors of any other system, unless (1) the conductors of the two systems are separated by a suitable mechanical partition, or (2) all of the conductors of either system are segregated by a grounded metal shield.
3. **It is recommended that separate nonincendive circuit conductors** to be in separate cables, unless (1) the conductors of each circuit are within a grounded metal shield, or (2) the conductors of each circuit have insulation with a minimum thickness of 0.01 in. (0.254mm)
4. **If a raceway (including conduit) and cable for a nonincendive circuit in Class I, Division 2 or Class II, Division 2 locations is capable of transmitting flammable atmosphere through the raceway and cable from the Division 2 location to a non-hazardous location,** it must be properly sealed at the boundary by using of non-approved sealing fittings.

ATEX Flameproof Apparatus

1. General

1.1 **The apparatus protected by the flameproof enclosure** in accordance with EN 50018 can be installed in such hazardous areas, for which the apparatus has been certified, as an explosive atmosphere containing flammable substances in the form of **gas, vapour, mist or dust** may be present.

~Note The apparatus has been certified to comply with EN 50281-1-1 (dust ignition protection).

1.2 **The apparatus enclosure must be kept closed in hazardous areas when the apparatus is energized** because the internal circuit of the apparatus is capable of igniting in the explosive atmosphere. (Never connect any hand-held communicator to the apparatus terminals by opening the cover, except while no explosive atmosphere is present.)

1.3 It is required to connect **the external earthing terminal of the apparatus to the equipotential bonding system** which includes protective conductors, metal conduits, metal cable sheaths, steel wire armouring and metallic parts of structures, but does not include the neutral conductors of the power systems.

~Note The protective conductor to which exposed conductive parts of equipment (machines, apparatus, devices, components and instrumentation thereof) are connected, must be separated in the hazardous area from the neutral conductor, and must be connected to the power system earth point in the non-hazardous area, if the power system is directory earthed.

For external earthing and bonding of the apparatus it is recommended to use a **cable lug** so that the conductor is secured against loosening and twisting, and so that the contact pressure is permanently secured.

1.4 Either **cable systems** (cable entry systems) or **conduit systems** can be employed for wiring of the apparatus in the hazardous areas (see 2 or 3).

1.5 **Non-sheathed single core cables are not permitted for live conductors** unless they are installed inside enclosures or conduit systems.

1.6 **Conduits and, in special cases, cables** (for example, where there is a pressure difference) **must be sealed** so as to prevent the passage of the explosive atmosphere.

1.7 **Further information concerning installation and maintenance of apparatus** is given by relevant clauses in the following documents.

EN 60079-14 Electrical apparatus for explosive gas atmospheres

Part 14: **Electrical installations in hazardous areas**

EN 60079-17 Part 17: Inspection and maintenance of electrical installations in hazardous areas.

EN 60079-19 Part 19: Repair and overhaul for apparatus used in explosive atmospheres

EN 50281-1-2 Electrical apparatus for use in the presence of combustible dust

Part 1-2: Electrical apparatus protected by enclosures

-- **Selection, installation and maintenance**

2. Cable systems

- 2.1 **Thermoplastic sheathed cables, thermosetting sheathed cables, or elastomeric sheathed cables** can be selected for fixed wiring in the hazardous areas.
- 2.2 Flameproof cable entry devices (cable glands) certified to comply with EN 50018 and appropriate to the type of cable employed, must be used for the connection of cables to the apparatus.

3. Conduit systems

For conduit systems, relevant national standards or codes of practice should be followed prior to the following recommendations.

- 3.1 **Screwed heavy gauge steel, solid drawn or seam welded conduit, or flexible conduit for protection of cables in explosive atmospheres** (see ISO 10807) can be selected for fixed wiring in the hazardous areas.
- 3.2 **Conduit must be threaded for connection** to permit the full engagement of five threads.
- 3.3 Either **conduit entry devices or sealing devices such as stopping boxes** should be provided at the wall of the apparatus enclosure to limit the pressure piling effect and to prevent hot gases from entering the conduit system from the enclosure containing a source of ignition. **Each type of both the devices must be certified to comply with EN 50018.**
- 3.4 **The stopping boxes**, if used, **should be filled with a compound** which does not shrink on setting and is impervious to, and unaffected by, chemicals found in the hazardous area. **The depth of the compound in the stopping box** should be at least equal to the internal diameter of the conduit, but in no case less than 10 mm.
- 3.5 When the conduit contains three or more **non-sheathed single or multi-core cables**, the total cross-sectional areas of cables, including insulation, should not be more than 40% of the cross-sectional area of the conduit.

4. Installation in explosive atmospheres caused by air/dust mixtures

- 4.1 **Conduit or cable glands**, if employed to connect cables to the apparatus, must be selected and used in such a way that an IP6X protection (dust-tight) is guaranteed.
- 4.2 It is recommended to maintain the apparatus so that **the dust layer will not exceed a thickness of 5mm.**

~Note *Where the ignition temperature of a dust layer up to 5mm thickness is equal to, or higher than, the value that is obtained by adding 75K to the maximum surface temperature of the enclosure "T ...°C" as marked on the apparatus, the apparatus is incapable of causing ignition of the dust layer. (T...°C is based on the maximum ambient temperature.)*

Instruction for Safety

1. Introduction

Explosion protected models

Smart Pressure Transmitters **ST3000 series 900** has been constructed and certified to comply with the CENELEC standards EN 50014, EN 50018,

EN 50281-1-1 and EN1127-1. Be sure to read all applicable laws of your country and local regulations for the installation of equipment for explosive atmospheres.

EN 50014, Electrical apparatus for potentially explosive atmospheres - General requirements


EN 50018, Electrical apparatus for potentially explosive atmospheres - Flame-proof enclosure “d”

EN 50281-1-1, Electrical apparatus for use in the presence of combustible dust - Part1-1: Electrical apparatus protected by enclosures

EN 1127-1, Explosive atmospheres-Explosion prevention and protection- Part 1: Basic concepts and methodology

2. Smart Pressure Transmitters ST3000 series 900

Safety information marked on the transmitter

“ **II 2 G D EEx d II C T6**” is a full marking in accordance with the Directive 94/9/EC.

“**II**” indicates “equipment - group II” for use in places other than mines.

“**2**” indicates “equipment - category 2” for use in areas in which explosive atmospheres are likely to occur (**Zone 1**).

“**G**” is the symbol of the equipment - group and the equipment - category concerning explosive atmospheres caused by gases, vapors or mists.

“**D**” is the symbol of the equipment - group and the equipment - category concerning explosive atmospheres caused by dust (“Dust ignition protection”).

“**d**” is the symbol for the type of protection d (flameproof enclosure).

“**II C**” indicates that the group equipment is suitable for use in the explosive gas group “C” which contains hydrogen, acetylene and carbon disulfide (Annex A to EN 50014).

“**T6**” indicates that the maximum surface temperature of the transmitter is in the temperature class T6, i. e. the maximum surface temperature never exceeds 85°C at the maximum ambient temperature of 60°C.

For particular use in the presence of combustible dust only,

“ **II 2 D**” can be abstracted from the full marking.

“**IP67**” indicates a protection class provided by enclosures (known as **IP code** specified in EN 60529), i. e. the first numeral “6” means that the transmitter is protected by a dust - tight enclosure as prescribed in EN 50281-1-1. The second numeral “7”

means that the transmitter is protected against the effects of temporary immersion in water.

“**CE**” (CE marking) indicates that, in accordance with the relevant European Directives: **Directive 94/9/EC** (ATEX Directive) and **Directive 89/336/EEC** (EMC Directive), the transmitter complies with the protection requirements relating to the design and construction of the transmitter. In addition, the CE marking is followed by the identification number **0344** of the notified body (KEMA) responsible of the production quality assurance notification under Directive 94/9/EC.

“**INERIS 99ATEX0010 X**”: The certificate number of EC-type examination carried out by INERIS responsible of the examination under Directive 94/9/EC.

“**DATE**”: The year of construction of Smart Pressure Transmitter ST3000 series 900 is printed with the last two figures, together with the name of the month.

3. Installation

3.1 Operating condition

WARNING

Never open the enclosure while the internal circuit is alive.

3.2 Mounting and wiring

For use in explosive atmospheres of gase, fluid or vapor:

The cable and conduit entry devices must be of a certified flameproof type, suitable for the conditions of use and correctly installed.

With the use of conduit entries a sealing device must be provided either in the flameproof enclosure or immediately on the entrance thereto.

For use in the presence of combustible dust:

The cable and conduit entry devices must be of a certified flameproof type of E - or ATEX - Generation, suitable for the conditions of use and correctly installed. Those devices must satisfy the requirements for IP6X (dust - tight) as specified in EN 60529.

For external earthing and bonding:

A cable lug must be used so that the conductor is secured against loosening and twisting and so that the contact pressure is permanently secured.

Special condition for safe use:

The fastening screws of this apparatus are made of stainless steel and have a yield stress of 500N/mm^2

4. Operation

Precautions

WARNING

Do not open the enclosure when energized.

5. Maintenance

WARNING

Unauthorized modifications of any part of the enclosure or the internal circuit may invalidate the verified explosion protection of Smart Pressure Transmitter ST3000 series 900.

The integrity of enclosure must always be maintained.

6. Troubleshooting

WARNING

Do not open the enclosure when energized.

7. Specifications

Item	Description
Enclosure rating	IP67
Explosion protection	Flameproof II 2 D EEx d IIC T6 ; Dust ignition protection II 2 D ; for ambient temperature - 20 to 60°C (Note 1)

~Note *The cable and conduit entry devices must be of a certified flameproof type (see 3.2 Mounting and wiring)*

FM Intrinsically Safe System (in accordance with NEC and ANSI/ISA RP 12.6)

CAUTION

-
- Only suitable **associated apparatus separately approved by FM (FMRC)** shall be connected to the intrinsically safe apparatus.
 - Electrical equipment connected to the associated apparatus in non-hazardous locations shall not use or generate more than 250 Vrms.
 - Tampering and replacement of any components within the intrinsically safe apparatus with non-factory components may adversely affect the safe use of the system.
-

Installation requirements

1. The intrinsically safe and associated apparatus shall be installed in accordance with **the control drawing(s)** attached.
Especially, the control drawing(s) provides guidance on determining **the maximum allowed capacitance and inductance of the interconnecting cables**.
2. The intrinsically safe and associated apparatus is permitted to be installed in any hazardous (classified) location for which they have been approved, **by using any of the wiring methods suitable for ordinary (unclassified) locations**, including wiring methods for communication systems.
3. **Conductors of the intrinsically safe circuit shall not be placed in raceways, cable trays, and cables with conductors of any non-intrinsically safe circuit, unless** (1) the conductors of the intrinsically safe circuit are separated from these of the non-intrinsically safe circuits by a distance of at least 50 mm, and secured or separated by a grounded partition or an approved insulating partition; or (2) either all of the intrinsically safe circuit conductors or all of the non-intrinsically safe circuit conductors are in grounded metal-sheathed or metal-clad cables where the sheathing or cladding is capable of carrying fault current to ground.
4. **Different intrinsically safe circuits shall be in separate cables, unless** (1) the conductors of each circuit are within a grounded metal shield, or (2) the conductors of each circuit have insulation with a minimum thickness of 0.01 inch (0.25 mm).
5. Intrinsically safe apparatus, associated apparatus, shields of conductors or cables, enclosures and raceways, if of metal, shall be grounded.

6. **If the associated apparatus is a type of shunt diode barriers**, supplementary bonding to the grounding electrode is needed. And the grounding path resistance from the farthest barrier to the grounding electrode shall not exceed 1Ω .

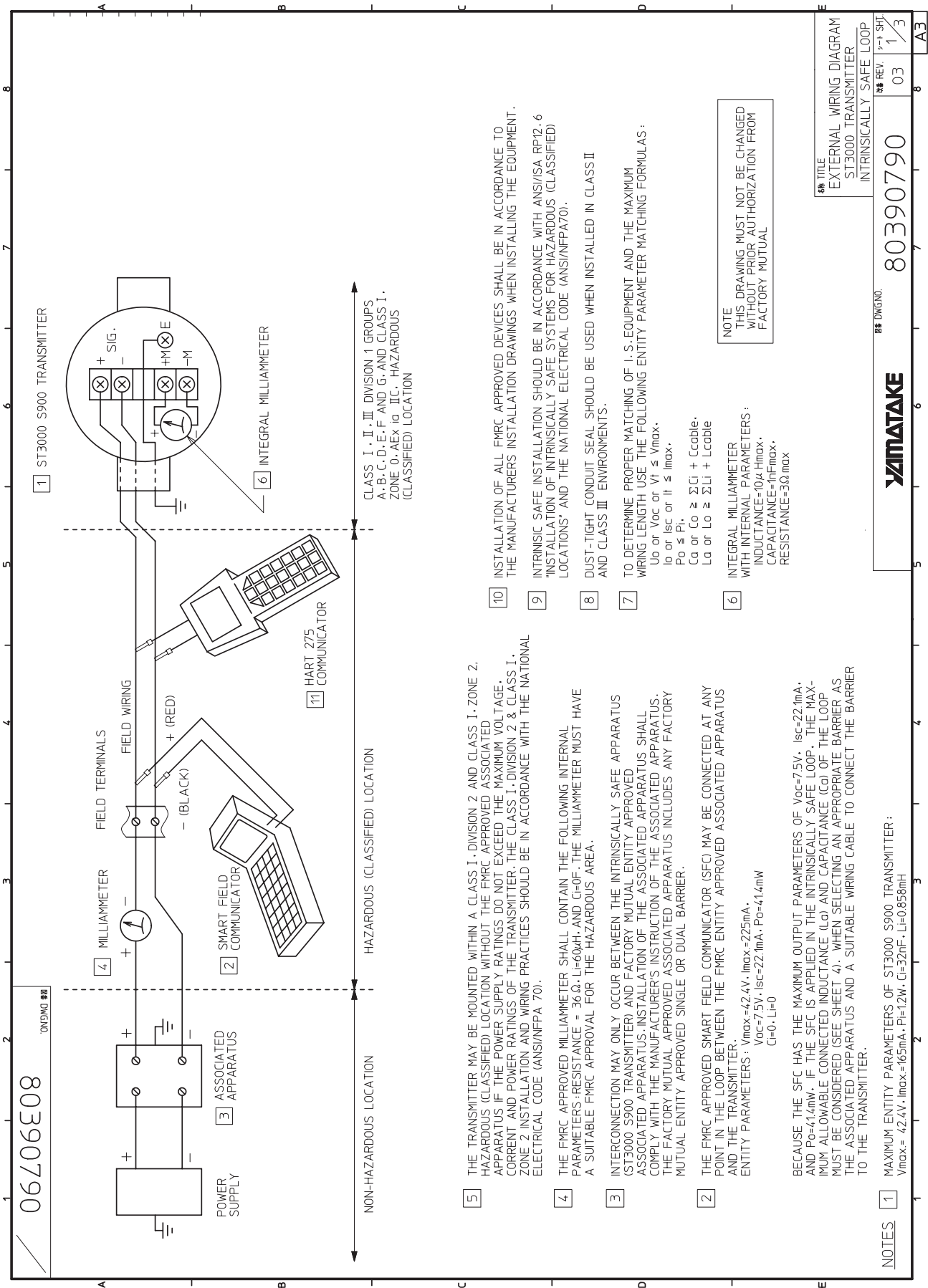
In practice, the bonding to the grounding electrode is achieved by connecting the grounding terminals of the barriers to the intrinsically safe ground bus which is connected to the grounding electrode with an insulated conductor not smaller than No.12 AWG (2.05 mm in dia.).
7. **In hazardous locations, non-current-carrying metal parts** of the apparatus, raceways, and other enclosures of the intrinsically safe system shall be bonded to ensure **the electrical continuity**.
8. **In non-hazardous locations, where metal raceways are used for the intrinsically safe system wiring in hazardous locations, all intervening raceways, fittings, boxes, enclosures, etc.** between the hazardous locations and the point of grounding for the power supply system or point of grounding of a separately derived system, shall be grounded by using bonding jumpers with proper fittings or other approved means of bonding.
9. Where **conduits and cables** are used to protect the intrinsically safe wiring against environments, the conduits and cables **must be sealed** so that they do not transmit gases, vapors, or dust from a hazardous location to a non-hazardous location. **Sealing fittings** should be installed in each conduit run leaving the hazardous location, on either side of the boundary within 10 ft (3.05 m) of the boundary. Such seals need not be explosionproof.
10. **The grounding electrode** usually available on premises is specified in a), b), c) or d):
 - a) **Metal underground water pipe** in direct contact with the earth for 10 ft (3.05 m) or more.
 - b) **Metal frame of the building**, where effectively grounded.
 - c) **Concrete-encased electrode**. An electrode encased by at least 2 in. (50.8 mm) of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 20 ft (6.1m) of one or more bare or zinc galvanized or other electrically conductive coated steel reinforcing bars or rods not less than 1/2 in. (12.7 mm) diameter, or consisting of at least 20 ft (6.1 m) of bare copper conductor not smaller than No.2 AWG (6.54 mm in dia.).
 - d) **Ground ring**. A ground ring encircling the building or structure, in direct contact with the earth at a depth below earth surface not less than 2 1/2 ft (762 mm), consisting of at least 20 ft (6.1 m) of bare copper conductor not smaller than No.2 AWG.

Where none of the above electrodes is available, made electrodes should be used:

 - e) **Rod and pipe electrodes**. Not less than 8 ft (2.44 m) in length, consisting of the following materials, and being installed in the following manner:

- Electrodes of pipe or conduit shall not be smaller than 3/4 in. trade size and, where of iron or steel, shall have the outer surface galvanized or otherwise metalcoated for corrosion protection.
 - Electrodes of rods of iron or steel shall be at least 5/8 in. (15.87 mm) in diameter. Stainless steel rods less than 5/8 in. (15.87 mm) in diameter, nonferrous rods, or their equivalent shall not be less than 1/2 in. (12.7 mm) in diameter.
 - The electrode shall be installed such that at least 8 ft (2.44 m) of length is in contact with the soil. It shall be driven to a depth of not less than 8 ft (2.44 m).
- f) **Plate electrodes.** Each plate electrode shall expose not less than 2 sq ft (0.186 sq m) of surface to exterior soil. Electrodes of iron or steel plates shall be at least 1/4 in. (6.35 mm) in thickness. Electrodes of non-ferrous metal shall be at least 0.06 in. (1.52 mm) in thickness.

A single electrode consisting of a rod, pipe, or plate that does not have a resistance to ground of 25Ω or less shall be augmented by one additional electrode of any of the types specified in a) to f). Where multiple rod, pipe, or plate electrodes are installed, they shall not be less than 6 ft (1.83 m) apart.



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1 ST3000 S900 TRANSMITTER

3 ASSOCIATED APPARATUS

2 SMART FIELD COMMUNICATOR

11 HART 275 COMMUNICATOR

6 INTEGRAL MILLIAMMETER

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

- 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).
- 4 THE FMRC APPROVED MILLIAMMETER SHALL CONTAIN THE FOLLOWING INTERNAL PARAMETERS: RESISTANCE = 36Ω, LI=60μH, AND GI=0F. THE MILLIAMMETER MUST HAVE A SUITABLE FMRC APPROVAL FOR THE HAZARDOUS AREA.
- 3 INTERCONNECTION MAY ONLY OCCUR BETWEEN THE INTRINSICALLY SAFE APPARATUS (ST3000 S900 TRANSMITTER) AND FACTORY MUTUAL ENTITLED 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 ENTITLED APPROVED SINGLE OR DUAL BARRIER.
- 2 THE FMRC APPROVED SMART FIELD COMMUNICATOR (SFC) MAY BE CONNECTED AT ANY POINT IN THE LOOP BETWEEN THE FMRC ENTITLED APPROVED ASSOCIATED APPARATUS AND THE TRANSMITTER.
ENTITY PARAMETERS: Vmax=42.4V, Imax=225mA,
Voc=7.5V, Isc=22.1mA, Po=41.4mW
Cr=0, LI=0

- 10 INSTALLATION OF ALL FMRC APPROVED DEVICES SHALL BE IN ACCORDANCE TO THE MANUFACTURER'S INSTALLATION DRAWINGS WHEN INSTALLING THE EQUIPMENT.
- 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).
- 8 DUST-TIGHT CONDUIT SEAL SHOULD BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS.
- 7 TO DETERMINE PROPER MATCHING OF I. S. EQUIPMENT AND THE MAXIMUM WIRING LENGTH USE THE FOLLOWING ENTITY PARAMETER MATCHING FORMULAS:

$$U_o \text{ or } V_{oc} \text{ or } V_i \leq V_{max}$$

$$I_o \text{ or } I_{sc} \text{ or } I_t \leq I_{max}$$

$$P_o \leq P_t$$

$$C_a \text{ or } C_o \geq \Sigma C_i + C_{cable}$$

$$L_a \text{ or } L_o \geq \Sigma L_i + L_{cable}$$
- 6 INTEGRAL MILLIAMMETER WITH INTERNAL PARAMETERS:
 INDUCTANCE=10μHmax.
 CAPACITANCE=1nFmax.
 RESISTANCE=3Ω max.

