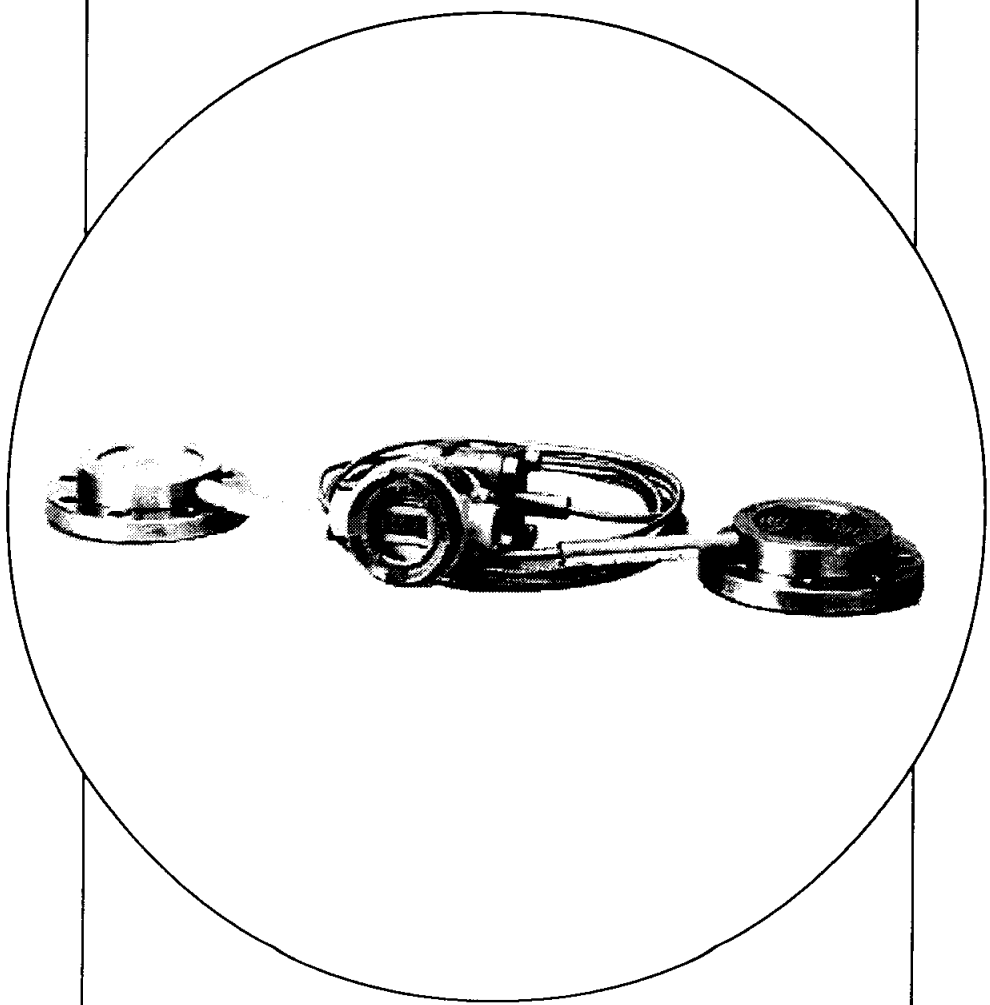
YAMATAKE

CM2-DST300-2001

# ST3000 Ace Smart Transmitter Electronic Differential Pressure Transmitter

## Model JTR929A/930A JTE929A/930A (Remote Diaphragm Seal Type) User's Manual



Yamatake Corporation

# Copyright, Notices and Trademarks

# Safety Instructions

## Preface

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

Read the safety instructions provided in this manual carefully and understanding 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 the safety of users:

⚠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 operations, be sure to observe the safety instructions provided on the next page. Yamatake Corporation. will assume no responsibility, or offer any guarantee with respect to any failure resulting from violation of these safety instructions.

# Safety Rules

## Installation

⚠ Warning

(1) When installing the transmitter, make sure that gaskets do not protrude from the process connection parts (in adaptor flange connections to connecting pipes and flanges). Gasket protrusion may cause leaks or output errors.
(2) Do not use the transmitter outside the rated pressure or temperature range or without observing the connection specifications. Damage or leaks may lead to serious accidents.
(3) Apply the methods specified in the explosion-proofing guidelines to cabling work in explosion-proof areas.

⚠ Caution

(1) Do not step on the transmitter after installation. Stepping on the transmitter may damage it or cause injuries.
(2) The glass indicator may break if hit with a tool or other object, and cause injuries.
(3) Ground the transmitter correctly. This is required by related regulations. Inadequate grounding may lead to output errors.
(4) This transmitter is heavy, please be sure of your footing and wear safety shoes when installing.

## Electrical wiring

⚠ Warning

(1) To avoid electric shocks, do not perform wiring work with wet hands or without turning the power off. Wear gloves over dry hands and turn the power off before starting wiring work.