NOTE
THIS DRAWING MUST NOT BE CHANGED
WITHOUT PROPER AUTHORIZATION FROM
FACTORY MUTUAL

8# TITLE EXTERNAL WIRING DIAGRAM ST3000 TRANSMITTER INTRINSICALLY SAFE LOOP	03	1/3
	03	1/3
	03	1/3

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YAMATAKE

06 DWGNO.

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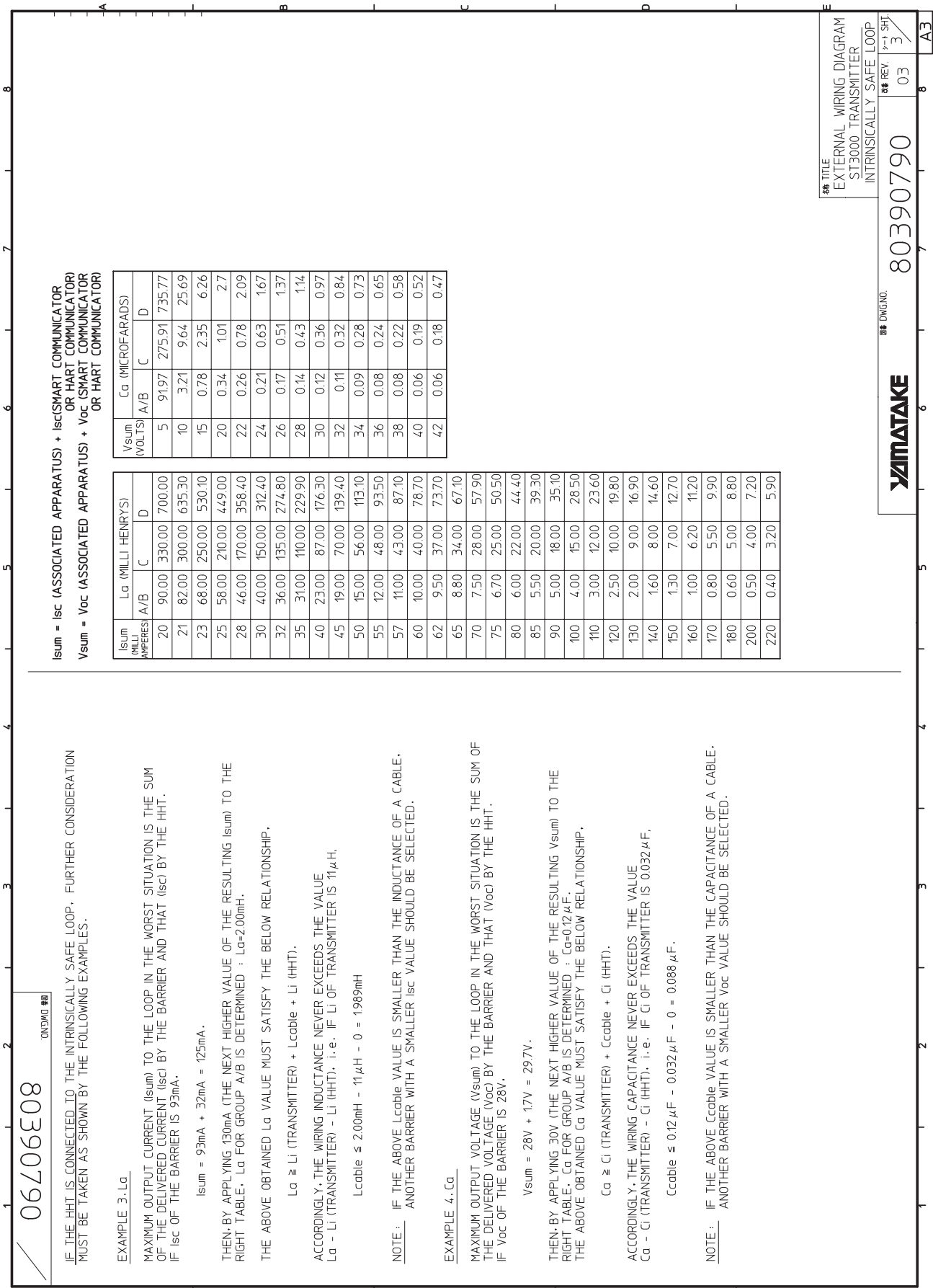
NOTES

1 MAXIMUM ENTITY PARAMETERS OF ST3000 S900 TRANSMITTER:
 Vmax = 42.4V, Imax = 165mA, Pi = 12W, Gi = 32nF, Li = 0.856mH

<p>06706E08</p> <p>06706E08</p>	<p>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. $V_{max}=30V$, $I_{max}=300mA$, $V_{oc}=17V$, $I_{sc}=32mA$ $C=0.07\mu F$, $L=0$</p>	<p>12 SMART FIELD COMMUNICATOR (SFC) AND HART 275 COMMUNICATOR (HHT) SHALL NOT BE CONNECTED IN THE LOOP AT THE SAME TIME.</p>	<p>13 AEX ID 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.</p>	<p>14 THE POWER SUPPLY CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V_{dc}.</p>	<p>CONSIDERATION OF AN INTRINSICALLY SAFE LOOP BASED ON ENTITY PARAMETERS</p> <p>THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION.</p> <p>BASICALLY, THE MAXIMUM UNPROTECTED CAPACITANCE (C) AND INDUCTANCE (L) OF THE INTRINSICALLY SAFE APPARATUS, INCLUDING INTERCONNECTING WIRING PARAMETERS (L_{cable}, C_{cable}), MUST BE EQUAL OR LESS THAN THE CAPACITANCE (C₀) AND INDUCTANCE (L₀) WHICH CAN BE SAFELY CONNECTED TO THE ASSOCIATED APPARATUS. ALSO, THE MAXIMUM OUTPUT PARAMETERS (V_{oc}, I_{sc}, P₀) 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.</p>	<p>IF THE SFC IS CONNECTED TO THE INTRINSICALLY SAFE LOOP, FURTHER CONSIDERATION MUST BE TAKEN AS SHOWN BY THE FOLLOWING EXAMPLES.</p> <p>EXAMPLE 1. L_a</p> <p>MAXIMUM OUTPUT CURRENT (I_{sum}) TO THE LOOP IN THE WORST SITUATION IS THE SUM OF THE DELIVERED CURRENT (I_{sc}) BY THE BARRIER AND THAT (I_{sc}) BY THE SFC. IF I_{sc} OF THE BARRIER IS 93mA,</p> $I_{sum} = 93mA + 22.1mA = 115.1mA.$ <p>THEN, BY APPLYING 120mA (THE NEXT HIGHER VALUE OF THE RESULTING (I_{sum}) TO THE TABLE OF NEXT PAGE, L_a FOR GROUP A/B IS DETERMINED : L_a=2.50mH.</p> <p>THE ABOVE OBTAINED L_a VALUE MUST SATISFY THE BELOW RELATIONSHIP.</p> $L_a \geq L_i \text{ (TRANSMITTER) } + L_{cable} + L_i \text{ (SFC).}$ <p>ACCORDINGLY, THE WIRING INDUCTANCE NEVER EXCEEDS THE VALUE L_a - L_i (TRANSMITTER) - L_i (SFC), i.e. IF L_i OF TRANSMITTER IS 11μH,</p> $L_{cable} \leq 2.50mH - 11\mu H - 0 = 2.489mH.$ <p>NOTE : IF THE ABOVE L_{cable} VALUE IS SMALLER THAN THE INDUCTANCE OF A CABLE, ANOTHER BARRIER WITH A SMALLER I_{sc} VALUE SHOULD BE SELECTED.</p> <p>EXAMPLE 2. C_a</p> <p>MAXIMUM OUTPUT VOLTAGE (V_{sum}) TO THE LOOP IN THE WORST SITUATION IS THE SUM OF THE DELIVERED VOLTAGE (V_{oc}) BY THE BARRIER AND THAT (V_{oc}) BY THE SFC. IF V_{oc} OF THE BARRIER IS 28V,</p> $V_{sum} = 28V + 7.5V = 35.5V.$ <p>THEN, BY APPLYING 36V (THE NEXT HIGHER VALUE OF THE RESULTING V_{sum}) TO THE TABLE OF NEXT PAGE, C_a FOR GROUP A/B IS DETERMINED : C_a=0.08μF.</p> <p>THE ABOVE OBTAINED C_a VALUE MUST SATISFY THE BELOW RELATIONSHIP.</p> $C_a \geq C_i \text{ (TRANSMITTER) } + C_{cable} + C_i \text{ (SFC).}$ <p>ACCORDINGLY, THE WIRING CAPACITANCE NEVER EXCEEDS THE VALUE C_a - C_i (TRANSMITTER) - C_i (SFC), i.e. IF C_i OF TRANSMITTER IS 0.032μF</p> $C_{cable} \leq 0.08\mu F - 0.032\mu F - 0 = 0.048\mu F.$ <p>NOTE : IF THE ABOVE C_{cable} VALUE IS SMALLER THAN THE CAPACITANCE OF A CABLE, ANOTHER BARRIER WITH A SMALLER V_{oc} VALUE SHOULD BE SELECTED.</p>
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TITLE
EXTERNAL WIRING DIAGRAM
ST3000 TRANSMITTER
INTRINSICALLY SAFE LOOP
03
REV 2
SHT 2

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

EXAMPLE 3. Lc

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 I_{sc} OF THE BARRIER IS 93mA.

$$I_{sum} = 93mA + 32mA = 125mA.$$

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

THE ABOVE OBTAINED Lc VALUE MUST SATISFY THE BELOW RELATIONSHIP.

$$Lc \geq Li \text{ (TRANSMITTER) } + Lcable + Li \text{ (HHT)}.$$

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

$$Lcable \leq 2.00mH - 11\mu H - 0 = 1989mH$$

NOTE : IF THE ABOVE Lcable VALUE IS SMALLER THAN THE INDUCTANCE OF A CABLE, ANOTHER BARRIER WITH A SMALLER I_{sc} 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.

$$V_{sum} = 28V + 17V = 297V.$$

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.

$$Ca \geq Ci \text{ (TRANSMITTER) } + Ccable + Ci \text{ (HHT)}.$$

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

$$Ccable \leq 0.12\mu F - 0.032\mu F - 0 = 0.088\mu F.$$

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)	Lc (MILLI HENRYS)		Vsum (VOLTS)		Ca (MICROFARADS)		
	A/B	D	A/B	D	A/B	D	
20	90.00	330.00	700.00	5	91.97	275.91	735.77
21	82.00	300.00	635.30	10	3.21	9.64	25.69
23	68.00	250.00	530.10	15	0.78	2.35	6.26
25	58.00	210.00	449.00	20	0.34	1.01	2.7
28	46.00	170.00	358.40	22	0.26	0.78	2.09
30	40.00	150.00	312.40	24	0.21	0.63	1.67
32	36.00	135.00	274.80	26	0.17	0.51	1.37
35	31.00	110.00	229.90	28	0.14	0.43	1.14
40	23.00	87.00	176.30	30	0.12	0.36	0.97
45	19.00	70.00	139.40	32	0.11	0.32	0.84
50	15.00	56.00	113.10	34	0.09	0.28	0.73
55	12.00	48.00	93.50	36	0.08	0.24	0.65
57	11.00	43.00	87.10	38	0.08	0.22	0.58
60	10.00	40.00	78.70	40	0.06	0.19	0.52
62	9.50	37.00	73.70	42	0.06	0.18	0.47
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				

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 EXTERNAL WIRING DIAGRAM
 ST3000 TRANSMITTER
 INTRINSICALLY SAFE LOOP
 03
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About This Publication

This manual is intended as a detailed “how to” reference for installing, piping wiring, configuring, starting up, operating, maintaining, calibrating, and servicing Yamatake’s family of ST3000 Smart Transmitters. It is based on using a model SFC160/260 Smart Field Communicator as the operator interface for the ST3000 Smart Transmitter. Be aware that some data in this manual overlaps information in the field Communicator Model SFC160/260 Operating Guide.

While this manual provides detailed procedures to assist first time users, it also includes keystroke summaries for most procedures as a quick reference for experienced users.

Precautions

General Precautions

1. Checking the Product

When you accept the ST3000 Smart Transmitter, check its appearance to make sure that it is not damaged.

A Smart Transmitter with semi-standard or special specifications may have different accessories.

2. Check the specifications

The specifications are marked on the name plate on the outside of the transmitter case. Make sure that the specifications match your order by referring to the specifications.

In making an inquiry, identify the model No. and the product No.

3. Transportation

We recommend to transport the transmitter to the installation site in the packaged state in order to prevent damages from occurring during transportation.

4. Storage Environment

(1) Storage location

During storage, protect the transmitter from rain water as well as from heavy vibration and shock. Store it at normal temperature and humidity (about 25°C, 65%RH) as much as possible.

(2) Store the transmitter in original packaging if possible.

(3) If a used transmitter must be stored for some period, wash it thoroughly after making sure that no fluid remains in the pressure receiving section.

5. Installation Environment

In order to maintain the original performance and reliability for a long time, install the transmitter in the following environment:

- (1) Ambient temperature
 - (a) The temperature gradient and temperature changes in installation environment should be as small as possible.
 - (b) If a transmitter is exposed to heat radiated from the process side, lower its ambient temperature as much as possible by insulating it or by selecting a well-ventilated location for installation.
 - (c) If a process fluid can freeze, prevent freezing by means of heat insulation.
- (2) Environment

Avoid corrosive environment as much as possible.

Install in explosion proof and intrinsically safe conditions.
- (3) Shock and vibration

Install the transmitter where shocks and vibrations will be as small as possible.
- (4) Installation of explosion proof type transmitter.

Refer to “Instructions for Explosion proof Transmitter“.

6. Application of Pressure to transmitter

In applying pressure to this transmitter, observe the following rules.

- (1) The locking bolts of the adapter flange are loose when shipped. Tighten them to the specified torque.
- (2) Do not apply a pressure that exceeds the specified level.
- (3) Do not tighten or loosen bolts while pressure is being applied to the transmitter.
- (4) When a transmitter is used for measuring a poisonous substance, handle it carefully even after the pressure is released.

7. Electronic Parts

- (1) This transmitter has several CMOS electronic components. Since static electricity can easily cause the functional destruction of a CMOS component, never directly touch them or touch a circuit with your hands.
- (2) Is components must be touched, equalize the potential of the components before doing so.
- (3) When the printed wiring board (PWB) is removed, protect it in a non-conductive bag.

8. Using a Transceiver

- (1) When a transceiver is used very near a transmitter, its transmission frequency (in the form of high frequency noise) may cause radio interference.

- (2) When using a transceiver, determine the distance that will be necessary for avoiding any interference, and ensure that the distance between the transceiver and the transmitter is greater.
- (3) When using a transceiver, be sure to close the cover of the transmitter

9. Welding in Proximity

- (1) When welding is to be carried out near the transmitter, the welding current may affect the operation of the transmitter depending on the grounding method.
- (2) Directly ground the welding equipment and power transformer. Do not ground to the stanchion pipe of the transmitter.
- (3) Turn off the power supply to the transmitter.

Technical Assistance

If you encounter a problem with your ST3000 Smart Transmitter, check to see how your transmitter is currently configured, and verify that all selections are consistent with your application.

If the problem persists, please call Yamatake group representatives.

An engineer will discuss your problem with you. Please have your complete model number, serial number, and software revision number on hand for reference. You can find the model and serial numbers on the transmitter nameplates. You can also view the software version number using the SFC.

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Chapter 1 : Introduction

1-1 : Introduction

The ST3000 Smart Transmitter Series 900 with FOUNDATION™ fieldbus is a Foundation registered device, which can cooperate seamlessly with other registered field devices as well as host systems in a wide range of control systems.

The ST3000 Smart Transmitter Series 900 with FOUNDATION™ fieldbus has following features:

- a) Fully complies with Fieldbus Foundation H1 (31.25kbps) Voltage Mode Bus specifications
- b) Supports the standard analog input (AI) function block
- c) Bus-powered device
- d) Comes with a device description (DD) file and a capability file (CF) for automatic configuration.

1-2 : ST3000 Smart Transmitters

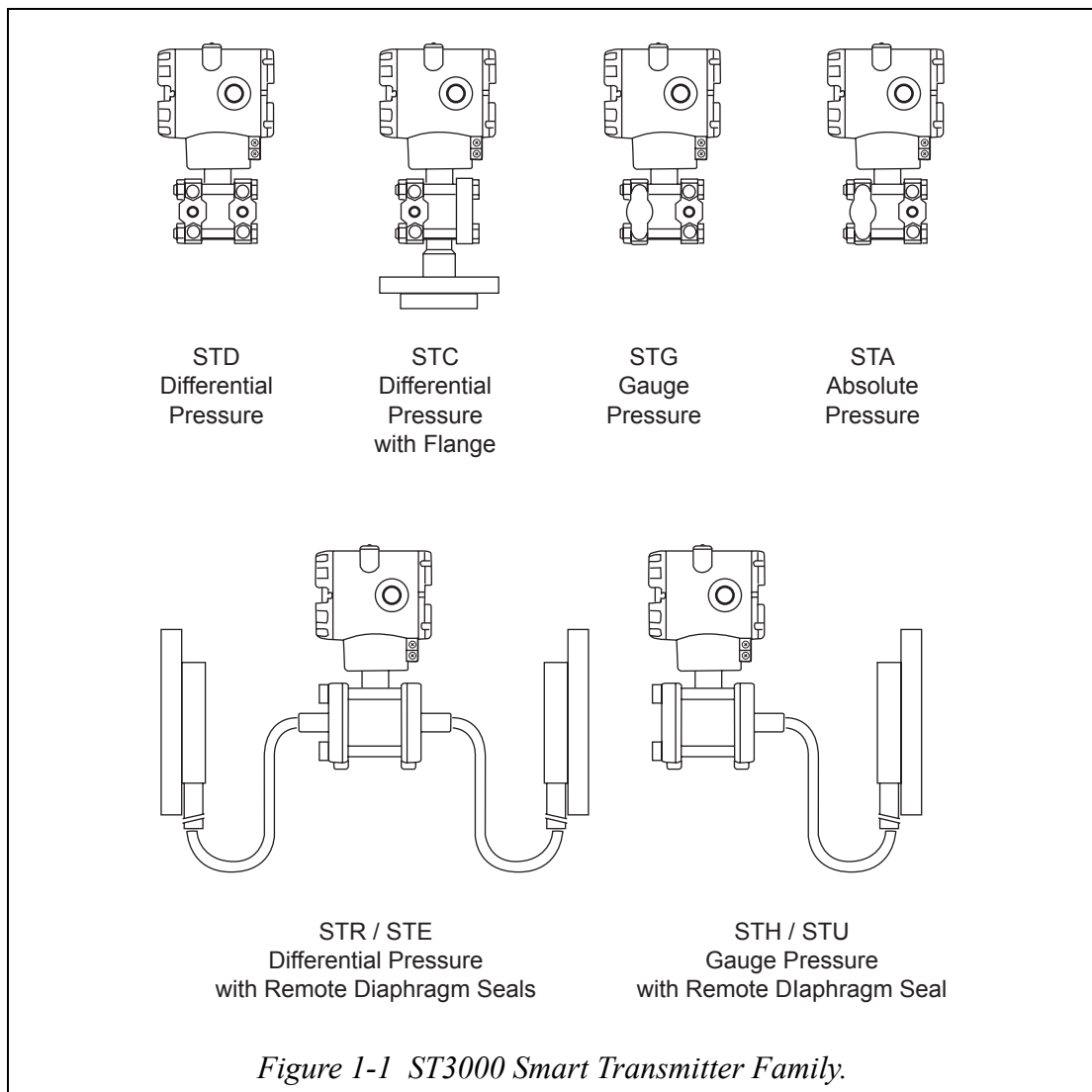
Yamatake's ST3000 Smart Transmitter includes model variations of these basic pressure measurement types.

- Differential Pressure
- Gauge Pressure
- Absolute Pressure

Transmitter adjustments

Except for optional zero and span adjustments available with ST3000 Smart Transmitters only, the ST3000 Smart Transmitter has no physical adjustments.

You need an SFC to make adjustments to a ST 3000 Smart Transmitter.



1-3 : Transmitter order

Order components

Figure 1-2 shows the components that are shipped and should be received for a typical ST3000 Smart Transmitter order.

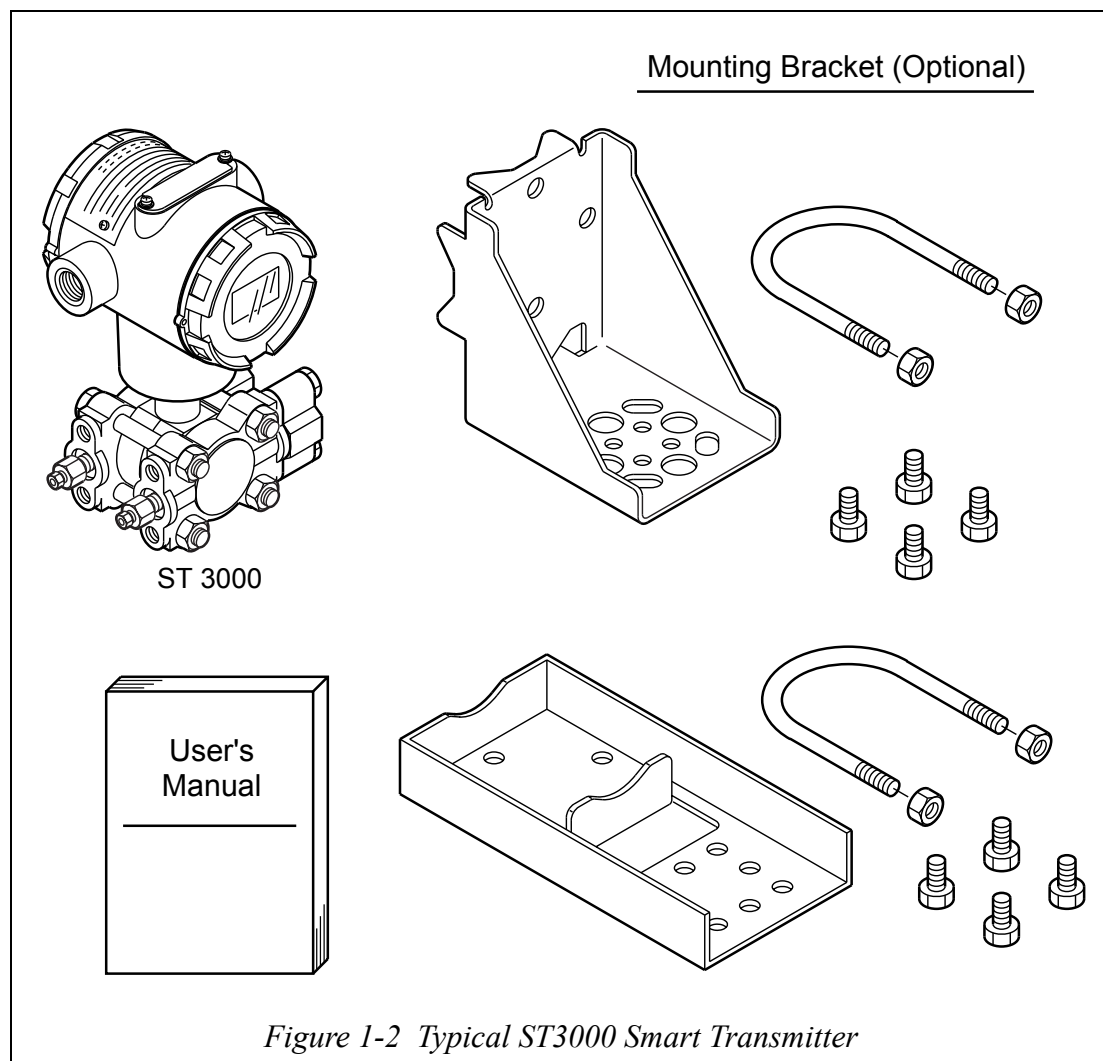


Figure 1-2 Typical ST3000 Smart Transmitter

Device description

Device description (DD) file and capability file (CF) can be downloaded from Yamatake Corporation WEB site (<http://www.yamatake.com>).

Chapter 2 : Installation

2-1 : Introduction

This section contains information for the installation of the ST3000 Smart Transmitter. It includes procedures for mounting, piping and wiring the transmitter for safe and proper operation.