⚠ Caution

(1) Study the specifications carefully and make sure the wiring is correct. Wiring mistakes may cause hardware damage or malfunctions.
(2) Provide a power supply that meets the specifications. The wrong power supply may cause hardware damage.

## Maintenance

⚠ Warning

(1) When disconnecting the transmitter from the process for maintenance, ensure that the residual pressure, fluid or gas have reached safe levels. Gas generation or fluid eruption may otherwise occur.
(2) To prevent burns or other harmful effects, check the venting or drainage direction and ensure that no personnel will be exposed to vented gas or drained fluid.
(3) Do not open the cover during operation in an explosion-proof area. This may result in an explosion or other accident.

⚠ Caution

(1) The transmitter was shipped under strict product control guidelines. Altering the transmitter, or modifying it in any way, may result in damage to the transmitter or to property.

# CONTENTS

# Precautions

## A. General Precautions

### A.1 Checking the Product

When you accept the ST 3000 Ace Smart Transmitter, check its appearance to make sure that it is not damaged.

The accessories shown in Figure A.1 should be attached(Options). Make sure that all the accessories have been delivered to you.

To make an inquiry, contact your supplier or our service network. The accessories are listed below.

(1) One L-wrench (M3)

(2) 1 mounting bracket, 1 U-bolt, 4 bolts and 2 nuts

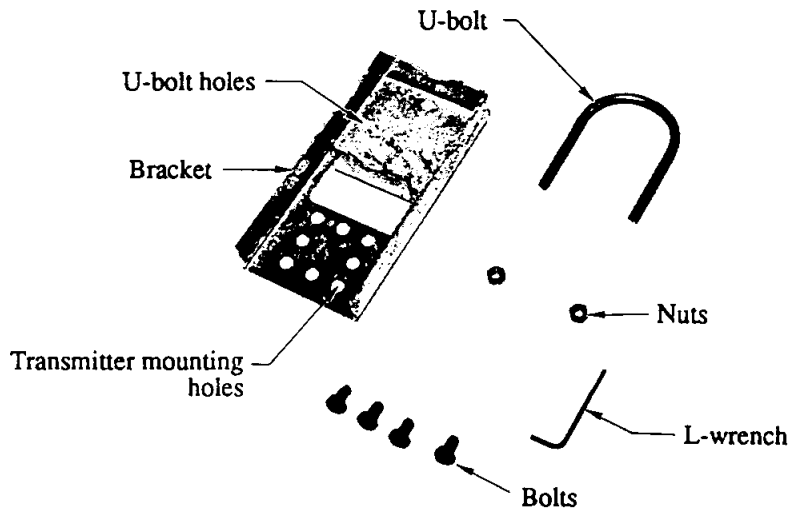



**Figure A.1 Accessories (Options)**

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

### A.2 Checking 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 and the model number table in Appendix A.

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

### A.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.

## A.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 without unpacking it 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. (For detailed information, refer to 9.2.2 Washing Meter Body.)

## A.5 Installation Environment

In order to maintain the original performance and reliability for a long period, 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 plant 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) Atmosphere
Avoid corrosive atmospheres as far as possible.
For flame-proof special explosion-proof and intrinsic-safety constructions, refer to Section B.
(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 "B. Instructions for Explosion-proof Transmitter".

## A.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. (Refer to 1.2.2 Specifications.)
(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.

## A.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 cause a circuit with your hands.
(2) If 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.

## A.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 in some cases.
(2) When using a transceiver, determine the distance that will be necessary for avoiding any influence on signals in advance, and ensure that the distance between the transceiver and the transmitter is larger than that distance.
(3) When using a transceiver, be sure to close the cover of the transmitter.

## A.9 Welding in Proximity of ST 3000 Ace Transmitter

(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.

# B. Precautions for Explosion-proof Transmitter

An explosion-proof transmitter has passed the required inspections at a public organization, in compliance with the Labor Safety and Hygiene Law. Use of an explosion-proof transmitter in a hazardous environment is permitted.

The transmitter has a name plate which displays the conformance mark and the information needed for preventing explosions. Check this information and use the transmitter correctly.