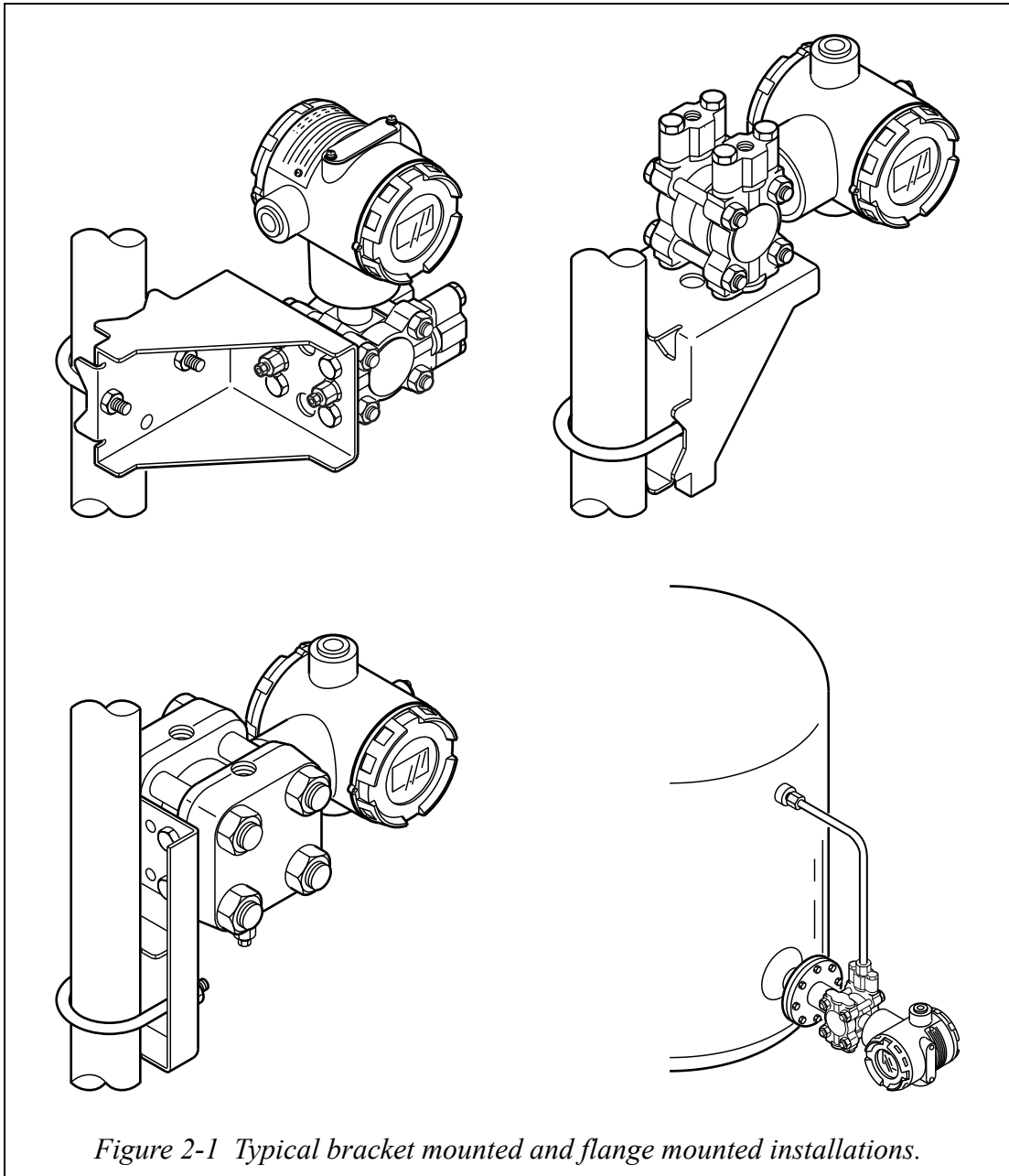
For Fieldbus configuration, refer to the “Fieldbus Integration Manual” (FB2-FBS100-3501).

2-2 : Mounting the ST3000 Smart Transmitter

Summary

You can mount all transmitter models except those with integral flanges to a 2 inch (50 mm) vertical or horizontal pipe using our optional angle or flat mounting bracket or a bracket of your own. Those models with integral flanges are supported by the flange connection.

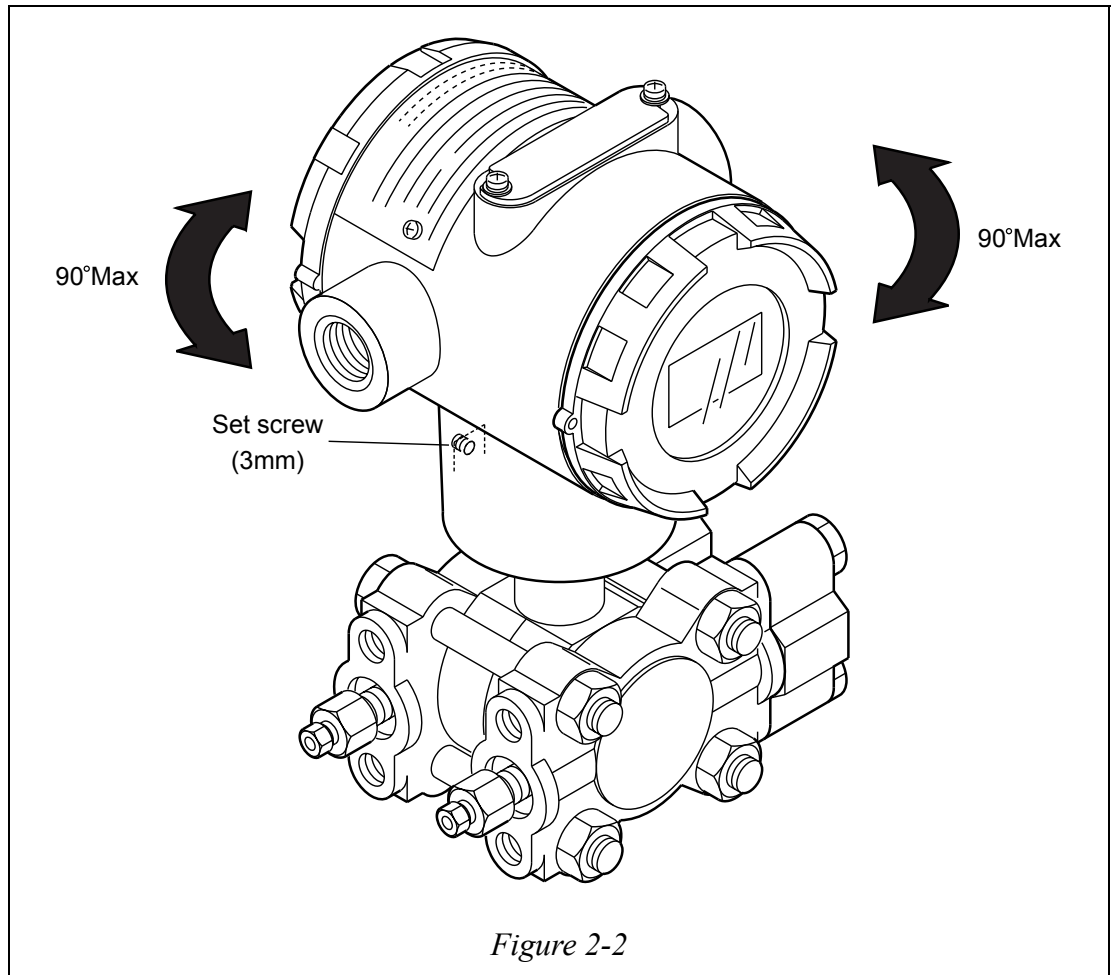
Figure 2-1 shows typical bracket mounted and flange mounted transmitter installations for comparison.



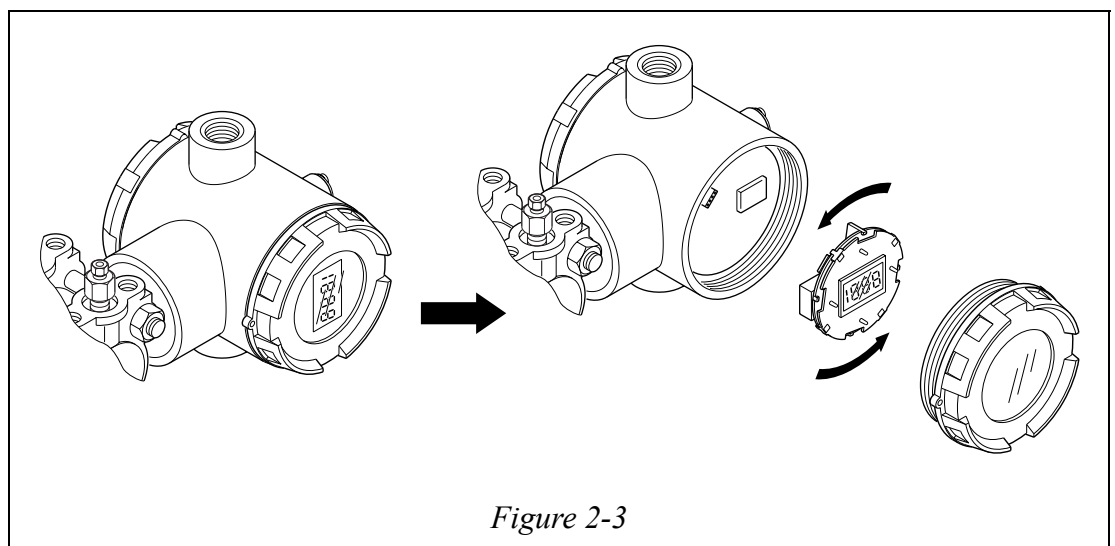
Methods of changing direction of indicator after mounted are shown below.

a) Rotate electronics housing 90° horizontally.

Loosen 3 mm set screw on outside neck of transmitter. Rotate electronics housing in a maximum of 90 degree increments (left or right) from the center to a position you require and tighten the set screw.



b) Rotate digital display module



Flange mounting

To mount a flange mounted transmitter model, bolt the transmitter's flange to the flange pipe on the wall of the tank. Tighten the bolts to a torque of

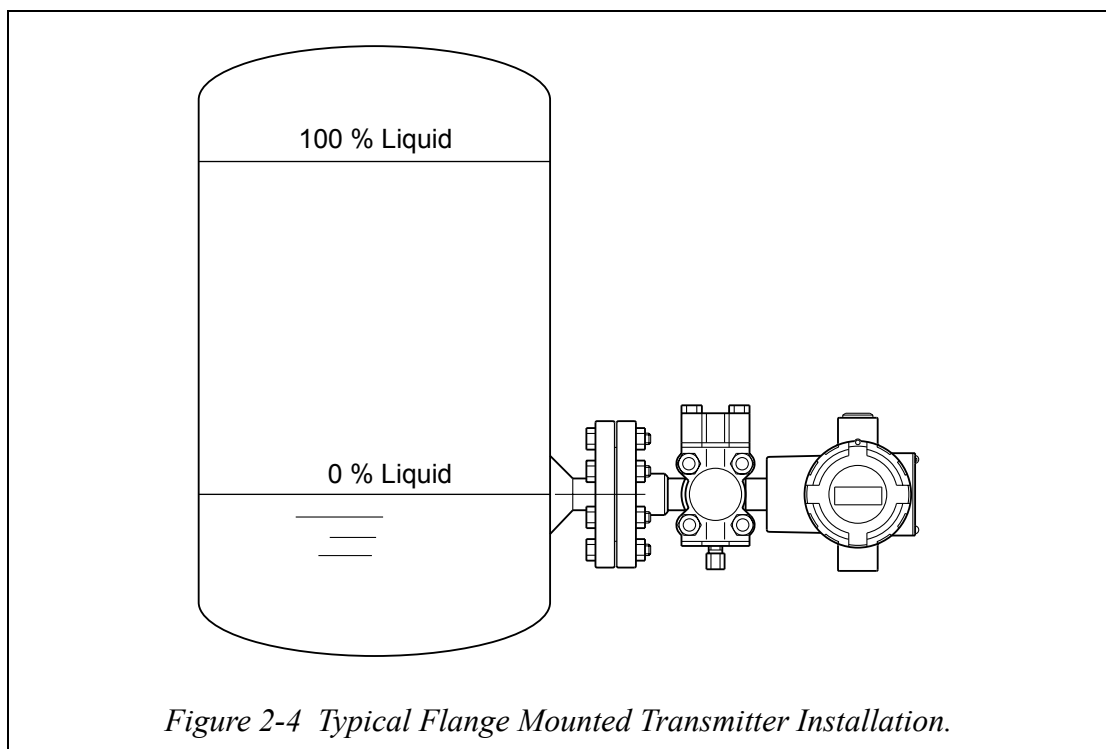
SNB : $20 \pm 1 \text{ N} \cdot \text{m}$

SUS304 : $10 \pm 1 \text{ N} \cdot \text{m}$

ATTENTION

On insulated tanks, remove enough insulation to accommodate the flange extension.

Figure 2-4 shows a typical installation for a transmitter with the flange on the high pressure (HP) side so the HP diaphragm is in direct contact with the process fluid. The low pressure (LP) side of the transmitter is vented to atmosphere (no connection).



Remote seal mounting

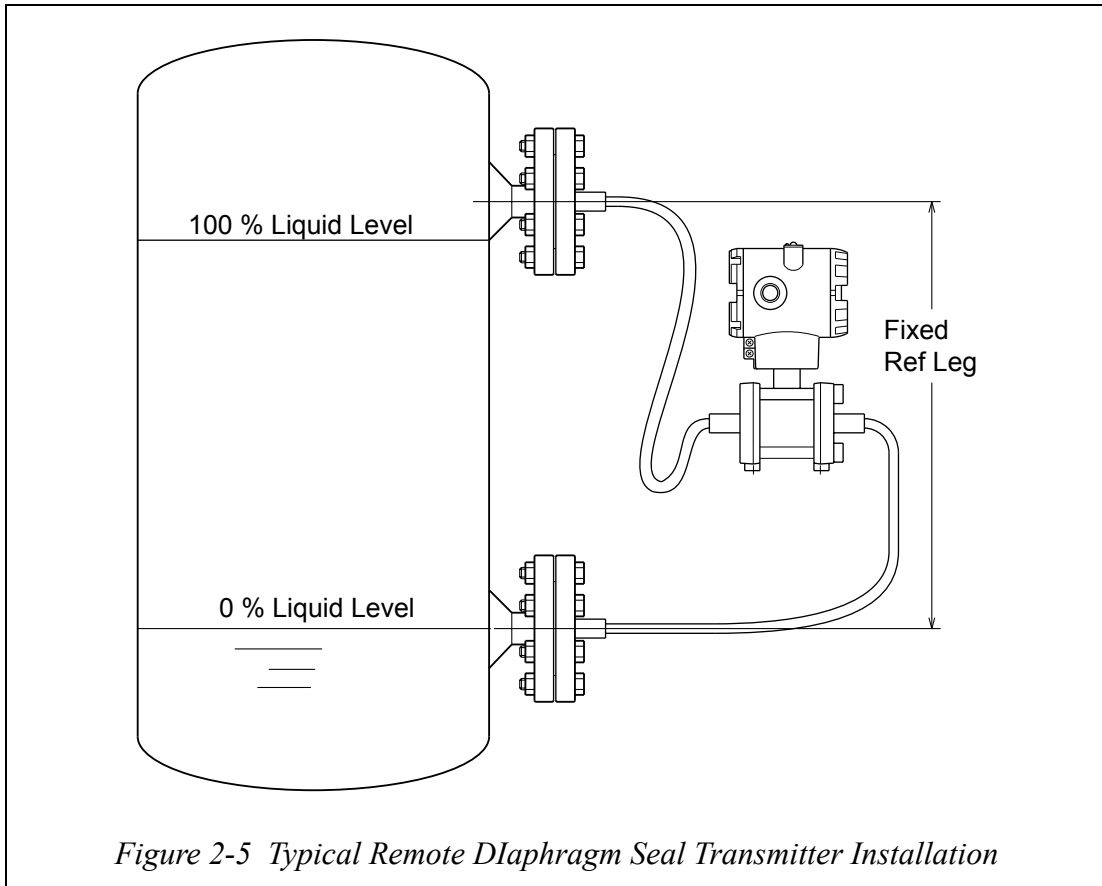
Use the procedure in "Table 2-1 Mounting Remote Diaphragm Seal Transmitter" to mount a remote diaphragm seal transmitter model. Figure 2-5 shows a typical installation for a remote diaphragm seal transmitter for reference.

ATTENTION

Mount the transmitter flanges within the limits stated here for the given fill-fluid in the capillary tubes with a tank at one atmosphere.

Table 2-1 Mounting Remote Diaphragm Seal Transmitter

Step	Action
1	Mount transmitter at a remote distance determined by length of capillary tubing.
2	<p>If Transmitter Model Number Is... STR929, STR930 STE929, STE930 Then Connect Remote Seal on... H mark side of transmitter to upper flange mounting on tank wall.</p> <p><u>ATTENTION</u> On insulated tanks, remove enough insulation to accommodate the flange extension.</p>
3	<p>If Transmitter Model Number is... STR929, STR930 STE929, STE930 Then Connect Remote Seal on... Opposite side of transmitter to lower flange mounting on tank wall.</p> <p><u>ATTENTION</u> On insulated tanks, remove enough insulation to accommodate the flange extension.</p>
4	Tighten bolts to torque of SNB7: $20 \pm 1 N \bullet m$, SUS304: $10 \pm 1 N \bullet m$.



ATTENTION

Calculation of Allowable Transmitter Installation Location in Remote Seal Type Differential Pressure Transmitter.

When installing a remote seal type differential pressure transmitter on an enclosed tank, we recommend the installation of the main unit below the lower flange. However, it is sometimes necessary to install the transmitter main unit between the upper and lower flanges due to piping restrictions.

The condition that must be satisfied to ensure normal transmitter operations is specified here.

If a transmitter is installed in the position shown in Figure 2-6, the inner pressure of the tank (P_0) and the head pressure of the liquid sealed in the capillary can be applied to its main unit (low limit flange side).

The transmitter functions normally as long as the pressure applied to its diaphragm surface is equal to or higher than the low limit P (kPa abs.) of the allowable pressure of its main unit.

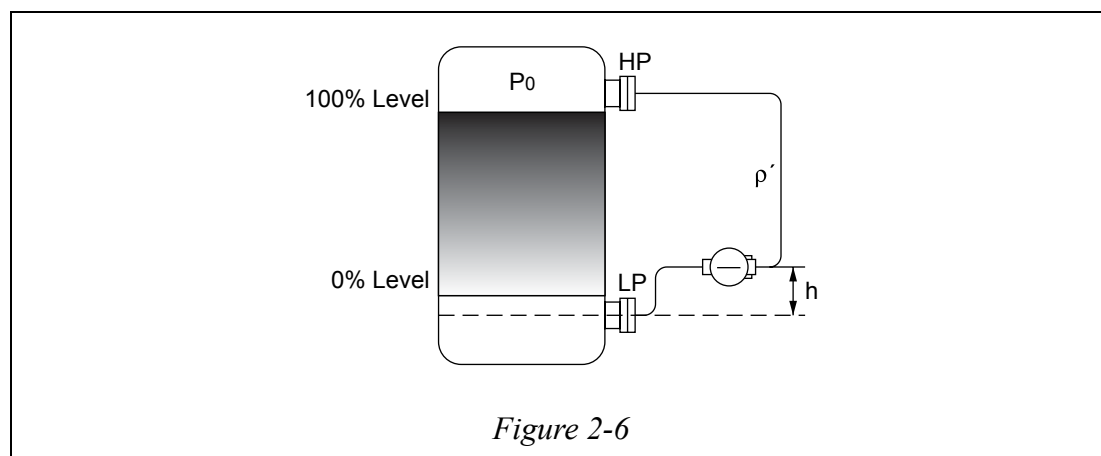


Figure 2-6

This condition can be expressed with the following formula;

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

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

Table 2-2

	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.

2-3 : Piping for the 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 2-7 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.

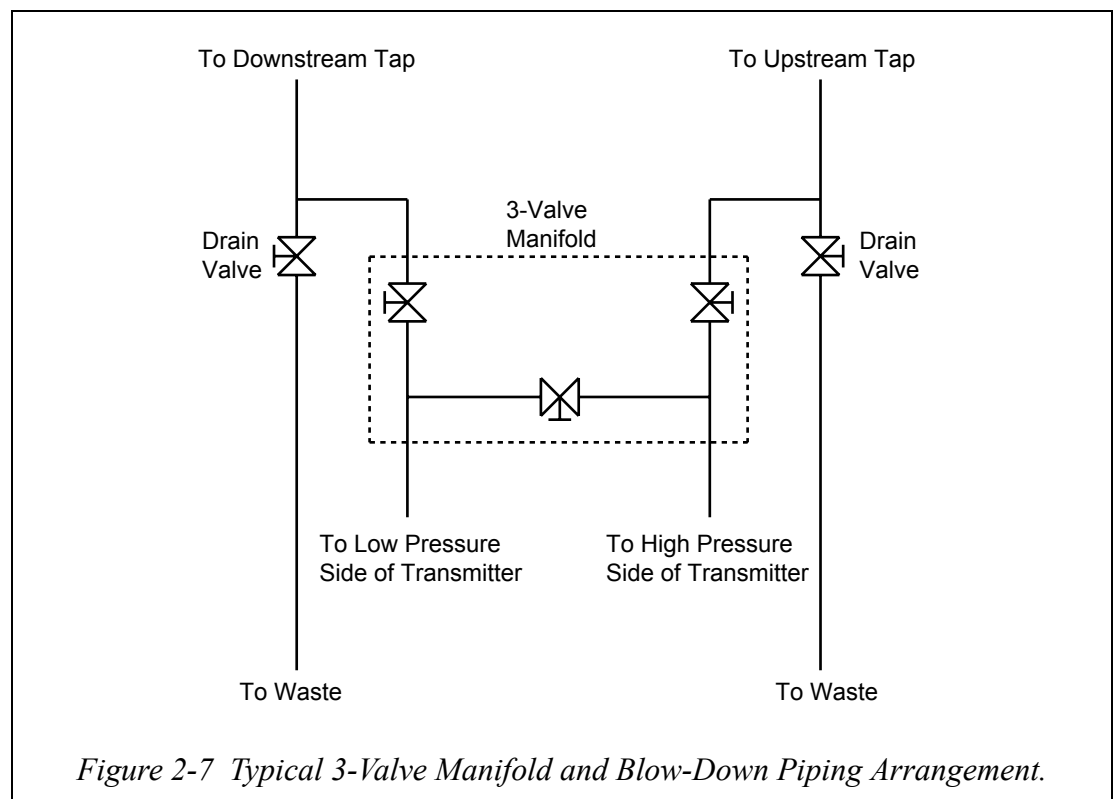


Figure 2-7 Typical 3-Valve Manifold and Blow-Down Piping Arrangement.

Process connections

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

Table 2-3 Process Connections

Transmitter type	Process Connection
Differential pressure	Process heads with 1/4 in. NPT internal thread connection. Flange adapters and manifolds with 1/2in. internal thread connections are optional.
Gauge pressure	Process head with 1/2 in. NPT internal thread connection. Process heads with 1/4 in. NPT internal thread connection. (STG9□0) Flange adapters and manifolds with 1/2 in. internal thread connections are optional (STG9□0)
Absolute pressure	Process heads with 1/2 in. NPT internal thread connection (STA923, 940)
Flange mounted liquid level	1.5, 2 or 3 in. flange with flush or 2, 3 or 4 in. 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

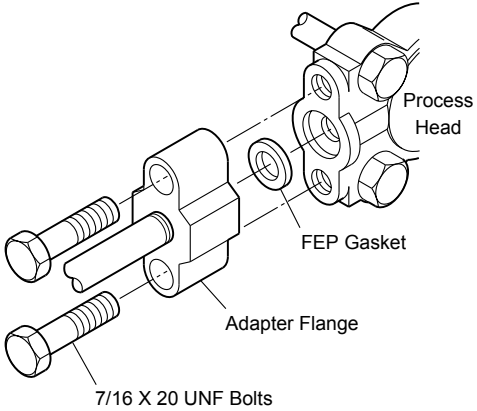
Table 2-4 gives the steps for installing an optional flange adapter on the process head.

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, submerge it in hot water for a few minutes then firmly press it into its recessed mounting groove in the adapter.

Table 2-4 Installing adapter flange

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

Table 2-4 Installing adapter flange

Step	Action
<p>3</p> <p>Secure adapter to process head by hand tightening 7/16-20 UNF hex-head bolts. Example-Installing adapter on process head</p> <p>ATTENTION Apply an anti-seize compound on the stainless steel bolts prior to threading them into the process head.</p>	 <p>The diagram illustrates the assembly of an adapter flange onto a process head. It shows a cross-section of the process head with an FEP gasket seated between it and the adapter flange. Four 7/16 X 20 UNF bolts are shown being inserted through the adapter flange into the process head. Labels with leader lines identify the 'Process Head', 'FEP Gasket', 'Adapter Flange', and '7/16 X 20 UNF Bolts'.</p>
<p>4</p>	<p>Evenly tighten adapter bolts to a torque of 47.5 to 54N•m (35 to 40 ftlb)</p>

2-3-1 :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 \triangleleft in illustration: Low level \triangleleft High level

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

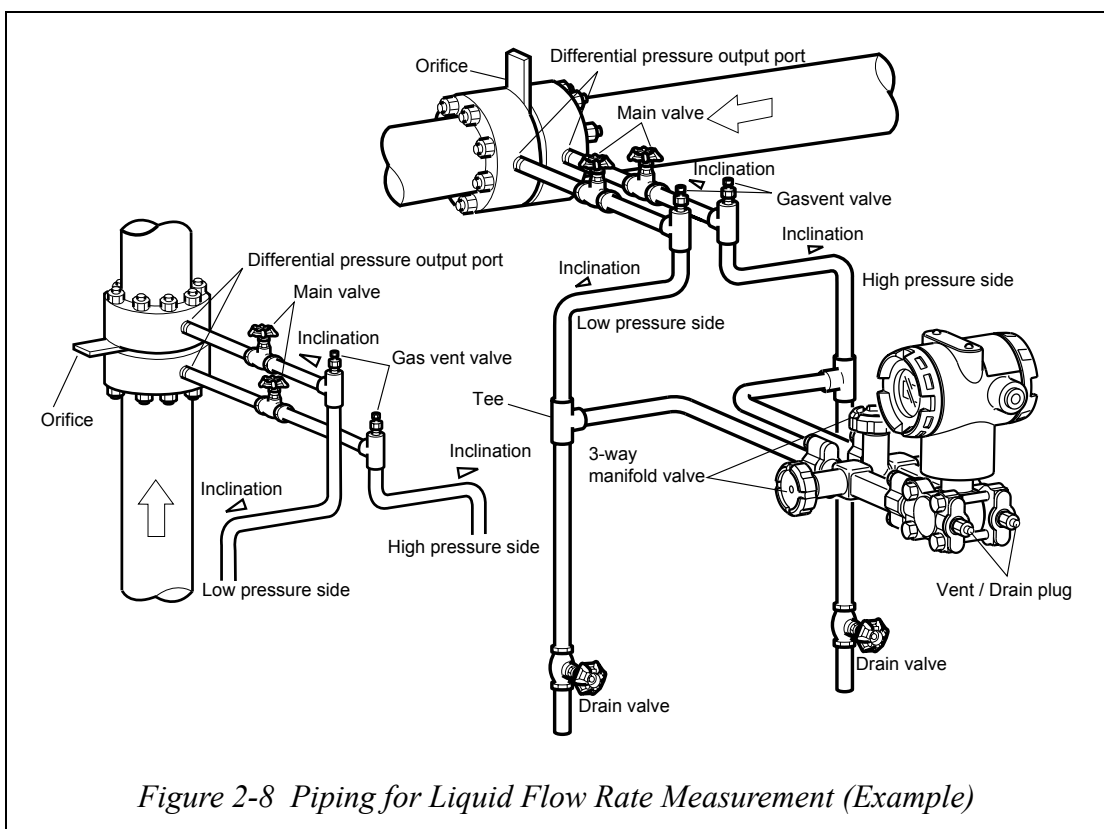


Figure 2-8 Piping for Liquid Flow Rate Measurement (Example)

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

Recommended piping -- Example 2

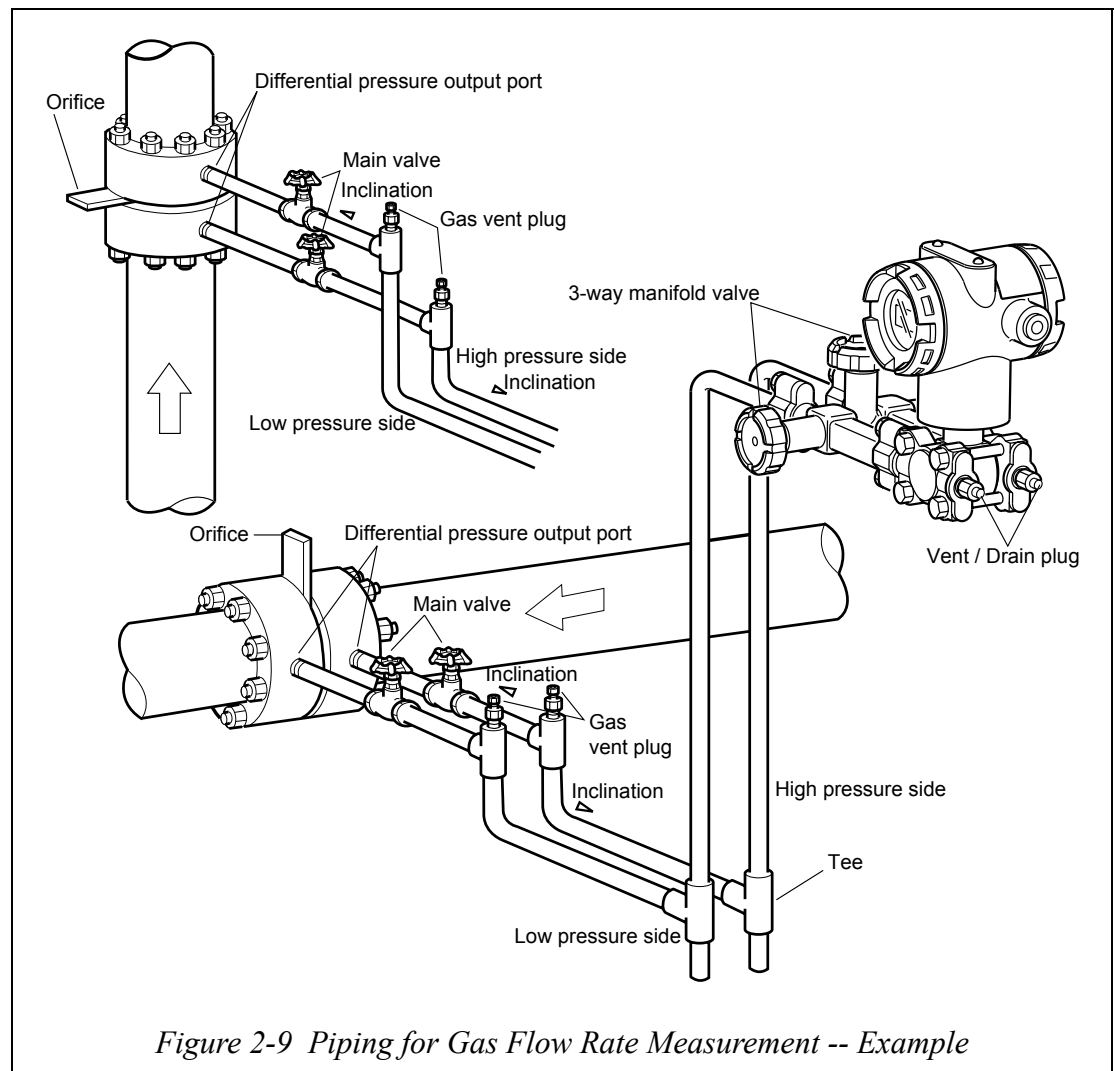
The illustration shows a typical example for gas flow rate measurement. This Differential pressure transmitter is located above the differential pressure output port of the process pipe. The condensate drains away from the transmitter.

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.



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 \triangle 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.

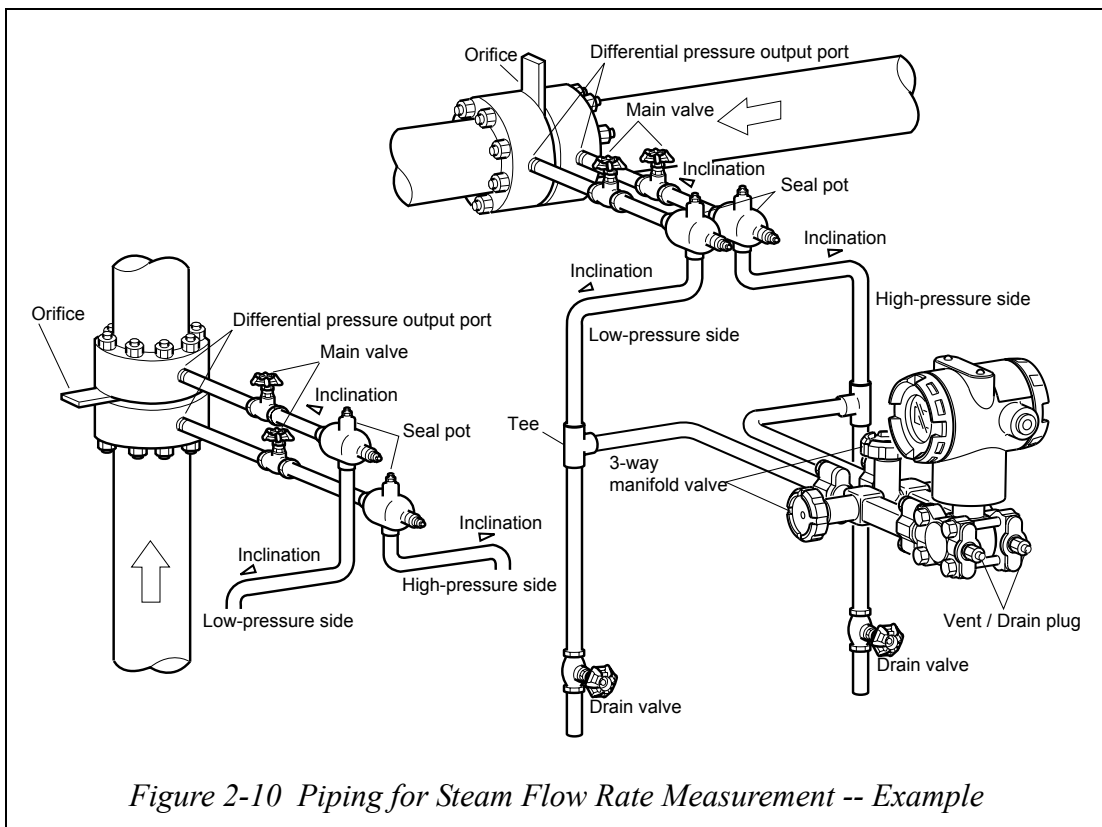


Figure 2-10 Piping for Steam Flow Rate Measurement -- Example

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

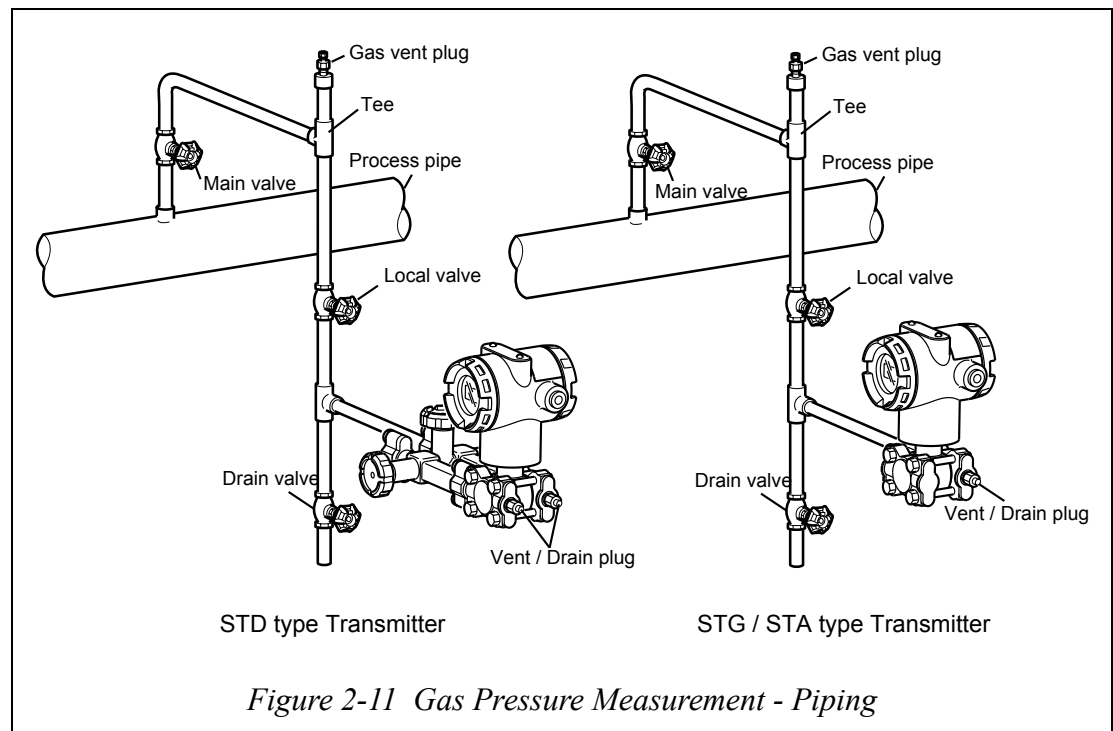
2-3-2 :Pressure Measurement - Piping

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.



Piping method

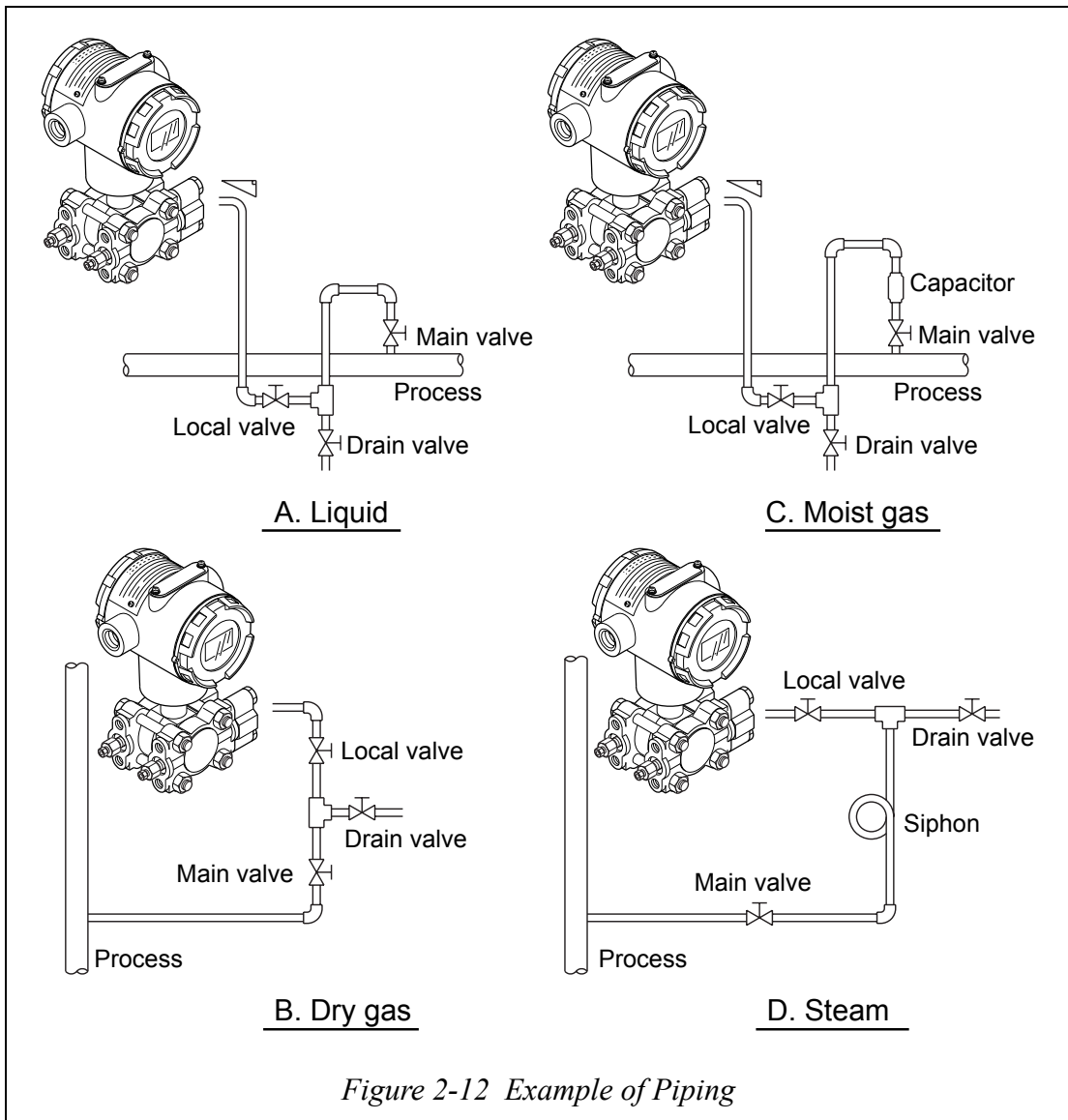
The piping method for the fluid to be measured depends on the meter installation position and the pipe line state. Typical examples of piping are shown in Figure 2-12.

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.



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.

2-3-3 :Liquid level measurement -- Piping (STD/STG)

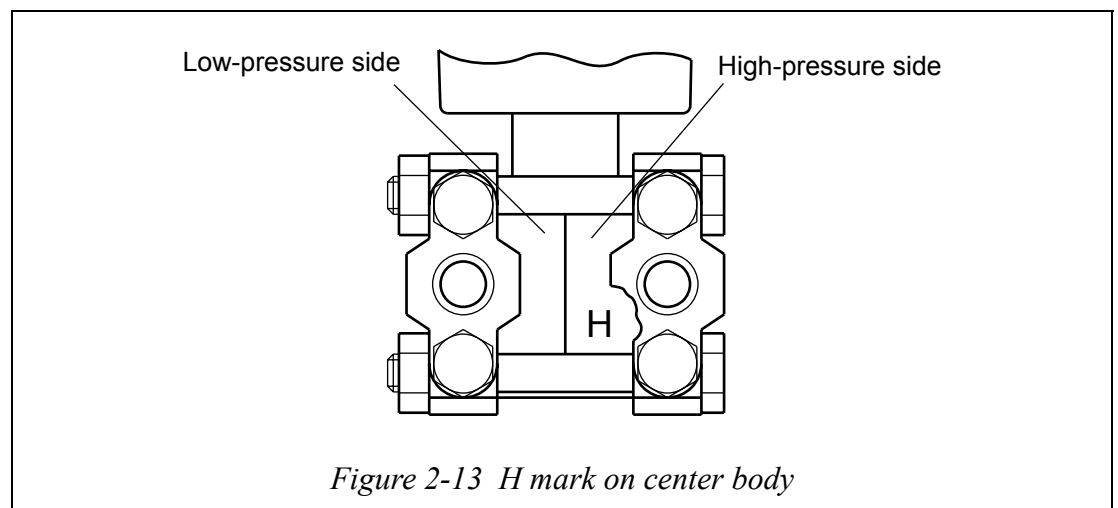
2-3-3-1 Piping

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.



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)

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.