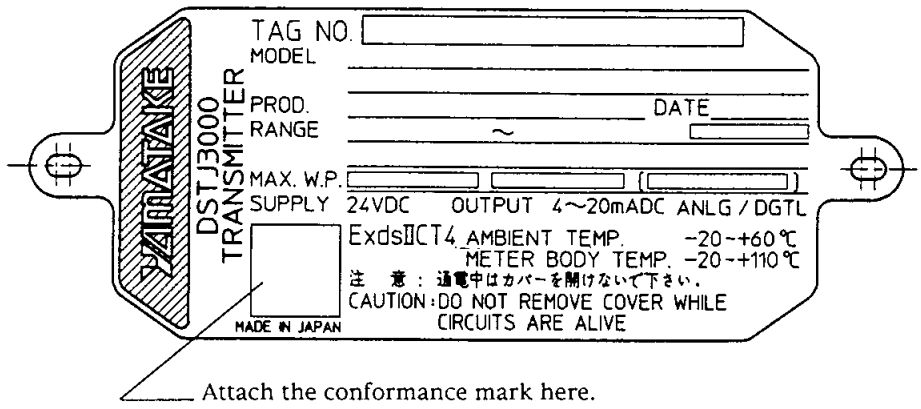



**Figure B.1 Name Plate** (Note)

Note: Ambient temperature range may be narrower than that indicated on the nameplate above depending on models.

## B.1 Transmitter with Flame-proof Special Explosion-proof Construction

### Precautions on Handling Transmitter:

(1) Installation Environment

The explosion class and the gas ignition temperature for this transmitter are "IICT4" (IIC: All gas vapor, T4: Gas vapor with ignition temperature of 135°C). It can be installed in "Class 1" and "Class 2" hazardous environments. It cannot be installed in a class 0 environment.

Make sure that the ambient temperature is within the range shown on the name plate. Here, AMBIENT TEMP. and METERBODY TEMP. mean the temperature around the transmitter and the temperature at the meter body (in contact with the fluid), respectively. If the ambient temperature exceeds these ranges, explosion-proof performance cannot be guaranteed. In such a case, lower the ambient temperature by following the instructions in "A.5 (1) Ambient temperature".

(2) Wiring method

For the external wiring, use the flame-proof packing type cable adaptor provided as an accessory.

**Caution**

The flame-proof packing type cable adapter which is provided as an accessory for the explosion-proof transmitter is inspected as a part of the case. Therefore, its explosion-proof performance cannot be guaranteed if combined with any other equipment.

(3) Maintenance

(a) In a hazardous environment, do not open the transmitter case cover or the meter case cover while the transmitter is running.

(b) The flame-proof explosion-proof performance is maintained because of the distance between clearances and the mechanical strength of the container. Therefore, avoid any case or cover corrosion, deformation or damage, and screw or joint damage that may lower the flame-proof explosion-proof performance.
If any damage arises, contact us.

Note) For detailed information about (1), (2) and (3), refer to "New Explosion-proof Guideline for Electric Plant Facilities (Gas Explosion Proof 1979)" published by the Industrial Safety Institute of the Ministry of Labor.

## B.2 Transmitter with Intrinsic-safety Construction

### Precautions on Handling Transmitter

(1) Installation Environment
The explosion class and the ignition temperature of gas for this transmitter are "3aG4" (3a: Gas of explosion class 2, including hydrogen, G4: Gas vapor with ignition temperature of 135°C). It can be installed in "Class 0", "Class 1" and "Class 2" hazardous environments.
Make sure that the ambient temperature is within the range shown on the name plate. Here, AMBIENT TEMP. and METERBODY TEMP. mean the temperature around the transmitter and the temperature at the meter body (in contact with the fluid), respectively.

(2) Wiring method
Meet the conditions shown in the system configuration drawing (Figure B.2) and avoid electrical and magnetic influence (mixing, induction etc.) from the lines of other electric circuits. Protect the cables from external damage.

(3) Maintenance
If the parts or internal wiring are changed, intrinsic-safety performance cannot be guaranteed. If repair is necessary, replace the entire printed wiring board.

Note) For detailed information about (1), (2) and (3), refer to "Explosion-proof Guideline for Electric Plant Facilities (Gas Explosion-proof 1979)" published by the Industrial Safety Institute of the Ministry of Labor.