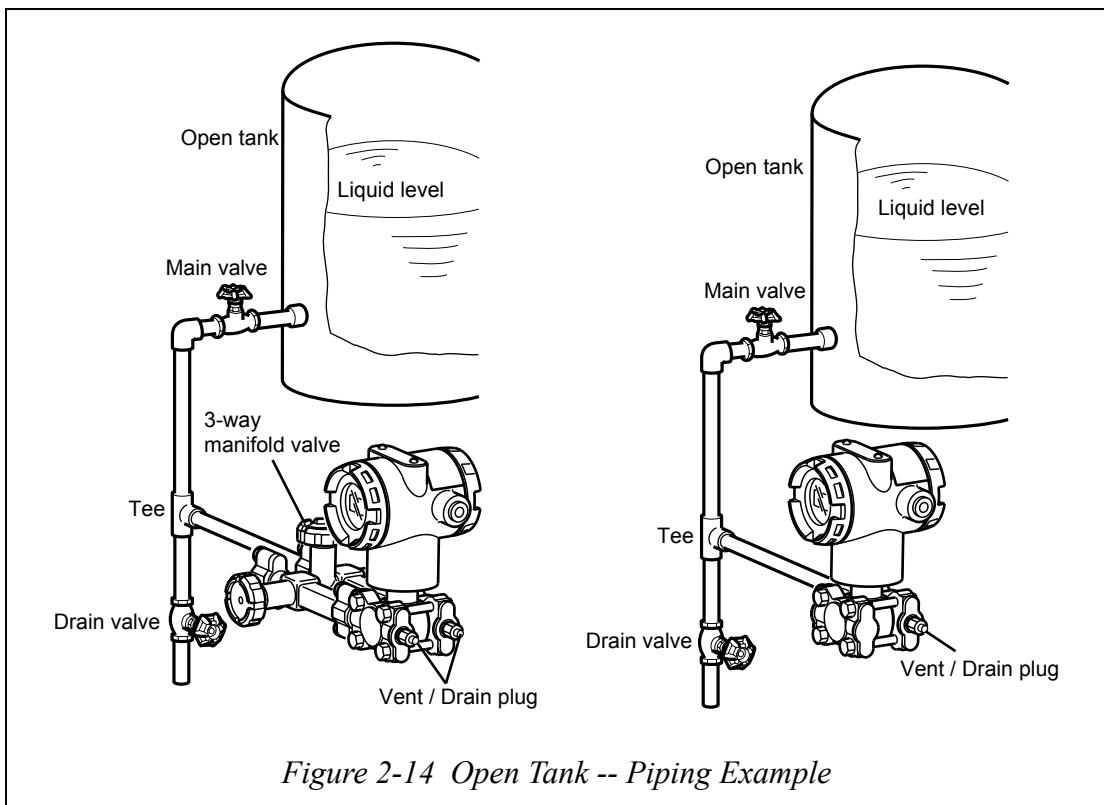


Figure 2-14 Open Tank -- Piping Example

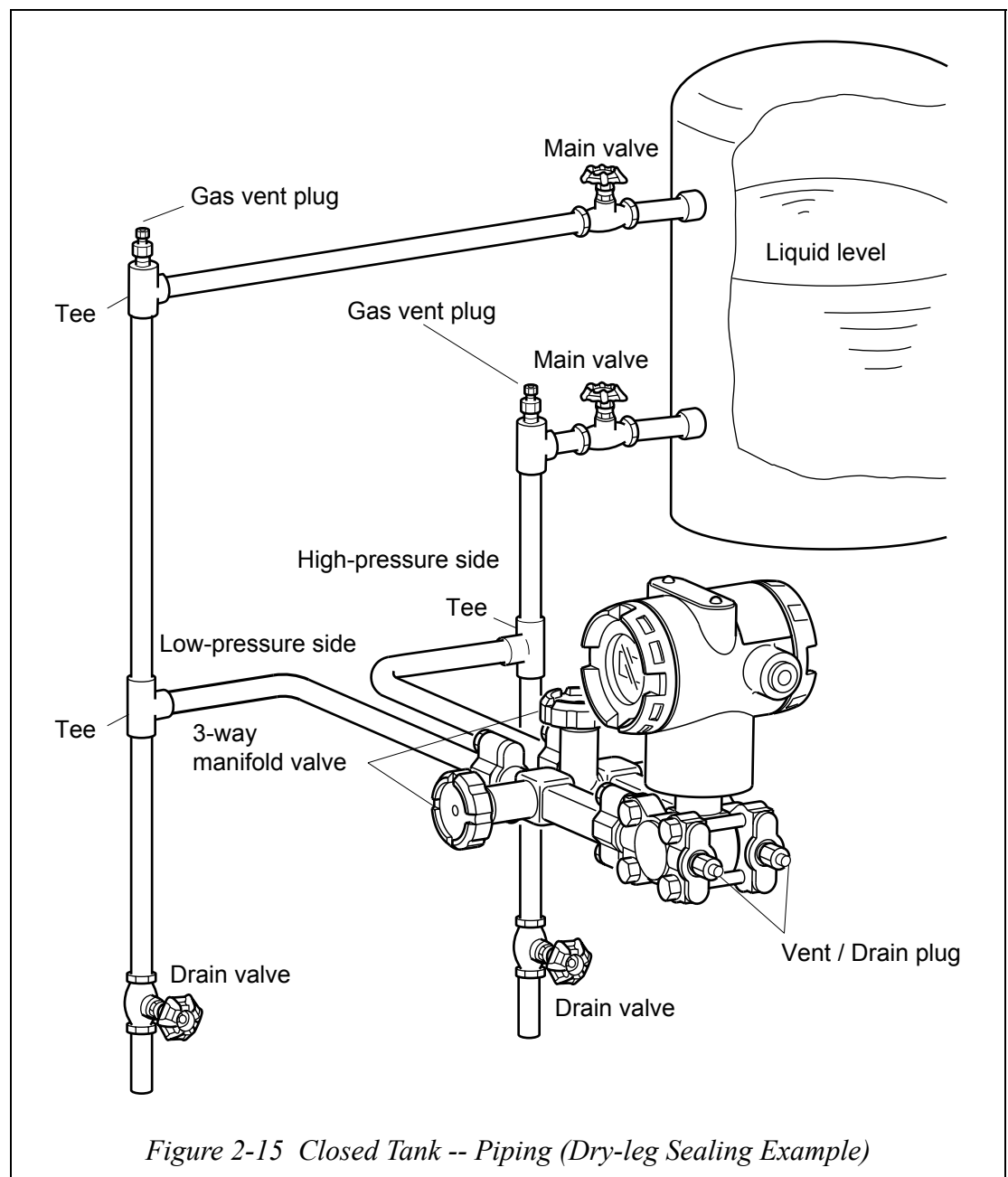
2-3-3-3 Closed tank - piping

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.



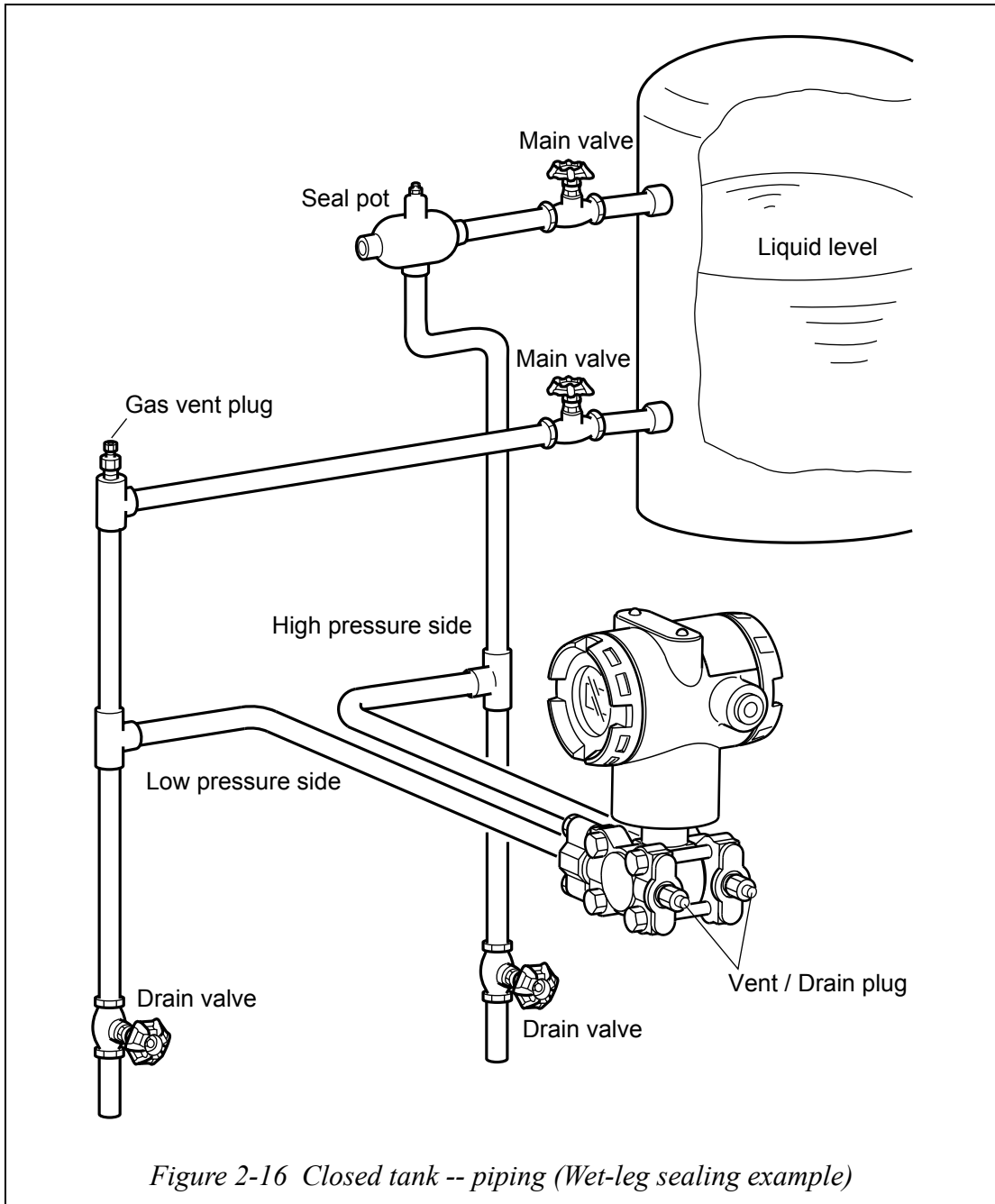
Recommended piping for wet leg - Example

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.



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).

2-4 : Wiring for the ST 3000 Smart Transmitter

2-4-1 :Wiring for the Transmitter -- Standard model

Introduction

The wiring instructions here are to be followed only if no explosion-proof standards or requirements apply.

When providing the wiring and cabling for an explosion-proof transmitter, refer to the instructions for explosion-proof transmitters (provided later) in this manual in addition to the following instructions.

Wire and cable this transmitter as explained below.

1. Turn the power to the Fieldbus off.

CAUTION

Make certain that the Fieldbus is not turned on while connecting the Fieldbus cable to the S900. Otherwise the S900 or the Fieldbus power supply might be permanently damaged. Yamatake's warranty does not cover these damages.

2. Connect the Fieldbus Signal “+” to the SIGNAL “+” terminal and Fieldbus Signal “-” to the SIGNAL “-” terminal.

~Note *The Fieldbus signal is polarity sensitive. The transmitter requires 9 to 32V DC to operate*

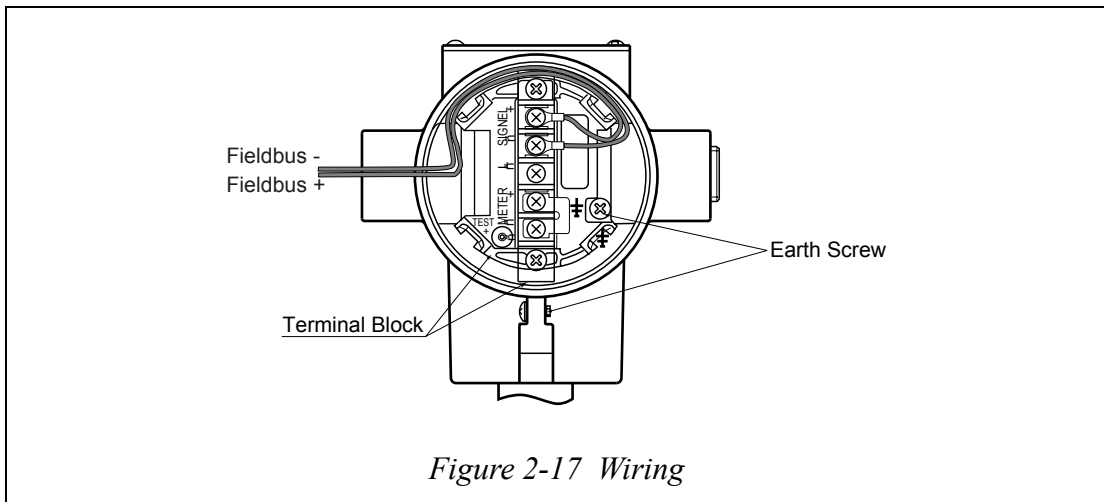


Figure 2-17 Wiring

3. If necessary, connect the Fieldbus Shield to the terminal marked with the ground symbol. To ground the transmitter, the ground resistance must be 100Ω or lower.

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

Guidelines

Explosion-proof requires special precautions and installation methods. Refer also to subsection "2-4-1 :Wiring for the Transmitter -- Standard 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 3 mm hexagonal wrench to open the locking structure.

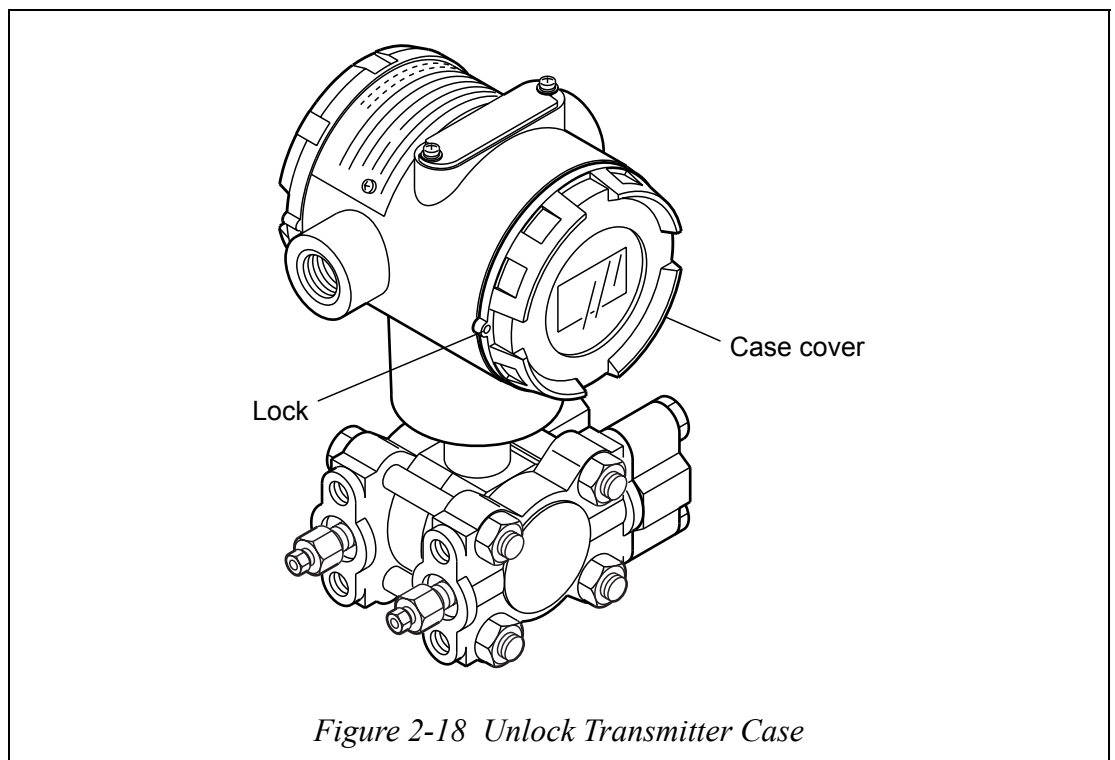


Figure 2-18 Unlock Transmitter Case

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.

Chapter 3 : Transmitter start-up

3-1 : Introduction

This section contains general information to establish communications and configure the ST3000 Smart Transmitter.

For details on establishing Fieldbus communications, refer to the “Fieldbus Integration Manual” (FB2-FBS100-3501).

3-2 : Establishing communications

Configuring parameters

To establish communications, all devices on the fieldbus network must be recognized by the LAS (Link Active Scheduler).

To setup a basic parameter for the Fieldbus communication, proceed with the following steps:

Set the network parameters according to the table below. Note that since all the devices on the same Fieldbus network use the same value, the values that the slowest device on the network can accommodate shall be set to the LAS.

Table 3-1

Symbol	Parameter name	Range of values
V(ST)	Slot Time	5 to 100
V(MID)	Minimum Interframe Gap	10 to $(V(MRD) - 1) \times V(ST)$, lower than 120 inclusive.
V(MRD)	Maximum Response Delay	$V(MRD) \times V(ST)$ shall be greater than 20 and V(MRD) shall be less than 11, inclusive.
T1	SM Step Timer	96000 (3 seconds)
T2	SM Set Address Sequence Timer	1920000 (60 seconds)
T3	SM Set Address Wait Timer	480000 (15 seconds)

~Note *An LAS requires parameters other than those listed here to operate. Please refer to the user's manual that comes with the LAS device.*

If necessary, restart the LAS and make sure that the S900 appears on the Fieldbus network with any one of the default addresses (0×F8 through 0×FB). If not, recheck the parameters above and the cable connections to the S900.

~Note *If more than one new Fieldbus device is attached to the network at the same time, up to four (4) of them will appear on the network addressed 0×F8 through 0×FB.*

Assign PD_TAG and NODE_ADDRESS

Assign the PD_TAG and the NODE_ADDRESS to the S900 with a fieldbus configurator. The default values of these parameters are given in the table below. If they are set successfully, the S900 is communicating properly on the Fieldbus network.

Symbol	Parameter name	Default Values
PD_TAG	Physical Device Tag	None (32 spaces)
NODE_ADDRESS	Node Address	0×F8

~Note *The PD_TAG and NODE_ADDRESS must be unique from all the devices on the same Fieldbus network. If the same NODE_ADDRESS is assigned to two devices, one of them will change its address to a default address (0×F8 through 0×FB).*

Chapter 4 : Function blocks and parameters

4-1 : Introduction

This section contains information on the structure and contents of all the function blocks implemented in the ST3000.

4-2 : Block structure and parameter descriptions

The S900 consists of the following function blocks;

Block	Reference FF Specifications	Original Parameters
Transducer block	FF-903 "Transducer Block (Part 2)" 2.1 Standard Pressure with Calibration	Contains Yamatake original parameters
AI function block	FF-891 "Function Block Application Part 2" 4.1 Analog Input	No Yamatake original parameters
Resource block	FF-891 "Function Block Application Process Part 2" 3.1 Resource Block	Contains Yamatake original parameters
DIAG function block	Yamatake original block	Contains Yamatake original parameters
PID function block	FF-891 "Function Block Application Part 2" 4.7 PID Control	No Yamatake original parameters

The conventions used in this section to define block parameters are given below;

Item	Description
Parameter	The standard mnemonics of the parameters defined by the Foundation Specifications. For Vendor specific parameters, Yamatake's own names are used.
Description	A brief description of the parameter. Please refer to the "Integration Manual" or the Foundation Specification FF-891 for detailed explanation.
Sub-parameter	Some of the parameters are structured. If this is the case, each of the sub-parameters are listed here.

Item	Description
Access attributes	<p>The following symbols are used to indicate attributes related to parameter access.</p> <p>S: Static data - Indicates that the parameter value cannot be overwritten during the execution of the block to which it belongs. (Data such as fixed data for individual device types and various configuration data)</p> <p>D: Dynamic data - Indicates that the parameter value can be modified by the block itself or by the user during the execution of the block to which it belongs. These are parameters that are changed occasionally or continuously according to the system state, device, or process that is in progress. These values are erased if a power outage occurs. (Data such as process measurement values and device execution status parameters)</p> <p>N: Nonvolatile data - These parameters, like dynamic data, may change during system operation. However, they are stored in nonvolatile memory and their most recent value is not lost if a power outage occurs. (This includes data such as PID setpoint values that must be restarted from the most recent value after a power outage occurs.)</p> <p>R: Parameters can only be read out.</p> <p>R/W: Parameters can be read out and are configurable.</p>
Size	The size of the parameter in bytes.
Valid Range	If the parameter value has a certain limits, they are specified here. Please note that the entire range of values may not be available.
Initial value	The factory default values of the parameter.
Unit	The unit applied to this parameter. If this column contains a parameter name such as "PV", the unit corresponding to the PV shall apply.

4-3 : Resource block

The resource block describes characteristics of the fieldbus device such as the device's name, manufacturer, and serial number.

Resource block parameters (Start index: 1000)

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
1	ST_REV	The revision level of the static data associated with a function block.	---	S-R	2	0 to 65535	0	None
2	TAG_DESC	User-specified descriptions of the intended application of the block. The AI FB does not check this parameter.	---	S-R/W	32	None	32 spaces	None
3	STRATEGY	An arbitrary number to identify grouping of blocks. The AI FB does not check this parameter.	---	S-R/W	1	0 to 65535	0	None
4	ALERT_KEY	An arbitrary number to identify the plant unit. The AI FB does not check this parameter.	---	S-R/W	1	1 to 255	0	None
5	MODE_BLK	The actual, target, permitted, and normal modes of a block.	Target	N-R/W				None
			Actual	D-R				
			Permitted	S-R/W				
			Normal	S-R/W				
6	BLOCK_ERR	An enumeration of error status associated with the hardware or software components of a block.	---	D-R				None
7	RS_STATE	Indicates the device's operating state.	Unsigned 8	D-R	1	0=Undefined 1=Start/Restart (start processing in progress) 2=Initialization (initialization in progress) 3=Online Linking (connection confirmation in progress) 4=Online (operating) 5=Standby (standby state) 6=Failure (failure occurred)		None
8	TEST_RW	Parameter used for applicability testing of communication software. This parameter is not used by users.	---	D-R/W	112			None
9	DD_RESOURCE	(Unused)	---	D-R/W	32			None
10	MANUFAC_ID	Unique identification number for manufacturers registered with Foundation.	---	S-R	4	0 to 0xFFFF	0x000DFC 96=YAMA TAKE	None
11	DEV_TYPE	Identification number that indicates the model of the device as defined by the manufacturer.	---	S-R	2	0 to 0xFF	0x0103=S9 00	None

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
12	DEV_REV	Revision number of the device as defined by the manufacturer.	---	S-R	2	0 to 0×FF	Depends on the device	None
13	DD_REV							
14	GRANT_DENY	Parameter that enables/disables access to the parameters in this block from human interface or the host. Whether or not this parameter is used depends on settings in the host.	Grant (Enable) Deny (Disable)	D-R/W	1	0 or 1	All bits set to 0	None
15	HAR_TYPES	Indicates the type of the hardware in which this resource block exists.	---	S-R	2	Fixed at 0×8000 (scalar input)	0×8000	None
16	RESTART	Restarts the device manually. In the specifications, there are several types of restart which the user can select from.	---	D-R/W	1	1: Run 2: Restart resource 3: Restart with defaults 4: Restart processor		None
17	FEATURES	Indicates the current operating state based on the content set with FEATURE_SEL in the option settings for device usage.	---	S-R	2	0×8000: Unicode0×4000: Reports0×1000: Software write lock	0×F500	None
18	FEATURE_SEL	Sets the device usage options.	---	S-R/W	2	Non-negative	0	None
19	CYCLE_TYPE	Indicates the current operating state based on the content set with CYCLE_SEL for the function block execution method.	---	S-R	2	0×8000: Scheduled (Follows the LAS schedule) 0×4000: Completion of block 0×2000: Manufacturer specific	0×8000	None
20	CYCLE_SEL	Sets the function block execution method.	---	S-R/W	2	As above	0	None
21	MIN_CYCLE_T	Indicates the minimum period for which a function block can be executed.	---	S-R	4	0 to 2 ³² -1	32000 (1 sec.)	1/32 msec
22	MEMORY_SIZE	Indicates a memory capacity that enables the addition of function blocks as a guideline.	---	S-R	2	0 to 65535		Kbytes
23	NV_CYCLE_T	Indicates the minimum required time to write "N-" type parameters to nonvolatile memory.	---	S-R	4	0 to 2 ³² -1	0	1/32 msec
24	FREE_SPACE	Indicates a memory capacity that enables the configuration addition as a guideline.	---	D-R	4	0 to 100.0	0	%
25	FREE_TIME	Indicates the load state as how much available time there is compared with function block execution time (Unused)	---	D-R	4	0 to 100.0	0	%
26	SHED_RCAS	Sets the write timeout time for a setpoint value change (SPC) from the host conducted by the RCAS_IN parameter when the function block mode is RCAS. If the setpoint value is not written within the time specified by this parameter, the function block automatically switches to the mode set in advance with the SHED_OPT parameter in the function block.	---	S-R/W	4	0 or a positive value	64000 (20 sec.)	1/32 msec

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
27	SHED_ROUT	Sets the write timeout time for a output value change (DDC) from the host connected by the ROUT_IN parameter when the function block mode is ROUT. If the output value is not written within the time specified by this parameter, the function block automatically switches to the mode set in advance with the SHED_OPT parameter in the function block.	---	S-R/W	4	0 or a positive value	640000 (20 sec.)	1/32 msec
28	FAULT_STATE	Indicates the current fault state (the output state when a fault has occurred in the function block) in the AO block. The value of this parameter can be set either in PID block execution or from the SET_FSTATE parameter of the next item.	---	N-R	1	1: clear (normal state) 2: Active (abnormal state)	1	None
29	SET_FSTATE	Forcibly sets the AO block to the fault state. The FAULT_STATE parameter is set to Active.	---	D-R/W	1	1: Off 2: Set	1	None
30	CLR_FSTATE	Clears the FAULT_STATE parameter. The FAULT_STATE parameter is cleared as long as there are no specific conditions for transitioning to the fault state in a SET_FAULT state parameter or function block execution.	---	D-R/W	1	1: Off 2: Set	1	None
31	MAX_NOTIFY	In alert transmission operations due to an alert object, indicates the maximum capacity of the device in terms of the maximum number of alarms that can be sent when confirmations are not performed by the host.	---	S-R	1	0 to 3	3	None
32	LIM_NOTIFY	Limit value for the actual use of the alert transmissions described above as stipulated by user settings.	---	S-R/W	1	0 to 3	3	None
33	CONFIRM_TIME	The maximum wait time for a confirmation for an alert transmission from a device. The alert will be resent if this time is exceeded without receiving a confirmation.	---	S-R/W	4	0 to 2 ³² -1	640000 (20 sec.)	1/32 msec
34	WRITE_LOCK	This parameter disables writes to all parameters within the device other than this parameter itself.	---	S-R/W	1	1: Unlocked (write enabled) 2: Locked (write disabled)	1	None
35	UPDATE_EVT	Alert parameter issued when a change occurs in resource block fixed data (items that have an access attribute of "S-" or "N-"). It has the following structure: <ul style="list-style-type: none"> Unacknowledged: The acknowledgement state Update state: The update state Time stamp: The time changed Static version: The revision number after the update Relative index: Parameter identification number for the parameter changed. 	Unacknowledged Update state Time stamp Static Revision Relative index	D-R D-R D-R D-R D-R	1 1 8 2 2	Unacknowledged: 0=Undefined (no change) 1= Acknowledged (acknowledged) 2=Unacknowledged (unacknowledged) Update state: 0=Undefined (no change) 1=Update reported (The update was reported) 2=Update not reported (The update was not reported)	None	

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
36	BLOCK_ALM	Parameter that indicates the configuration of the resource block and error states during execution. It has the following structure: Unacknowledged: Occurrence verification state • Alarm state: State in which an alarm has occurred • Time stamp: Time of alarm occurrence/recovery • Subcode: Alarm content subcode • Value: Alarm value	Unacknowledged	D-R/W	1			None
			Alarm State	D-R	1			
			Time stamp	D-R	8			
			Subcode	D-R	2			
			Value	D-R	1			
37	ALARM_SUM	Parameter that summarizes the state of the resource block BLOCK_ALM. • Current: The currently occurring state • Unacknowledged: Alarm verification state • Unreported: The state of reporting to the host. • Disabled: Alarm detection disablement state	Current	D-R	2	In the resource block, only the state of the block alarm is the object of this parameter.		None
			Unacknowledged	D-R	2			
			Unreported	D-R	2			
			Disabled	S-R/W	2			
38	ACK_OPTION	Enables or disables automatic confirmation on the occurrence of a block alarm (BLOCK_ALM) for a resource block. Automatic confirmation refers to confirmation over the communication system without any operations, and is seen as equivalent.	---	S-R/W	2	0: Disabled 1: Enabled	0	None
39	WRITE_PRI	Defines the priority of the warning issued when a WRITE_LOCK is set to write enabled (unlocked) state.	---	S-R/W	2	0 to 15	0	None
40	WRITE_ALM	Alarm parameter that is issued when the resource block WRITE_LOCK parameter is unlocked.	Unacknowledged	D-R/W	1			None
			Alarm state	D-R	1			
			Time stamp	D-R	8			
			Subcode	D-R	2			
			Value	D-R	1			
41	ITK_VER	Version number of the mutual operability test tool.	---	S-R	1		4	None

Index	Parameter (Yamatake original parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
42	SOFTWARE_REV	Indicates the revision number of the software of the device.	---	S-R	4			None
43	SIM_ACTIVE_SW	Enables or disables simulation function.	---	S-R/W	2	0: SIM_INACTIVE 1: ACTIVE	0	None

4-4 : Transducer block

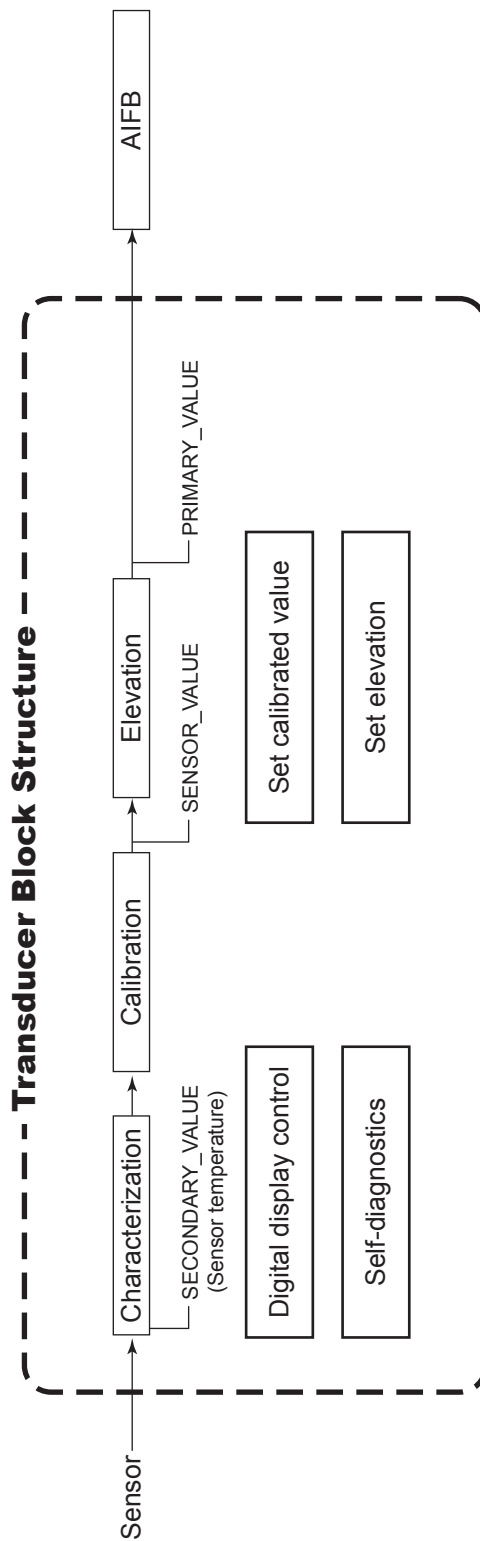
The Transducer Block (TB) performs required calculations, such as linearization and characterization for the sensor signal input, to generate pressure or, differential pressure or the sensor temperature.

The TB supplies pressure or differential pressure to the AIFB as PRIMARY_VALUE and the sensor temperature as SECONDARY_VALUE.

The device can be adjusted and calibrated using the parameters of the TB for various installations and applications.

The TB also drives an optional digital display meter and performs intensive self-diagnostics to assure the safe and accurate operation of the device.

A block diagram of the S900 TB is shown below.



Transducer block parameters (Start index: 1100)

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
1	ST_REV	The revision level of the static data associated with a function block.	-	S-R	2	0 to 65536	0	None
2	TAG_DESC	User-specified descriptions of the intended application of the block. The RB does not check this parameter.	-	S-R/W	32	-	spaces	None
3	STRATEGY	An arbitrary number to identify grouping of blocks. The TB does not check this parameter.	-	S-R/W	2	0 to 65536	0	None
4	ALERT_KEY	An arbitrary number to identify the plant unit. The TB does not check this parameter.	-	S-R/W	1	1 to 255	1	None
5	MODE_BLK	The actual, target, permitted, and normal mode of the block: Target: The mode to "go to" Actual: The mode the "block is currently in" Permitted: Allowed modes that target may take on Normal: The mode to which the block should be set during normal operating conditions.	Target	N-R/W	1	O/S, AUTO	O/S	None
			Actual	D-R	1	O/S, AUTO	O/S	None
			Permitted	S-R/W	1	O/S, AUTO	O/S, AUTO	None
			Normal	S-R/W	1	O/S, AUTO	AUTO	None
6	BLOCK_ERR	An enumeration of error status associated with the hardware or software components of the block.	-	D-R	2	-	0x0000	None
7	UPDATE_EVT	An alert generated by the TB to report any changes to its static data. The alert contains its acknowledged status, time stamp, a new static revision number, and a relative index of an updated static data.	Unacknowledged	D-R	1	0, 1, 2	0	None
			Update State	D-R	1	0, 1, 2	0	None
			Time Stamp	D-R	8	-	0x00000000 00000000	None
			Static Revision	D-R	2	-	0x0000	None
			Relative Index	D-R	2	-	0	None
8	BLOCK_ALM	An alarm generated by the TB to report any configuration, hardware failures, communication disconnection, or system failures.	Unacknowledged	D-R	1	0, 1, 2	0	None
			Alarm State	D-R	1	0, 1, 2, 3, 4	0	None
			Time Stamp	D-R	8	-	0x00000000 00000000	None
			Subcode	D-R	2	-	0	None
			Value	D-R	1	-	0	None
			Number of Transducers	N-R	2	0 to 2	1	None
9	TRANSDUCER_DIRECTORY	The directory of the number and starting indices of the transducers in the TB. The S900 does not use this parameter.	Index of 1st Transducer	N-R	2	-	1110	None
10	TRANSDUCER_TYPE	The type of the Transducer Block. The TRANSDUCER_TYPE for S900 = 100 (Standard Pressure with Calibration).	-	N-R	2	100 = Standard Pressure with Calibration	100	None
11	XD_ERROR	Error codes generated by the TB.	-	D-R	1	20 = Electronics failure 22 = I/O failure 23 = Data Integrity error	0	None

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
12	COLLECTION_DIRECTORY	The directory of the number starting indicates, and DD Item IDs of the data collections each transducer within the TB. The S900 does not use this parameter.	Number of Data Collections Index of 1st Data Collections DD item ID of 1st Data Collections	N-R N-R N-R	4 4 4	0 to 3 - -	1 1113 0	None None None
13	PRIMARY_VALUE_TYPE	The type of measurement.	-	S-R	2	107 = differential pressure 108 = gauge pressure 109 = absolute pressure	-	None
14	PRIMARY_VALUE	The sensor value (pressure) and status.	Status Value	D-R D-R	5	- -	- -	None PVR
15	PRIMARY_VALUE_RANGE	Specifies the upper and lower range limit of the sensor, the engineering unit code, and the decimal point position of the Primary Value. S900 does not use a decimal point.	EU_100 EU_0 Units Index	N-R N-R N-R	4 4 2	Sensor range upper limit Sensor range lower limit 1130=Pa, 1132=MPa, 1133=kPa, 1136=hPa, 1137=bar, 1138=mbar, 1141=psi, 1144=g/cm ² , 1145=kg/cm ² , 1146=inH ₂ O, 1149=mmH ₂ O,1155=inHg	- - 1133	PVR PVR Follows the Units Index of XD_SCALE of AI FB connected to ch1.
16	CAL_POINT_HI	The highest calibration value. The S900 does not use this parameter.	Decimal Point	N-R	1	-	-	None
17	CAL_POINT_LO	The lowest calibration value.S900 does not use this parameter.	-	S-R/W	4	-	+INF	CU
18	CAL_MIN_SPAN	The minimum span of the calibration value.S900 does not use this parameter.	-	S-R/W N-R	4 4	- -	-INF -	CU CU
19	CAL_UNIT	The unit code for the calibration value.	-	S-R/W	2	1130=Pa, 1132=MPa, 1133=kPa, 1136=hPa, 1137=bar, 1138=mbar, 1141=psi, 1144=g/cm ² , 1145=kg/cm ² , 1146=inH ₂ O, 1149=mmH ₂ O,1155=inHg	1133	None
20	SENSOR_TYPE	Defines the type of the sensor.SENSOR_TYPE of S900 is 125 (Piezo resistive).	kPa	S-R	2	125= Piezo resistive	125	None

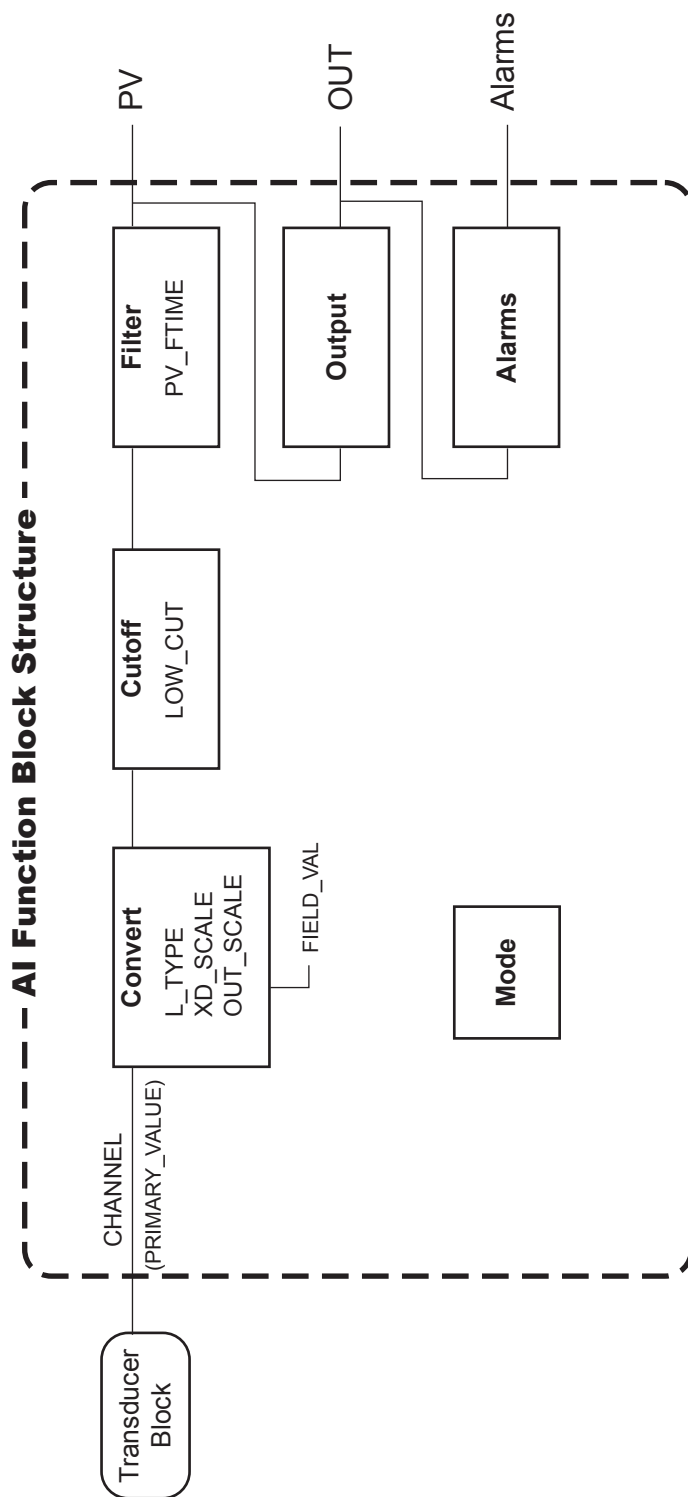
Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
21	SENSOR_RANGE	Specifies the upper and lower range limits, the engineering unit code, and the decimal point position of the sensor value. SENSOR_RANGE of S900 is fixed at 1133 (kPa). S900 does not use a decimal point.	EU_100 EU_0 Units Index Decimal Point	N-R N-R N-R N-R	4 4 2 1	Sensor range upper limit Sensor range lower limit 1133=kPa (fixed)	- - 1133 2	kPa kPa None None
22	SENSOR_SN	Defines the sensor serial number.	-	N-R	32	-	-	None
23	SENSOR_CAL_METH OD	The method of the last sensor calibration.	-	S-R/W	1	100 = volumetric 101 = static weigh 102 = dynamic weigh 103 = factory trim standard calibration 104 = user trim standard calibration 105 = factory trim special calibration 106 = user trim special calibration 255 = other	-	None
24	SENSOR_CAL_LOC	The location of the last sensor calibration.	-	S-R/W	32	-	NULL	None
25	SENSOR_CAL_DATE	The date of the last sensor calibration.	-	S-R/W	7	-	0	date
26	SENSOR_CAL_WHO	The name of the person responsible for the last calibration.	-	S-R/W	32	-	NULL	None
27	SENSOR_ISOLATOR_MTL	Type of material of the sensor isolator. S900 does not support this parameter	-	N-R	2	-	-	None
28	SENSOR_FILL_FLUID	Type of fill fluid used in sensor.	-	N-R	2	-	-	None
29	SECONDARY_VALUE	The secondary value. SECONDARY_VALUE of S900 is sensor temperature.	Status Value	D-R D-R	1 4	- -	- -	None SVU
30	SECONDARY_VALUE_UNIT	Engineering unit to be used with SECONDARY_VALUE.	-	S-R	1	100=K 1001=°C 1002=°F 1003=°R	1001	Follows the units index of XD_SCALE of AI FB connected to ch2.

Index	Parameter (Yamatake original parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
31	MEASUREMENT_STA TUS	Indicates S900's self-diagnostics information.		D-R	4	-	0×00000000	None
32	SENSOR_VALUE	The measured pressure value. The unit of this parameter is fixed to kPa.		D-R	4	-	0.0	kPa
33	CAL_CMD	The calibration command.	CAL_ENUM	D-R/W	1	0=NONE 1=CAL_LOWER 2=CAL_UPPER 254=CAL_RESET 255=CAL_INIT	0	None
34	CAL_STATUS	Calibration status as a result of CAL_CMD operations.	CAL_VAL	D-R	4	-	0.0	CU
35	HEIGHT_VALUE	The distance between two flanges of remote diaphragm seals type transmitter to activate the fill fluid ambient temperature correction function.		S-R/W	4	-	0	HVR
36	HEIGHT_VALUE_RAN GE	Specifies the upper and lower range limits, the engineering unit code, and the decimal point position of the HEIGHT_VALUE. S900 does not use a decimal point.	EU_100 EU_0 Units Index	S-R S-R S-R/W	4 4 2	30 (meter) -30 (meter) 1010=meter 1018=feet 1019=inch	30 -30 1010	HVR HVR None
37	ELEVATION_CMD	Elevation command.	Decimal Point	S-R D-R/W	1 1	- 0=NONE 1=SET_ELEV 2=CLEAR_ELEV	- 0	None None
38	ELEVATION_VALUE	Elevation value.		S-R/W	4	-	0.0	PVR
39	ELEVATION_STATUS	Elevation status as a result of ELEVATION_CMD operations.		D-R/W	1	0=NONE 1=SET_ELEV Success 2=CLEAR_ELEV Success 11=SET_ELEV Failed 12=CLEAR_ELEV Failed 255=ELEV_VALUE set directly	0	None

Index	Parameter (Yamatake original parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
40	DISPLAY_MODE	Selects the value to be displayed on the LCD.		S-R/W	1	0=NONE 1=AI_PV 2=AI_OUT 3=AI_FIELD_VAL 4=XD_PV 5=DISPLAY_RANGE	3	None
41	DISPLAY_RANGE	Specifies the display scale when DISPLAY_RANGE is selected for DISPLAY_MODE.	EU_100	S-R/W	4	-	100	DR
			EU_0	S-R/W	4	-	0	DR
			Units Index	S-R/W	2	-	%	None
			Decimal Point	S-R	1	-	2	None

4-5 : Analog input function block

The analog input function block (AIFB) accepts the transducer block output from the selected channel, processes it with user-configured options, and provides the processed input value for other Fieldbus devices. The figure below illustrates a block diagram for the AIFB:



AI function block parameters (Start index: 1200, 1300)

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Range	Initial value	Units
1	ST_REV	The revision level of the static data associated with a function block.	---	S-BS	2	0 to 65535	0	None
2	TAG_DESC	User-specified descriptions of the intended application of the block. The AI FB does not check this parameter.	---	S-UD	32	None	32 spaces	None
3	STRATEGY	An arbitrary number to identify grouping of blocks. The AI FB does not check this parameter.	---	S-UD	1	0 to 65535	0	None
4	ALERT_KEY	An arbitrary number to identify the plant unit. The AI FB does not check this parameter.	---	S-UD	1	1 to 255	0	None
5	MODE_BLK	The actual, target, permitted, and normal modes of a block.	Target					None
			Actual					
			Permitted				O/S, MAN, AUTO	
			Normal					
6	BLOCK_ERR	An enumeration of error status associated with the hardware or software components of a block.	---					None
7	PV	The primary analog value after input processing based on L_TYPE, LOW_CUT and PV_FTME calculation.	Status					None
8	OUT	The resulted value of the AI FB execution.	Status					OUT
			Value				OUT_SCALE +/- 10%	
9	SIMULATE	Manually supplied input value from the XB to simulate a real input signal.	Simulate Status					None
			Simulate Value				Same as XB	XD
			Transducer Status					None
			Transducer Value				Same as XB	XD
			Enable/Disable				1: disable 2: enable	None
10	XD_SCALE	The high and low scale values, engineering units code, and the decimal point position to be used in displaying the Transducer parameter.	EU_100					XD
			EU_0					XD
			Unit Index					None
11	OUT_SCALE	The high and low scale values, engineering units, and the decimal point position to be used in displaying the OUT parameter.	DP					None
			EU_100					OUT
			EU_0					OUT
			Unit Index					None
12	GRANT_DENY	Semaphores provided for human interfaces and other host devices to restrict access to certain parameters. The AI FB does not check this parameter.	Grant				0 or 1	None
			Deny					None

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Range	Initial value	Units	
13	IO_OPTS	A set of lags to select or activate various I/O options.	---			bit 10: Low-cut 1: Enable 0: Disable		None	
14	STATUS_OPTS	Defines optional features for the OUT parameter status.	---			0 or 1		None	
15	CHANNEL	The number of the logical hardware channel that is currently connected to the AI FB.	---			1		None	
16	L_TYPE	Defines calculation type for the value passed from transducer block.				1: Direct 2: Indirect 3: Square root		None	
17	LOW_CUT	Low limit value used in input processing to eliminate noise near zero for flow sensor.				Non-negative		OUT	
18	PV_FTIME	Time constant of a single exponential filter for the PV.				Non-negative		Sec.	
19	FIELD_VAL	The raw value in percent of XD_SCALE before L_TYPE, LOW_CUT and PV_FTIME calculation.	Status					None	
20	UPDATE_EVT	An alert generated by the AI FB to report any changes in its static data. The alert contains its acknowledged status, time stamp, a new static revision number, and a relative index of an updated static data.	Value			Not specified		%	
			Unacknowledged					None	
			Update State						
			Time Stamp						
			Static Revision						
21	BLOCK_ALM	An alarm generated by the AI FB to report any configuration, hardware failures, communication disconnection, or system failures.	Relative Index						
			Unacknowledged					None	
			Alarm State						
			Time Stamp						
			Subcode						
22	ALARM_SUM	A summary of alarms generated by the AI FB, whether they were generated, reported, acknowledged, or disabled.	Value						
			Current					None	
			Unacknowledged						
			Unreported						
23	ACK_OPTION	Enables or disables automatic acknowledgements of the alarms.	Disabled						
								None	
24	ALARM_HYS	Hysteresis value for the PV to clear its alarm conditions after it returns to within limits.							
								%	
25	HI_HI_PRI	An alarm priority of high-high, high, low, low-low alarms, respectively. All the parameters have the same format and range.							
								None	
26	HI_HI_LIM	An alarm setpoint in the engineering unit in use for the high-high, high, low, low-low alarms, respectively.							
								PV_SCALE, +INF	

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Range	Initial value	Units
27	HI_PRI	An alarm priority of high-high, high, low, low-low alarms, respectively.All the parameters have the same format and range.				0 to 15		None
28	HI_LIM	An alarm setpoint in the engineering unit being used for the high-high, high, low, low-low alarms, respectively.						
29	LO_PRI	An alarm priority of high-high, high, low, low-low alarms, respectively.All the parameters have the same format and range.				0 to 15		None
30	LO_LIM	An alarm setpoint in the engineering unit being used for the high-high, high, low, low-low alarms, respectively.				-INF, PV_SCALE		PV
31	LO_LO_PRI	An alarm priority of high-high, high, low, low-low alarms, respectively.All the parameters have the same format and range.				0 to 15		None
32	LO_LO_LIM	An alarm setpoint in the engineering unit being used for the high-high, high, low, low-low alarms, respectively.				-INF, PV_SCALE		PV
33	HI_HI_ALM	A set of alarm data including the alarm state and time stamp for the high-high, high, low, low-low alarms, respectively.All the alarms have the same set of parameters.	Unacknowledged Alarm State Time Stamp Subcode Value					None None None None PV
34	HI_ALM	A set of alarm data including the alarm state and time stamp for the high-high, high, low, low-low alarms, respectively.All the alarms have the same set of parameters.	Unacknowledged Alarm State Time Stamp Subcode Value					None None None None PV
35	LO_ALM	A set of alarm data including the alarm state and time stamp for the high-high, high, low, low-low alarms, respectively.All the alarms have the same set of parameters.	Unacknowledged Alarm State Time Stamp Subcode Value					None None None None PV
36	LO_LO_ALM	A set of alarm data including the alarm state and time stamp for the high-high, high, low, low-low alarms, respectively.All the alarms have the same set of parameters.	Unacknowledged Alarm State Time Stamp Subcode Value					None None None None PV

4-6 : PID function block

The PID function block is an algorithm that produces an output signal in response to the measured variable and the setpoint.