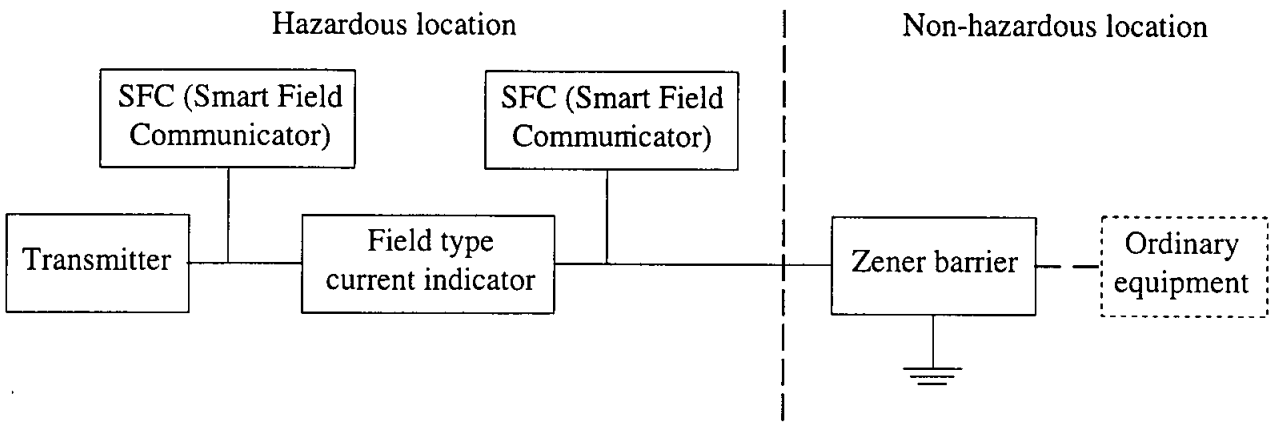



**Figure B.2 System Configuration**

(a) Install a Zener barrier (8907/51 - 24/45) in a non-hazardous location and perform independent class 1 ground work.
(b) The inductance and the capacitance of the external wiring of an intrinsic-safety circuit must not exceed 0.45 mH and 21 nF, respectively.
(c) The conditions for ordinary equipment connected to a Zener barrier are 500 VAC and 35 A or lower.
(d) Use the field type current indicator and SFC which have passed inspection in combination with the intrinsic-safety transmitter.

# 1. Outline

## 1.1 Outline

The ST3000 Ace Smart Transmitter has an integrated micro-processor and transmits an analog signal of 4 to 20 mADC in proportion to the measured differential pressure.

Parameters (range, damping time constant, constant-current output etc.) can be set and changed remotely from the instrument room via the SFC (portable setting display). An external zero adjustment function is available as an option. This function enables zero adjustment by the transmitter.

# 2. Operating Principle

In the pressure receiving unit, the differential pressure (process pressure) of the process fluid is transmitted to the sensor unit via a filler fluid.

The differential pressure (process pressure) sensor of the sensor unit is strained according to the transmitted differential pressure (process pressure) and its resistance value changes. This resistance value is detected by the Wheatstone bridge circuit and sent to the transmitting section after A/D conversion. At the same time, the ambient temperature and the static pressure are detected by the two types of auxiliary sensors (temperature sensor and static pressure sensor) on the sensor chip and sent to the transmitting unit after digitalization.

The signals that are sent to the transmitting unit are processed by the microprocessor.

For the analog output signal, the differential pressure (process pressure) of the process fluid is outputted after being converted to an analog signal of 4 to 20 mA DC corresponding to the preset range.

The differential pressure (process pressure), temperature and static pressure characteristics data for each transmitter are collected during the manufacturing process and loaded into the PROM of each transmitter via a production line computer.

The micro processor processes information in the memory and outputs the results.

A wide range of I/O characteristics data for the semiconductor sensors are also loaded into the PROM.

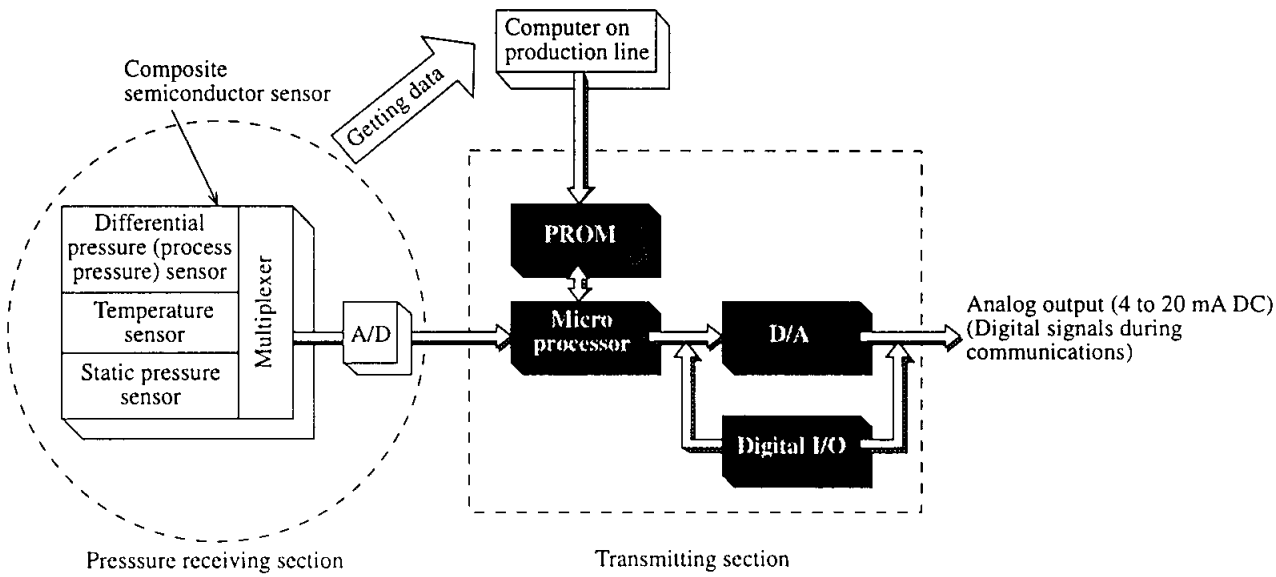



**Figure 2.1 Operating Principle**

# 3. Installation

## 3.1 Installation Dimensions

Refer to the external dimensions drawing in Apprendix A.