The output has three terms: proportional, integral and derivative. The output is adjusted by tuning constants. There are three tuning constants in the PID equation.

1. GAIN is the tuning constant of the Proportional term.
2. RESET is the tuning constant of the Integral.
3. RATE is the tuning constant of the Derivative.

The ST3000 employs FF standard parameters of the PID Function block. Refer to FF specifications, FF-891 "Function Block Application Process Part 2" for details.

PID function block parameters (Start index:1400)

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
1	ST_REV	Refers to the revision number of the static data that belongs to the block. If a parameter for which the access attribute is "S-" is modified, it changed by an increment of 1 each modification.	---	S-BS	2	0 to 65535	0	None
2	TAG_DESC	Tag name for the user-defined transducer block. This is used for reference by the host, and is unrelated to the operation or execution of the function block itself.	---	S-UID	32		32 spaces	na
3	STRATEGY	An arbitrary group number for the transducer block. (This parameter is unrelated to block operation. It is provided so that the different types of blocks can be grouped arbitrarily so that they can be identified more easily in later database search operations.)	---	S-UID	2	0 to 65535	0	None
4	ALERT_KEY	Identification number for the related plant-internal devices. (This parameter is unrelated to block operation. It is provided so that the different types of blocks can be grouped arbitrarily so that they can be identified more easily in later database search operations.)	---	S-UID	1	1 to 255	0	None
5	MODE_BLK	Transducer block mode parameter set. MODE_BLK has the following structure: <ul style="list-style-type: none"> • Target: Parameter for the mode set from the host. • Actual: Refers to the value of the mode used by the function block. • Permitted: Refers to the value of the mode used by the function block. • Normal: Refers to the value of the mode that should be the normal state. 	---	S-UID	1	1 to 255	0	None
6	BLOCK_ERR	Refers to the error status from the transducer block.	---	D-BD	2			None
7	PV	Either the primary analog value for use in executing the function, or a process value associated with it.	Status	D-BD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
		Value	Value	D-BD	4			PV

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
8	SP	The analog setpoint of this block.	Status	N-PD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
9	OUT	The primary analog value calculated as a result of executing the function.	Value	N-PD	4	PV_SCALE +/- 10%		PV
10	PV_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the PV parameter and parameters which have the same scaling as PV.	Status	N-PD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
			Value	N-PD	4	OUT_SCALE +/- 10%		OUT
			EU_100	S-UD	4		100	PV
			EU_0	S-UD	4		0	PV
			Unit Index	S-UD	2	See CONTROL_OPTS parameter	%	na
11	OUT_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.	DP	S-UD	1	0 to 255	0	na
			EU_100	S-UD	4		100	OUT
			EU_0	S-UD	4		0	OUT
			Unit Index	S-UD	2	See CONTROL_OPTS parameter	%	na
12	GRANT_DENY	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.	DP	S-UD	1	0 to 255	0	None
			Grant	D-UD	1	0 or 1	0	None
			Deny	D-UD	1	0 or 1	0	None
13	CONTROL_OPTS	Options which the user may select to alter the calculations done in a control block.	---	S-UD	2	0: Invalid1: Valid	0	None
14	STATUS_OPTS	Options which the user may select in the block processing of status.	---	S-UD	2	0: Invalid1: Valid	0	None
15	IN	The primary input value of the block, required for blocks that filter the input to acquire the PV.	Status	D-BD	1	Good: Good value Uncertain: Unknown Bad: Unusable		None
16	PV_FTME	Time constant of a single exponential filter for the PV, in seconds.	Value	D-BD	4	---		PV
17	BYPASS	The normal control algorithm may be bypassed through this parameter. When set to bypass (in percentage), the setpoint value will be directly transferred to the output. To prevent a bump on transfer to/from bypass, the setpoint will automatically be initialized to the output value or process variable, respectively, and the path broken flag will be set for one execution.	---	S-UD	4	0 or positive value	0	sec.
			---	S-UD	1	1: Off 2: On	0	None
18	CAS_IN	This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link.	Status	N-PD	1	Good: Good value Uncertain: Unknown Bad: Unusable		None
19	SP_RATE_DN	Ramp rate at which downward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero, then the setpoint will be used immediately. For control blocks, rate limiting will apply only in Auto. For output blocks, rate limiting will apply in Auto, Cas, and RCas modes.	Value	N-PD	4	---		PV
			---	S-UD	4	0 or positive value	+ 8	PV/sec.

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
20	SP_RATE_UP	Ramp rate at which upward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero, then the setpoint will be used immediately. For control blocks, rate limiting will apply only in Auto. For output blocks, rate limiting will apply in Auto, Cas, and RCas modes. The setpoint high limit is the highest setpoint operator entry that can be used for the block.	---	S-UD	4	0 or positive value	+8	PV/sec.
21	SP_HI_LIM	The setpoint high limit is the highest setpoint operator entry that can be used for the block.	---	S-UD	4	PV_SCALE (EU_100) +10%	100	PV
22	SP_LO_LIM	The setpoint low limit is the lowest setpoint operator entry that can be used for the block.	---	S-UD	4	PV_SCALE (EU_0) -10%	0	PV/sec.
23	GAIN	A dimensionless value used by the block algorithm in calculating the block output.	---	S-UD	4	0 or positive value		None
24	RESET	The integral time constant, in seconds, per repeat.	---	S-UD	4	0 or positive value		sec.
25	BAL_TIME	This specifies the time for the internal working value of bias or ratio to return to the operator set bias or ratio, in seconds. In the PID block, it may be used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is Auto, Cas, or RCas.	---	S-UD	4	Positive value	0	sec.
26	RATE	Defines the derivative time constant, in seconds.	---	S-UD	4	0 or positive value		sec.
27	BKCAL_IN	The value and status from a lower block's BKCAL_OUT that is used to prevent reset windup and to initialize the control loop.	Status	D-BD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
28	OUT_HI_LIM	Limits the maximum output value.	Value	D-VD	4	---		OUT
29	OUT_LO_LIM	Limits the minimum output value.	---	S-UD	4	OUT_SCALE (EU_100) +10%	100	OUT
30	BKCAL_HYS	The amount that the output must change away from its output limit before the limit status is turned off, expressed as a percent of the span of the output.	---	S-UD	4	0 to 50%		%
31	BKCAL_OUT	The value and status required by an upper block's BKCAL_IN so that the upper block may prevent reset windup and provide bumpless transfer to closed loop control.	Status	D-BD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
32	RCAS_IN	Target setpoint and status provided by a supervisory Host to a analog control or output block.	Value	D-BD	4	---		PV
33	ROUT_IN	Target output and status provided by a Host to the control block for use as the output (ROut mode).	Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
34	SHED_OPT	Defines the action to be taken on remote control device timeout.	Value	N-UD	4	---		PV
35	RCAS_OUT	Block setpoint and status after ramping - provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change.	---	S-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable	0	na
			Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
			Value	N-UD	4	---		PV
			---	S-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
			Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable		na
			Value	N-UD	4	---		PV

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
36	ROUT_OUT	Block output and status - provided to a Host for back calculation in ROut mode and to allow action to be taken under limited conditions or mode change.	Status	D-BD	1	Good: Good value Uncertain: Unknown Bad: Unusable	na	na
37	TRK_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point, associated with TRK_VAL.	Value	D-BD	4	---		OUT
			EU_100	S-UD	4		100	OUT
			EU_0	S-UD	4		0	OUT
			Unit Index	S-UD	2	See CONTROL_OPTS parameter	%	na
38	TRK_IN_D	This discrete input is used to initiate external tracking of the block output to the value specified by TRK_VAL.	DP	S-UD	1	0 to 255	0	None
			Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable	na	na
39	TRK_VAL	This input is used as the track value when external tracking is enabled by TRK_IN_D.	Value	N-UD	1	0: Feedback off 1: Feedback on		na
			Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable	na	na
40	FF_VAL	The feed forward value and status.	Value	N-UD	4	---		TRK
			Status	N-UD	1	Good: Good value Uncertain: Unknown Bad: Unusable	na	na
41	FF_SCALE	The feed forward input high and low scale values, engineering units code, and number of digits to the right of the decimal point.	Value	N-UD	4	---		FF
			EU_100	S-UD	4		100	FF
			EU_0	S-UD	4		0	FF
			Unit Index	S-UD	2		%	na
			DP	S-UD	1		0 to 255	0
42	FF_GAIN	The gain that the feed forward input is multiplied by before it is added to the calculated control output.	---	S-UD	4		0	None
			Unacknowledged	D-BD	1	"Unacknowledged";	None	None
43	UPDATE_EVT	This alert is generated in the event of any change to the static data.	Update state	D-BD	1			0=Undefined (no change)
			Time stamp	D-BD	8			1=Acknowledged
			Static Revision	D-BD	2			2=Unacknowledged
			Relative Index	D-BD	2			"Update state";
								0=Undefined (no change) 1=Update reported 2=Update not reported
44	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.	Unacknowledged	D-BD	1			None
			Alarm State	D-BD	1			
			Time Stamp	D-BD	8			
			Subcode	D-BD	2			
			Value	D-BD	1			

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units	
45	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.	Current	D-BD	2	Bit1: high high alarm Bit2: High alarm Bit3: Low low alarm Bit4: Low alarm Bit5: Deviation high alarm Bit6: Deviation low alarm Bit7: Block alarm	0	None	
			Unacknowledged	D-BD	2				
			Unreported	D-BD	2				
			Disabled	S-UD	2				
46	ACK_OPTION	Selection of whether alarms associated with the block will be automatically acknowledged.	---	S-UD	2	0: Disabled 1: Enabled	0	None	
47	ALARM_HYS	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percentage of the PV span.	---	S-UD	4	0 to 50%	0.5%	%	
48	HI_HI_PRI	Priority of the high high alarm.	---	S-UD	1	0 to 15	0	None	
49	HI_HI_LIM	The setting for high high alarm in engineering units.	---	S-UD	4	PV_SCALE, +8	0	PV	
50	HI_PRI	Priority of the high alarm.	---	S-UD	1	0 to 15	0	None	
51	HI_LIM	The setting for high alarm in engineering units.	---	S-UD	4	PV_SCALE, +8	0	PV	
52	LO_PRI	Priority of the low alarm.	---	S-UD	1	0 to 15	0	None	
53	LO_LIM	The setting for the low alarm in engineering units.	---	S-UD	4	-8, PV_SCALE	0	PV	
54	LO_LO_PRI	Priority of the low low alarm.	---	S-UD	1	0 to 15	0	None	
55	LO_LO_LIM	The setting of the low low alarm in engineering units.	---	S-UD	4	-8, PV_SCALE	0	PV	
56	DV_HI_PRI	Priority of the high deviation alarm.	---	S-UD	1	0 to 15	0	None	
57	DV_HI_LIM	The setting of the high deviation alarm limit in engineering units.	---	S-UD	4	0 to PV span, +8	0	PV	
58	DV_LO_PRI	Priority of the low deviation alarm.	---	S-UD	1	0 to 15	0	None	
59	DV_LO_LIM	The setting of the low deviation alarm limit in engineering units.	---	S-UD	4	-8, PV span to 0	0	PV	
60	HI_HI_ALM	The status of high high alarm and its associated time stamp.	Unacknowledged	D-BD	1				None
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
			Subcode	D-BD	2				
			Value	D-BD	4				
			Unacknowledged	D-BD	1				
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
Subcode	D-BD	2							
Value	D-BD	4							
61	HI_ALM	The status of high alarm and its associated time stamp.	Unacknowledged	D-BD	1				None
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
			Subcode	D-BD	2				
			Value	D-BD	4				
			Unacknowledged	D-BD	1				
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
Subcode	D-BD	2							
Value	D-BD	4							
62	LO_ALM	The status of the low alarm and its associated time stamp.	Unacknowledged	D-BD	1				None
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
			Subcode	D-BD	2				
			Value	D-BD	4				
			Unacknowledged	D-BD	1				
			Alarm state	D-BD	1				
			Time stamp	D-BD	8				
Subcode	D-BD	2							
Value	D-BD	4							

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Valid range	Initial value	Units
63	LO_LO_ALM	The status of the low low alarm and its associated time stamp.	Unacknowledged	D-BD	1			None
			Alarm state	D-BD	1			None
			Time stamp	D-BD	8			None
			Subcode	D-BD	2			None
			Value	D-BD	4			PV
64	DV_HI_ALM	The status and time stamp associated with the high deviation alarm.	Unacknowledged	D-BD	1			None
			Alarm state	D-BD	1			None
			Time stamp	D-BD	8			None
			Subcode	D-BD	2			None
			Value	D-BD	4			PV
65	DV_LO_ALM	The status and time stamp associated with the low deviation alarm.	Unacknowledged	D-BD	1			None
			Alarm state	D-BD	1			None
			Time stamp	D-BD	8			None
			Subcode	D-BD	2			None
			Value	D-BD	4			PV

4-7 : Diagnostics block

The diagnostics block is a Yamatake original block which provides the results of self-diagnostics of the device.

Diagnostics block parameters (Start index: 1500)

Index	Parameter (FF standard parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Range	Initial value	Units
1	ST_REV	Refers to the revision number of the static data that belongs to the block. If a parameter for which the access attribute is "S-" is modified, it is changed by an increment of 1.	---	S-B	2	0 to 65535	0	None
2	TAG_DESC	Tag name for the user-defined transducer block. This is used for reference by the host, and is unrelated to the operation or execution of the function block itself.	---	S-UD	32		32 spaces	None
3	STRATEGY	An arbitrary group number for the transducer block. (This parameter is unrelated to block operation. It is provided so that the different types of blocks can be grouped arbitrarily so that they can be identified more easily in later database search operations.)	---	S-UD	2	0 to 65535	0	None
4	ALERT_KEY	Identification number for the related plant-internal devices. (This parameter is unrelated to block operation. It is provided so that the different types of blocks can be grouped arbitrarily so that they can be identified more easily in later database search operations.)	---	S-UD	1	1 to 255	0	None
5	MODE_BLK	Transducer block mode parameter set. MODE_BLK has the following structure: <ul style="list-style-type: none"> • Target: Parameter for the mode set from the host. • Actual: Refers to the value of the mode used by the function block. • Permitted: Refers to the value of the mode used by the function block. • Normal: Refers to the value of the mode that should be the normal state. 	---	S-UD	1	1 to 255	0	None
6	BLOCK_ERR	Refers to the error status for the transducer block.	---	D-BD	2			None

Index	Parameter (Yamatake original parameter)	Description	Sub-parameter	Access attribute	Size (bytes)	Range	Initial value	Units
7	DEVICE_STATUS	Refers to the results of each item in the device self-diagnostics.	---	D-R	4		0×00000000	None
8	MEASUREMENT_STATUS	A mapping parameter that indicates the results of the device self-diagnostics executed in the Transducer Function Block	---	D-R	4		0×00000000	None
9	OPERATING_TIME	A parameter indicates the operating hour of the device, in hours.	---	S-R/W	4		0	hour

Chapter 5 : Operation

5-1 : Introduction

This section covers the procedure for operation on a fieldbus network. Since each FOUNDATION™ fieldbus configurator has a different of method to configure it, this section will explain how to reconfigure them manually.

5-2 : Ranging

5-2-1 :Elevation (TB)

The elevation feature is used for the cancellation of the impulse line head pressure or for adjustment at the installation to the process.

The corrected PRIMARY_VALUE after elevation is calculated using the following equation:

$$\text{PRIMARY_VALUE (corrected)} = \text{PRIMARY_VALUE} + \text{ELEVATION_VALUE}$$

The ELEVATION_VALUE is set by one of the following procedures:

1. ELEVATION_CMD

Set 1 (SET_ELEV) to ELEVATION_CMD.

This sets the present SENSOR_VALUE to ELEVATION_VALUE.

2. Manual setting

Set the desired value to ELEVATION_VALUE.

To clear the ELEVATION_VALUE, set 0.0 to ELEVATION_VALUE.

5-2-2 :XD_SCALE (AI FB)

The range and engineering unit of the FIELD_VAL parameter are configured by the XD_SCALE parameter of the AIFB. The table below lists the engineering units available for the S900. To select the desired engineering unit, set the Unit Code to the Unit Index Sub-parameter of the XD_SCALE parameter.

Table 5-1

Engineering Unit	Unit Code
Pa	1130
MPa	1132
kPa	1133
hPa	1136
bar	1137
mbar	1138
psi	1141
g/cm ²	1144

Table 5-1

Engineering Unit	Unit Code
kg/cm ²	1145
inH ₂ O	1146
mmH ₂ O	1149
inHg	1155
mmHg	1157

5-2-3 :OUT_SCALE (AI FB)

The range and engineering units of the PV and OUT parameters are configured by the OUT_SCALE parameter of the AIFB. To select the desired engineering unit, set the Unit Code defined by Fieldbus Foundation specification to the Unit Index Sub-parameter of the OUT_SCALE parameter.

5-2-4 :Output conformity (AI FB)

The input signal from the sensor (PRIMARY_VALUE of the TB) that is supplied through the CHANNEL (S900 has one channel) is scaled to a percentage (%) of the ranges of the XD_SCALE. FIELD_VAL is the raw output from the AIFB in percentage (%) and is calculated by using the following equation:

$$\text{FIELD_VAL (\%)} = 100 * (\text{PRIMARY_VALUE} - \text{EU@0\%}) / (\text{EU}\rightarrow\text{100\%} - \text{EU@0\%})$$

FIELD_VAL is then processed by the low value cut-off and damping and becomes PV and OUT. PV and OUT have the same value if the MODE is in AUTO. In the MAN mode, the manually set value can alter OUT. Besides low-cut and damping, PV or OUT is processed with the following equations which are selected by L_TYPE:

L_TYPE = 1 (Direct)	PV (OUT) = PRIMARY_VALUE
L_TYPE = 2 (Indirect)	PV (OUT) = (FIELD_VAL/100) * (EU@100% - EU@0%)
L_TYPE = 3 (Indirect Square root)	PV (OUT) = SQRT((FIELD_VAL/100) * (EU@100% - EU@0%))

EU@0, EU@100, and the engineering unit are determined by the OUT_SCALE parameter.

5-2-5 :Low cut-off (AI FB)

To activate the Low Cut-off function, set the value to Bit 10 (Low cutoff) of IO_OPTS. PV (OUT) will be forced to 0 (0.0) when PV (OUT) is LOW_CUT or lower. The unit for LOW_CUT value is same as the unit used for OUT_SCALE.

5-3 : Damping

You can adjust the damping time constant (in seconds) setting PV_FTIME parameter. Set the PV_FTIME to zero to disable the damping function.

5-4 : Digital display setting

If your S900 comes with the optional LCD display unit, the parameter for the display can be configured by the DISPLAY_MODE parameter of the TB. To select the desired parameter, select the code or the DD item name from the table below and set it to the DISPLAY_MODE parameter from your Fieldbus configurator:

Table 5-2

Parameter on Display	Code (DD Item Name)
(None)	0 (NON)
PV of AIFB	1 (AI_PV)
OUT of AIFB	2 (AI_OUT)
FIELD_VAL of AIFB	3 (AI_FIELD_VAL)
PRIMARY_VALUE of TB	4 (XD_PV)
Scaled OUT of AIFB by DISPLAY_RANGE parameter	5 (DISPLAY_RANGE)

Table 5-3

Operating Condition	Indication
Normal (Mode = AUTO)	Continuous indication
Mode ↔ AUTO	Blinking
Critical Status	≡ ≡ ≡
Communication failure between display and CPU	- -

Chapter 6 : Maintenance

6-1 : Introduction

This section covers the routine maintenance procedures for a fieldbus network. Since each FOUNDATION™ fieldbus configurator has a different method to configure it, this section will explain how to reconfigure them manually.

6-2 : Calibration

The S900 is shipped precalibrated at our factory. The S900 does not require recalibration once it has been installed. If recalibration is required, we recommend a bench calibration in a controlled environment.

This section explains step-by-step procedures to manually calibrate the unit from your Fieldbus configurator.

~Note *The commands and responses that the S900 recognizes are in numeric representation. If your configurator supports DD (Device Description) and is capable of displaying descriptions written in DD, they will appear on your screen as well. They are listed in parenthesis after each numeric value.*

6-2-1 :Calibrating zero (TB)

To manually calibrate Zero, follow the procedure described below:

- a) Place the S900 on flat surface and apply a pressure equal to Zero.
- b) Set CAL_VAL and CAL_UNIT to the Zero value.
- c) From your Fieldbus configurator, set the CAL_ENUM sub-parameter of the CAL_CMD parameter in the TB to 1 (CAL_LOWER).
- d) Verify that the SENSOR_VALUE has been corrected to Zero with the configurator.

6-2-2 :Calibrating span (TB)

To manually calibrate Span, follow the procedure described below:

- a) Place the S900 on flat surface and apply pressure equal to Span.
- b) Set CAL_VAL and CAL_UNIT to the Span value.
- c) From your Fieldbus configurator, set the CAL_ENUM sub-parameter of the CAL_CMD parameter in the TB to 2 (CAL_UPPER).
- d) Verify that the SENSOR_VALUE has been corrected to Span with the configurator.

~Note *To reset the current Zero and Span corrections, set the CAL_ENUM sub-parameter to 254 (CAL_RESET). The Zero and Span must be corrected before being used on the process.*

6-3 : Self-diagnostics

Detailed information on the measurement status can be obtained via MEASUREMENT_STATUS.

Table 6-1

MEASUREMENT_STATUS	Status	Description	Corrective Action
0×000002	Critical	Characterization data failure occurred	1. Reset unit 2. Contact service center
0×000004		Suspect input occurred	1. Reset unit 2. Contact service center
0×000100	Non-Critical	Sensor over temperature occurred	Check process temperature
0×000200		Excess zero correction occurred	Recalibrate
0×000400		Excess span correction occurred	Recalibrate
0×001000		Meter body overload or meter body failure occurred	Check process pressure
0×004000		Correct reset status	Recalibrate
0×010000		External switch failure occurred	Call service center

6-4 : Disassembly and assembly

6-4-1 : Before you start

WARNING

- Never open the case cover while the transmitter is ON or in a hazardous location.
- Handle the explosion-proof transmitter with care. It may lose its explosion-proof performance due to corrosion, deformation, damage to the case cover, or damage to a screw or a joined part.
- The explosion-proof performance of the special explosion-proof pressure transmitter is not guaranteed unless it is LOCKED. Always tighten the case cover completely, and lock the case cover.

Dismounting and mounting 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, make sure that no dust or rain gains ingress into the transmitter case.

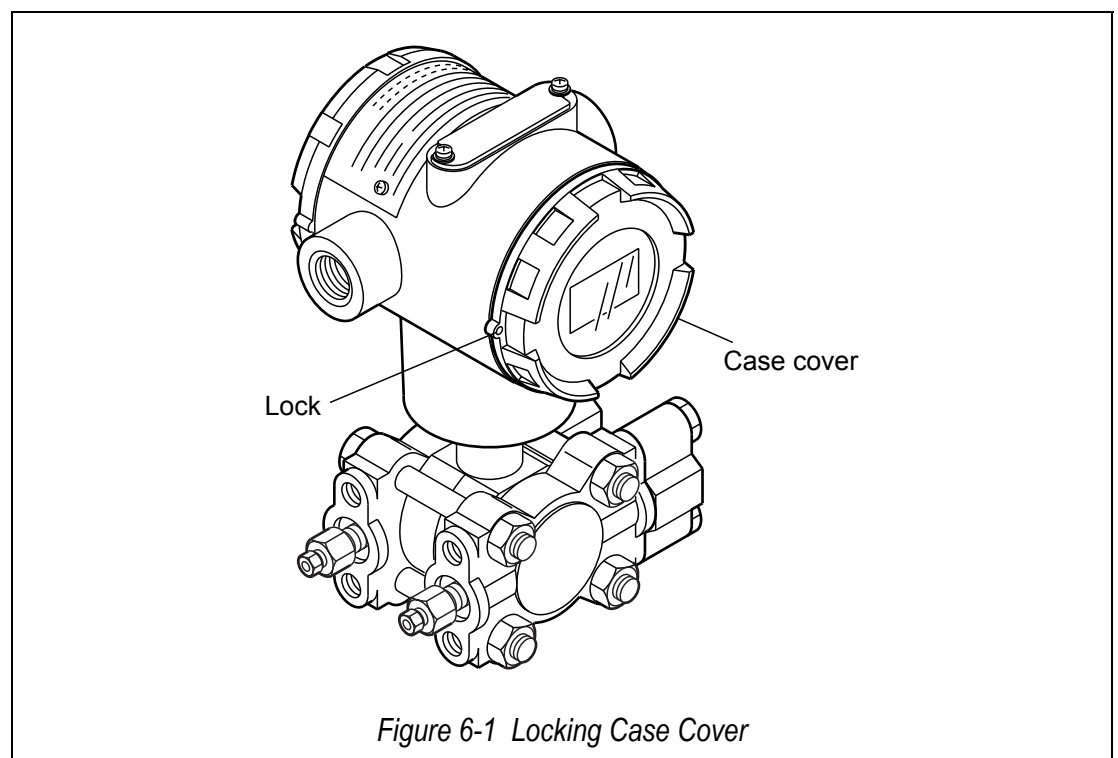


Figure 6-1 Locking Case Cover

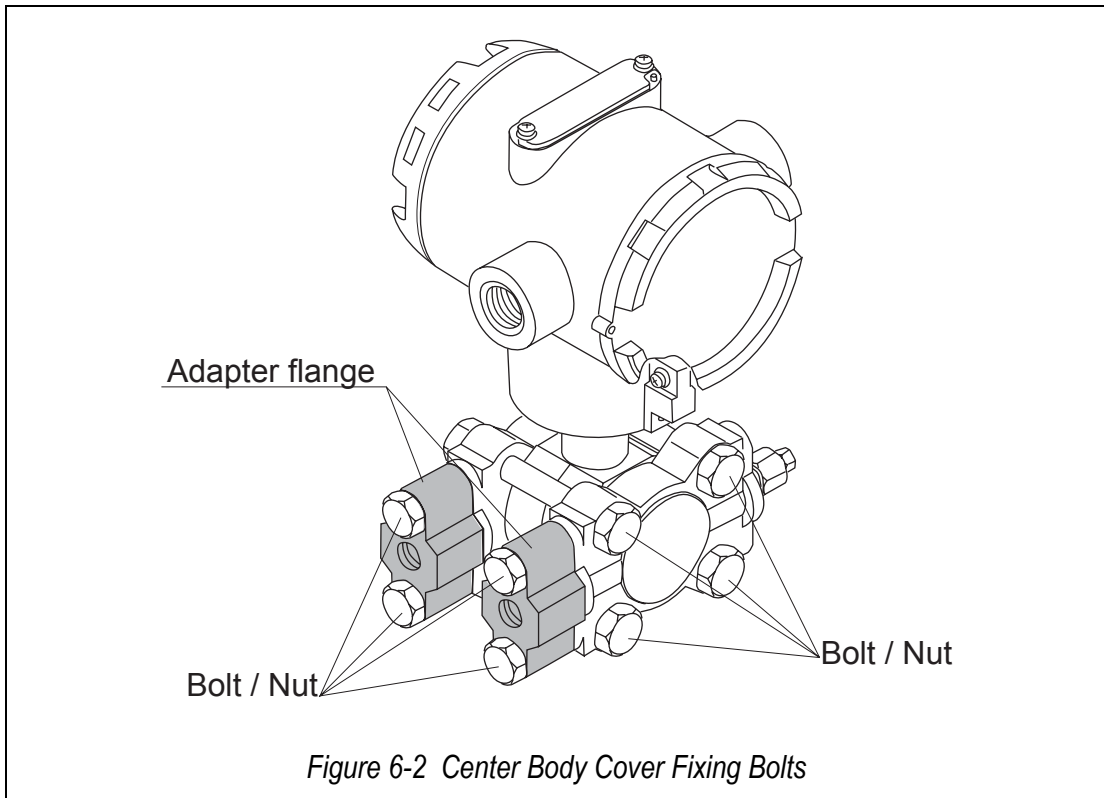
6-4-2 :Mount center body cover and adapter flange

Dismount covers

Remove the four sets of bolts & nuts, shown in the illustration.

Remarks:

After dismounting, handle the center body cover carefully. Avoid damage to the diaphragm.



Mount covers and adapter flanges

When mounting the centers body cover and adapter flanges, tighten the bolts to the following torque.

Replace the seal gasket, if it is damaged.

Table 6-2 Cover bolts / nuts and tightening torque

Model No.	Wetted parts material (other than diaphragm)	Bolt/Nut Material	Bolt/Nut tightening torque N·m		
			Cover material Carbon steel/Stainless steel		Cover material PVC
			When new gasket is used	When existing gasket is reused	When new / existing gasket is used
STD910	SUS316	SUS304	35±2	20±1	-
STD920 STD930	SUS316 Hastelloy C	Carbon steel	22±2	17±1	10±1
		SUS630			-
		SUS304	15±1	10±1	-
STD920 STD930	Tantalum SUS316L	Carbon steel	45±2	30±1.5	15±1
		SUS630			-
		SUS304	35±2	20±1	15±1
STD960	SUS316 Hastelloy C Tantalum SUS316L	Carbon steel SUS630	45±2	30±1.5	-
		SUS304	35±2	20±1	-
STD921 STD931 STD961	SUS316	Carbon steel SUS630	280±30		-
		SUS304	170±20		-
STG940 STG960	SUS316 Hastelloy C	Carbon steel	22±2	17±1	10±1
		SUS630			-
		SUS304	15±1	10±1	10±1
STG940 STG960	Tantalum SUS316L	Carbon steel	45±2	30±1.5	15±1
		SUS630			-
		SUS304	35±2	20±1	15±1
STG981	SUS316 Hastelloy C	Carbon steel SUS630	90±20		-
		SUS304	55±20		-
STA923 STA940	SUS316 Hastelloy C Tantalum SUS316L	Carbon steel SUS630	45±2	30±1.5	-
		SUS304	35±2	20±1	15±1
STC929	SUS316	Carbon steel SUS630	22±2	17±1	-
		SUS304	15±1	10±1	-

Table 6-3 Adapter flange bolt / nut and tightening torque

Bolt/Nut Material	Bolt/Nut tightening torque N·m	
	Adapter flange material Carbon steel/Stainless steel	Adapter flange material PVC
Carbon steel	20±1	7±0.5
SUS630		-
SUS304	10±0.5	7±0.5

6-4-3 :Washing the center body

Introduction

The transmitter and the pipes must be kept clean to maintain its accuracy and achieve satisfactory performance. Deposits accumulated in the pressure chamber of the transmitter may result in measurement errors.

Rinsing the center body (STD/STG/STA/STC Type)

Rinse the center body using the following procedure:

- (1) Remove the hexagon head bolts of the center body and dismount the cover.
- (2) Wash the diaphragm and the inner surface of the cover with a solvent and a soft brush. Take care not to deform or damage the diaphragm.
- (3) In reassembling the center body, replace the cover gasket with a new one as necessary.
- (4) Tighten the cover bolts at the specified tightening torque. (Refer to "Table 6-2Cover bolts / nuts and tightening torque")

Remarks related to cold area

If you stop the operation after measuring liquid that can be frozen (such as water) in a cold area, drain the liquid 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 dismounted for maintenance, wash the diaphragm using a soft brush and solvent. Work carefully without deforming or damaging the diaphragm.

Appendix

A. Default value of block parameters

A-1 : Transducer block

FF Standard Parameter

Index	Parameter	Sub-parameter	Default Value	FF
1	ST_REV	-	-	0
2	TAG_DESC	-	spaces	spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	AUTO	O/S
6	BLOCK_ERR	-	-	
7	UPDATE_EVT	-	-	
8	BLOCK_ALM	-	-	
9	TRANSDUCER_DIRECTORY	-	-	
10	TRANSDUCER_TYPE	-	100 = Standard Pressure with Calibration	TYPE of Transducer
11	XD_ERROR	-	-	
12	COLLECTION_DIRECTORY	-	-	
13	PRIMARY_VALUE_TYPE	-	One of the following depending on the model. 107 = differential pressure 108 = gauge pressure 109 = absolute pressure	0
14	PRIMARY_VALUE	-	-	
15	PRIMARY_VALUE_RANGE	EU_100	Upper limit of sensor range	
		EU_0	Lower limit of sensor range	
		Units Index	Same as XD_SCALE	
		Decimal Point	2	
16	CAL_POINT_HI	-	+INF	+INF
17	CAL_POINT_LO	-	-INF	-INF
18	CAL_MIN_SPAN	-	0	0.0
19	CAL_UNIT	-	1133 = kPa	%
20	SENSOR_TYPE	-	125 = Piezo resistive	0
21	SENSOR_RANGE	EU_100	Upper limit of sensor range	
		EU_0	Lower limit of sensor range	
		Units Index	1133 = kPa	
		Decimal Point	2	
22	SENSOR_SN	-	Unique serial number	
23	SENSOR_CAL_METHOD	-	-	0
24	SENSOR_CAL_LOC	-	NULL	NULL
25	SENSOR_CAL_DATE	-	0	0
26	SENSOR_CAL_WHO	-	NULL	
27	SENSOR_ISOLATOR_MTL	-	0	
28	SENSOR_FILL_FLUID	-	0	
29	SECONDARY_VALUE	-	-	
30	SECONDARY_VALUE_UNIT	-	1001 = °C	

Yamatake original parameter

Index	Parameter	Sub-parameter	Default Value
31	MEASUREMENT_STATUS	-	-
32	SENSOR_VALUE	-	-
33	CAL_CMD	CAL_ENUM	0 = NONE
		CAL_VAL	0.0
34	CAL_STATUS	-	0 = NONE
35	HEIGHT_VALUE	-	Flange Height
36	HEIGHT_VALUE_RANGE	EU_100	30
		EU_0	-30
		Units Index	1010 = m
		Decimal Point	-
37	ELEVATION_CMD	-	0 = NONE
38	ELEVATION_VALUE	-	0.0
39	ELEVATION_STATUS	-	0 = NONE
40	DISPLAY_MODE	-	Display option code = R: 5 = DISPLAY_RANGE Display option code = P: 3 = AI_FIEDL_VAL
41	DISPLAY_RANGE	EU_100	Upper range of display
		EU_0	Lower range of display
		Units Index	Display unit
		Decimal Point	-

A-2 : AI function block

A-2-1: AI1 (index=1200)

Index	Parameter	Sub-parameter	Default Value	FF
1	ST_REV	-	-	0
2	TAG_DESC	-	Spaces	Spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	Auto	O/S
6	BLOCK_ERR	-	-	
7	PV	-	-	
8	OUT	-	-	
9	SIMULATE	-	Disable	Disable
10	XD_SCALE	EU_100	Upper limit of sensor range	0-100%
		EU_0	Lower limit of sensor range	
		Units Index	Calibration unit	
		Decimal Point	1	
11	OUT_SCALE	EU_100	100.0	0-100%
		EU_0	0.0	
		Units Index	%	
		Decimal Point	1	
12	GRANT_DENY		-	
13	IO_OPTS		{0×00,0×00}	0
14	STATUS_OPTS		{0×00,0×00}	0
15	CHANNEL		1	0
16	L_TYPE		Output conformity = Linear: 2 = Indirect Output conformity = Square-root 3 = Indirect_Sq_Root	0
17	LOW_CUT		0	0
18	PV_FTIME		-	0
19	FIELD_VAL		-	
20	UPDATE_EVT		-	
21	BLOCK_ALM		-	
22	ALARM_SUM		-	
23	ACK_OPTION		0×0000	0
24	ALARM_HYS		0.5%	0.5%
25	HI_HI_PRI		0	0
26	HI_HI_LIM		+INF	+INF
27	HI_PRI		0	0
28	HI_LIM		+INF	+INF
29	LO_PRI		0	0
30	LO_LIM		-INF	-INF
31	LO_LO_PRI		0	0
32	LO_LO_LIM		-INF	-INF
33	HI_HI_ALM		-	
34	HI_ALM		-	
35	LO_ALM		-	
36	LO_LO_ALM		-	

A-2-2: AI2 (index=1300)

Index	Parameter	Sub-parameter	Default Value	FF
1	ST_REV	-	-	0
2	TAG_DESC	-	spaces	spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	O/S	O/S
6	BLOCK_ERR	-	-	
7	PV	-	-	
8	OUT	-	-	
9	SIMULATE	-	disable	disable
10	XD_SCALE	EU_100	100	0-100%
		EU_0	0	
		Units Index	1001 = °C	
		Decimal Point	1	
11	OUT_SCALE	EU_100	100.0	0-100%
		EU_0	0.0	
		Units Index	%	
		Decimal Point	1	
12	GRANT_DENY		{0×00, 0×00}	
13	IO_OPTS		{0×00, 0×00}	0
14	STATUS_OPTS		{0×00, 0×00}	0
15	CHANNEL		2	0
16	L_TYPE		2 = Indirect	0
17	LOW_CUT		0.f	0
18	PV_FTIME		0	0
19	FIELD_VAL		-	
20	UPDATE_EVT		-	
21	BLOCK_ALM		-	
22	ALARM_SUM		-	
23	ACK_OPTION		0×0000	0
24	ALARM_HYS		0.5%	0.5%
25	HI_HI_PRI		0	0
26	HI_HI_LIM		+INF	+INF
27	HI_PRI		0	0
28	HI_LIM		+INF	+INF
29	LO_PRI		0	0
30	LO_LIM		-INF	-INF
31	LO_LO_PRI		0	0
32	LO_LO_LIM		-INF	-INF
33	HI_HI_ALM		-	
34	HI_ALM		-	
35	LO_ALM		-	
36	LO_LO_ALM		-	

A-3 : Resource block**FF standard parameters**

Index	Parameter	Sub-parameter	Default Value	FF Initial Value
1	ST_REV	-	-	0
2	TAG_DESC	-	spaces	spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	Auto	O/S
6	BLOCK_ERR	-	-	
7	RS_STATE	-	-	
8	TEST_RW	-	-	
9	DD_RESOURCE	-	(NULL)	null
10	MANUFAC_ID	-	0×000DFC96 = (Yamatake Manufacturer ID)	
11	DEV_TYPE	-	0x0103	
12	DEV_REV	-	-	
13	DD_REV	-	-	
14	GRANT_DENY	-	0×00, 0×00	
15	HARD_TYPES	-	0×8000 = scalar input	
16	RESTART	-	-	
17	FEATURES	-	0×D100 = (Following 4 functions) <ul style="list-style-type: none"> • Unicode strings • Reports Supported • Soft Write lock supported • Change of BYPASS in AUTO mode 	
18	FEATURE_SEL	-	0×0000	Set by mfr
19	CYCLE_TYPE	-	0×8000 = scheduled	
20	CYCLE_SEL	-	0×0000	0
21	MIN_CYCLE_T	-	4000 = 125mS	
22	MEMORY_SIZE	-	0	
23	NV_CYCLE_T	-	0	
24	FREE_SPACE	-	0%	
25	FREE_TIME	-	0%	
26	SHED_RCAS	-	640000 = 20S	640000
27	SHED_ROUT	-	640000 = 20S	640000
28	FAULT_STATE	-	0×01 = Clear	
29	SET_FSAFE	-	0×01 = OFF	1
30	CLR_FSAFE	-	0×01 = OFF	1
31	MAX_NOTIFY	-	3	
32	LIM_NOTIFY	-	3	MAX_NOTIFY
33	CONFIRM_TIME	-	640000 = 20S	640000
34	WRITE_LOC	-	0×01 = Not Locked	1
35	UPDATE_EVT	-	-	
36	BLOCK_ALM	-	-	
37	ALARM_SUM	-	-	
38	ACK_OPTION	-	0×0000	0
39	WRITE_PRI	-	0×00	0
40	WRITE_ALM	-	-	
41	ITK_VER	-	4	

Yamatake original parameters

Index	Parameter	Sub-parameter	Default Value
42	SOFTWARE_REV	-	0
43	SIM_ACTIVE_SW	-	0 = SIM_INACTIVE

A-4 : Diag block**FF standard parameter**

Index	Parameter	Sub-parameter	Default Value	FF Initial Value
1	ST_REV	-	-	0
2	TAG_DESC	-	spaces	spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	O/S	O/S
6	BLOCK_ERR	-	-	

Yamatake original parameter

Index	Parameter	Sub-parameter	Default Value
7	DEIVCE_STATUS	-	-
8	MEASUREMENT_STATUS	-	-
9	OPERATING_TIME	-	-

A-5 : PID function block

Index	Parameter	Sub-parameter	Default Value	FF Initial Value
1	ST_REV	-	-	0
2	TAG_DESC	-	Spaces	Spaces
3	STRATEGY	-	0	0
4	ALERT_KEY	-	1	0
5	MODE_BLK	Target	O/S	O/S
6	BLOCK_ERR	-	-	
7	PV		-	
8	SP		-	
9	OUT		-	
10	PV_SCALE		0-100%	0-100%
11	OUT_SCALE		0-100%	0-100%
12	GRANT_DENY		0×00,0×00	
13	CONTROL_OPTS		0×0000	0
14	STATUS_OPTS		0×0000	0
15	IN		-	
16	PV_FTIME		0	0
17	BYPASS		1	0
18	CAS_IN		-	
19	SP_RATE_DN		+INF	+INF
20	SP_RATE_UP		+INF	+INF
21	SP_HI_LIM		100	100
22	SP_LO_LIM		0	0
23	GAIN		0	0
24	RESET		+INF	+INF
25	BAL_TIME		0	0
26	RATE		0	0
27	BKCAL_IN		-	
28	OUT_HI_LIM		100	100
29	OUT_LO_LIM		0	0
30	BKCAL_HYS		0.5%	0.5%
31	BKCAL_OUT		-	
32	RCAS_IN		-	
33	ROUT_IN		-	
34	SHED_OPT		1	0
35	RCAS_OUT		-	
36	ROUT_OUT		-	
37	TRK_SCALE		0-100%	0-100%
38	TRK_IN_D		-	
39	TRK_VAL		-	
40	FF_VAL		-	
41	FF_SCALE		0-100%	0-100%
42	FF_GAIN		0	0
43	UPDATE_EVT		-	
44	BLOCK_ALM		-	
45	ALARM_SUM		-	
46	ACK_OPTION		0×0000	0
47	ALARM_HYS		0.5%	0.5%
48	HI_HI_PRI		0	0
49	HI_HI_LIM		+INF	+INF
50	HI_PRI		0	0
51	HI_LIM		+INF	+INF
52	LO_PRI		0	0
53	LO_LIM		-INF	-INF

Index	Parameter	Sub-parameter	Default Value	FF Initial Value
54	LO_LO_PRI		0	0
55	LO_LO_LIM		-INF	-INF
56	DV_HI_PRI		0	0
57	DV_HI_LIM		+INF	+INF
58	DV_LO_PRI		0	0
59	DV_LO_LIM		-INF	-INF
60	HI_HI_ALM		-	
61	HI_ALM		-	
62	LO_ALM		-	
63	LO_LO_ALM		-	
64	DV_HI_ALM		-	
65	DV_LO_ALM		-	

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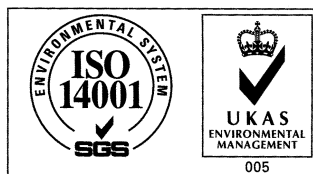
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