## 3.2 Installation Environment

Refer to Precautions "A.5 Installation Environment."

## 3.3 Installation Method

The transmitter can be installed by the following two methods.

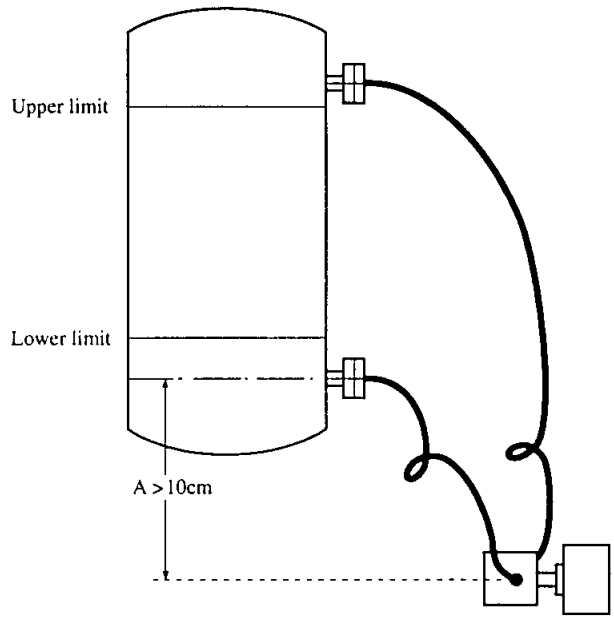
- Pipe stanchion mounting
- Line mounting

  In both cases, the bracket on which the transmitter is mounted is fixed to a vertical 50mm pipe or a horizontal 50mm pipe using the U-bolt. Make sure that the pipe is locked firmly to the foundation. It should not be unsteady.

For the line mounting method, the parts that are used for mounting a 50mm pipe to a line pipe are needed. The rear side of the pressure receiving section has 4 bolt holes. Mount this section on the bracket.

Note) In mounting a transmitter on a 50mm pipe, note that the assembly sequence of "transmitter - bracket - 50mm pipe" depends on the mounting direction.

**< Attention >**




Note:

1) For application to measuring liquid with hydrogen, consult us.
2) Mount the transmitter at 10cm lower than the lower tank nozzle.

**Figure 3 Location of Mounting Transmitter (example of tank level measurement)**

## 3.4 Mounting Direction

No special restriction is provided on the mounting direction.
However, the best method is to keep the pressure receiving diaphragm vertical.
After mounting the transmitter, adjust the zero point.

## 3.5 Process Installation

(1) Mount the flange on the process side flange using bolts and a gasket. Lock the bolts evenly and firmly in order to prevent leakage.
Minimize temperature changes in the capillary tube. Fix it to an appropriate support to prevent movement.
* Provide a flange gasket on the process side. If using a semi-metal or rubber gasket, select a gasket with a shape such that it will not touch the detector diaphragm.

(2) A flange used for measuring the liquid level in an open container should be fixed firmly to a place which has minimal temperature changes and no vibration. Protect the seal diaphragm to prevent damage. Make sure that no drain, or dust accumulates.

Remarks:
1. Do not twist the capillary tube.
2. In unwinding the capillary tube, hold the flange part and unwind the large ring of the tube.
3. Make sure that the capillary outlet extends downward from the horizontal position (so that no rain water will enter the protection pipe of the capillary outlet port.)
4. Do not apply a twisting force to the flange base by turning the capillary tube.
5. It is recommended that the capillary tube be fixed at a mid-point position in order to prevent mechanical vibration.

(3) Gasket selection for flange (3B flush mount)
Select the gasket for the flange, considering the following factors:
Since the diaphragm diameter is 95 mm, a commercially available 3B gasket will touch the diaphragm and may cause errors.
Select an appropriate material based on factors such as fluid, operating pressure and temperature. The inner diameter is also an important factor. The inner diameter should not come into contact with the diaphragm even if the gasket becomes misaligned or deformed.

Remarks:
① Select a gasket with an appropriate inner diameter (the diaphragm diameter is 95 mm.).
A commercially available 3B gasket is not appropriate because its inner diameter is too small (80 - 90 mm).
② Gasket collapse or deformation should not cause contact with the diaphragm.
- A gasket made of a soft material can be deformed by tightening.
- A gasket in transmitters mounted in the vertical position sometimes shift downward.
- Align the gasket accurately.

③ A gasket with a Teflon protective film requires the following precautions in addition to ① and ②.
- Excessive gasket tightening may cause damage to the protective film.
- Mount the protective film according to the "FEP Protective Film Mounting Procedure."
- If the zero point changes greatly after installing the pressure receiving unit, excess grease or gasket misalignment may be the cause.

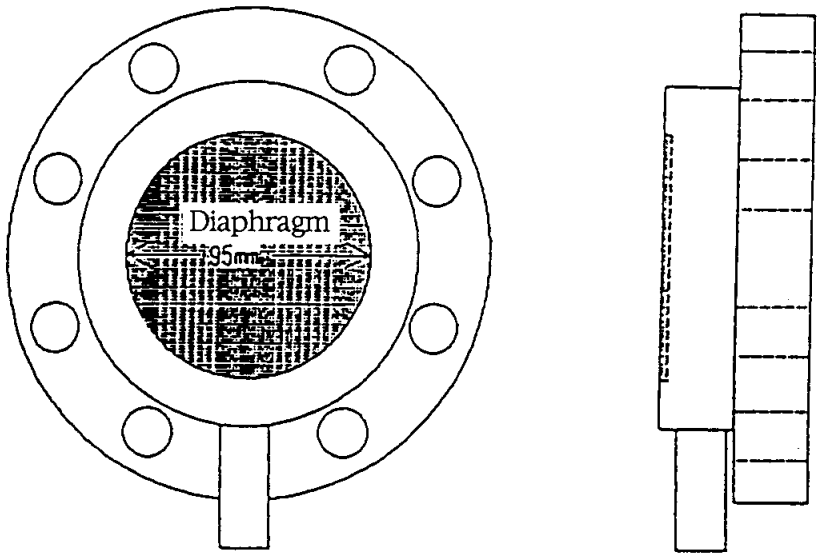



**Figure 3.1 External View of Pressure Receiving Unit**

Selection example
- Fluid : Sea water
- Temperature : Normal temperature
- Pressure : Max. 300kPa {3 kg/cm²}
- Gasket with Teflon protective film
- Flange : 3BJIS10k

Material : Non-flammable material (Non-asbestos)
External dimension : 134 mm
Inner diameter 98 mm $^{+2}_{-0}$
Thickness : 2 mm

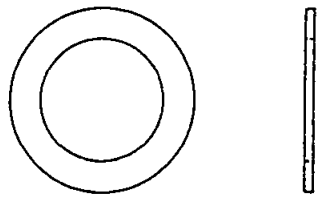


**Figure 3.2 External View of Gasket**

## 3.6 Mounting the Flanges for Flow Rate Measurement

When the transmitter is used for flow rate measurement, the differential pressure outlet taps should be mounted using the pipe tap method. If the inner diameter of a pipe is D, mount the high pressure side tap 2.5D from the upstream side orifice face and mount the low pressure side tap 8D from the downstream side orifice.

Connect the differential pressure outlet tap using a 3" flange. Mount the flange of the transmitter directly.

Remarks:

1. Do not twist the capillary tube.
2. In unwinding the capillary tube, hold the flange part and unwind the large ring of the tube.
3. Do not apply a twisting force to the flange base by turning the capillary tube.

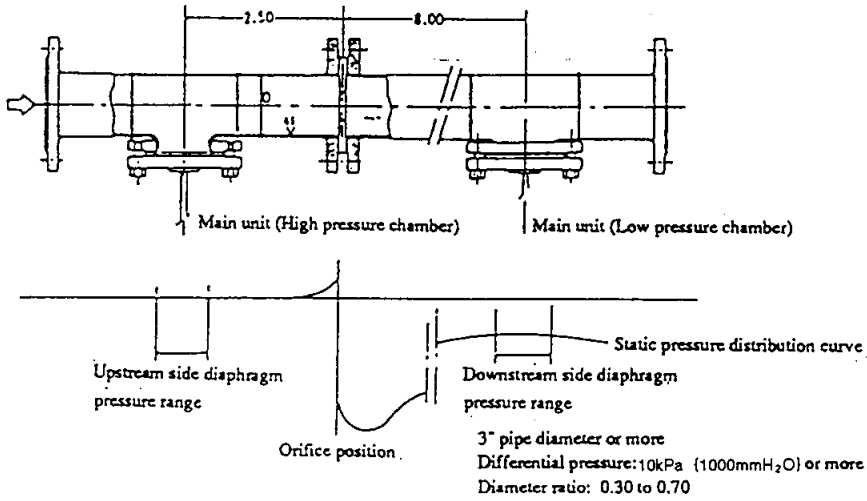



**Figure 3.3 Orifice Plate Assembly**

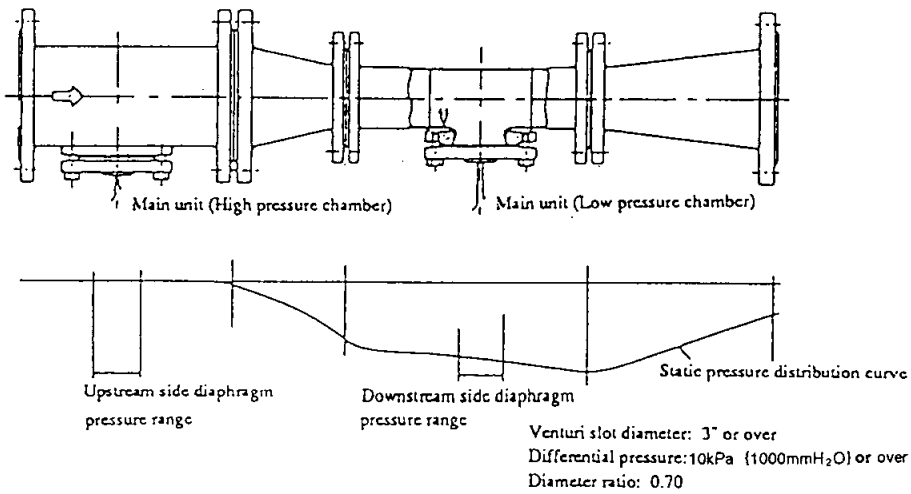



**Figure 3.4 Venturi Tube Assembly**

# 4. Wiring

## 4.1 Power Line

Since the two-wire system is adopted for the Model JTD transmitter, one line is used both as a power line and a signal line as shown in Figure 4.1.

Cables are led to the terminal unit through the side conduit hole (G1/2 internal thread).

Close the conduit connection part with sealing agent or a sealing plug so that no water drops can enter into the transmitter case.

Make sure that the cables start below the connection ports.

(An elbow to be used for changing the electrical*1 wiring direction is available. Use it if necessary.)

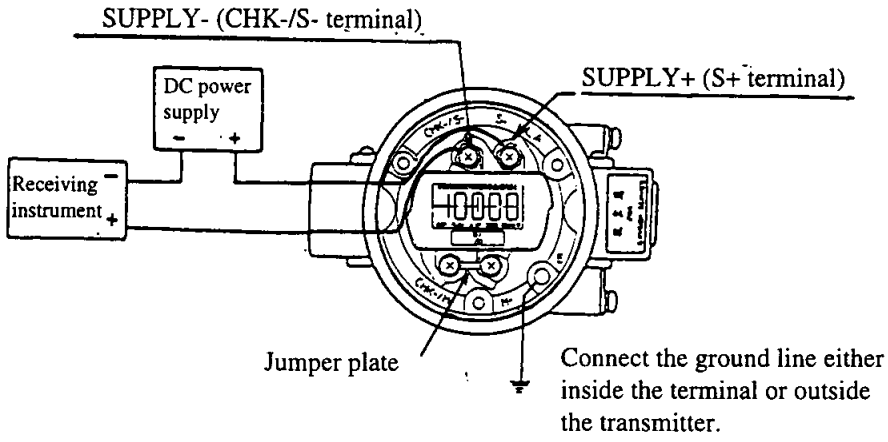
* 1 Select Optional Specifications - G1, G2 or G3.

## 4.2 Ground

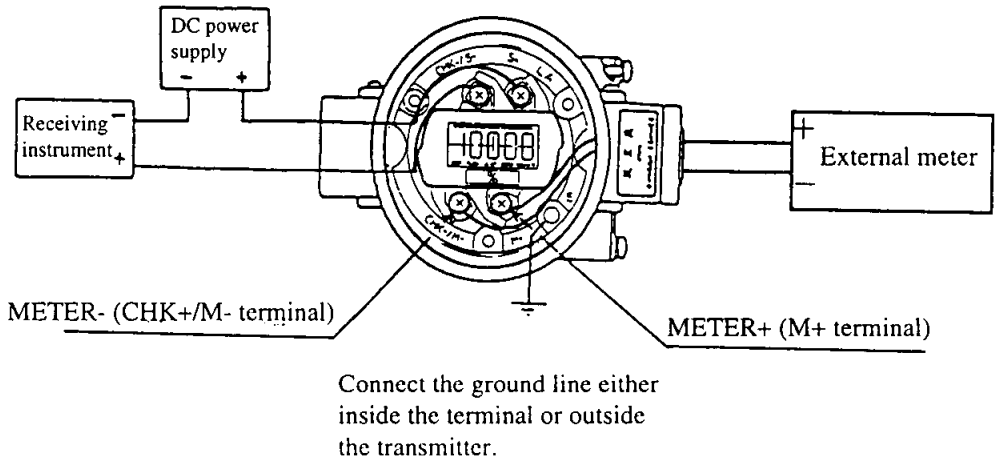
Two ground terminals are provided; one on the terminal unit and the other on the outside. Either one may be used. Connect the ground terminal to a Class 3 ground (ground resistance of 100 Ω or less) or higher quality ground.

## 4.3 External Meter Wiring

When an external meter is used, dismount the jumper board and connect the lines as shown in Figures 4.1, just like when a transmitter with a meter is used. Dismount the conduit lid after loosening its stopper using a L-wrench. When an external meter is not connected, do not dismount the jumper board.




Receiving instrument connection

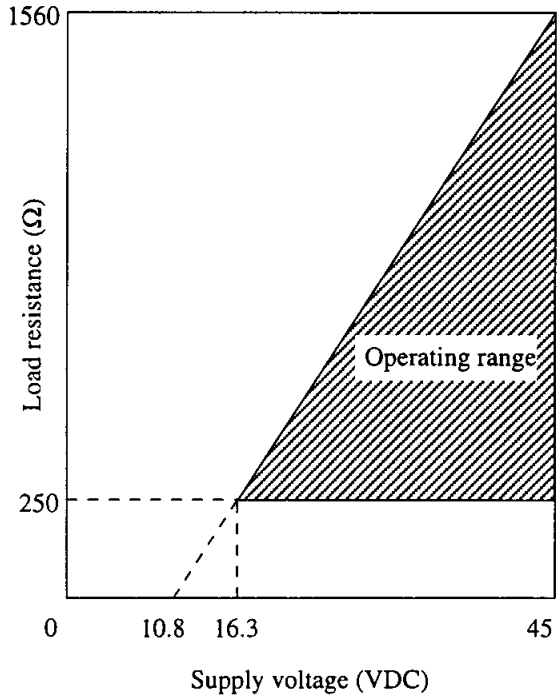



External meter connection

**Figure 4.1 Wiring**

## 4.4 Supply Voltage and Load Resistance

Make sure that the load resistance connected to the loop is within the range shown in Figure 4.2.




Note) The load resistance should be at least 250 Ω for performing communications with the SFC.

**Figure 4.2 Supply Voltage vs Load Resistance Characteristics**

## 4.5 Wiring of Flame-proof Special Explosion-proof Model

A transmitter with the flame-proof special explosion-proof construction has a transmitter case cover and a meter case cover characterized by having a locking structure. Tighten the covers after wiring and lock them firmly. (Use L-wrench M3 for flame-proof special explosion-proof construction locking.)

(A transmitter with an indicator requires locking of two parts: the transmitter and the meter. See Figure 4.3.)

The wiring method is explained in "B.1.(2), Wiring Method".

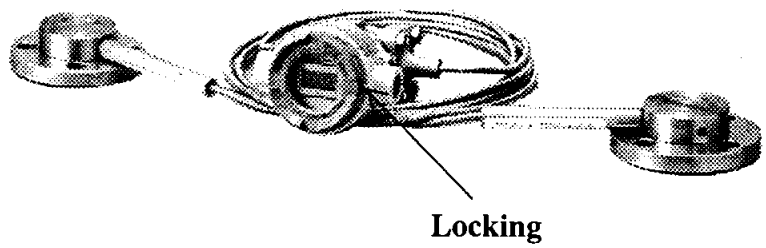



**Figure 4.3 Locking**

## 4.6 Wiring of Intrinsic-safety Model

The wiring method is explained in "B.2.(2), Wiring Method".

For the Zener barrier (8907/51-24/45), refer to manual OM2-3260-8900.

# 5. Mounting a FEP protective diaphragm on a flange

## 5.1 3B flange

Perform the following work immediately before mounting to the pressure receiving unit flange.

1. Hold the transmitter with the pressure receiving unit diaphragm flange facing upward.
2. Apply about 15 g of Diaflow Grease to the diaphragm surface and spread a thin layer of it over the entire surface with your fingers.
   (The average grease thickness on the diaphragm should be about 2 mm.) (refer to Figure 5.1.)
3. Fit a FEP protective diaphragm into the raised face of the diaphragm (refer to Figure 5.2.)
4. Spread the grease outward from the central part of the diaphragm toward the outside. Spread slowly, ensuring that all air is excluded between the diaphragm and the Teflon protective diaphragm. Squeeze the grease out until almost none remains on the raised face.
   The average grease thickness on the diaphragm will be about 0.5 mm after squeezing out 5 - 7 g of grease.
   Do not apply excessive force, as this may deform the diaphragm. (refer to Figure 5.3.)
5. Place a non-flammable gasket (non-asbestos) on the pressure receiving unit flange and mount on the process flange. Tighten bolts and nuts to a tightening torque of about 200 kgf-cm.
6. If zero point fluctuations may adversely effect operations, record the input data before and after flange tightening using the SFC, and keep fluctuations between ±0.1kPa {±10 $mmH_2O$}.
   Since large fluctuations may cause zero point shifting, repeat the above work.

(Note) Considerable skill is required to apply grease without causing large zero point fluctuations. If you are not successful, ask your Yamatake Corporation representative or service staff for help.

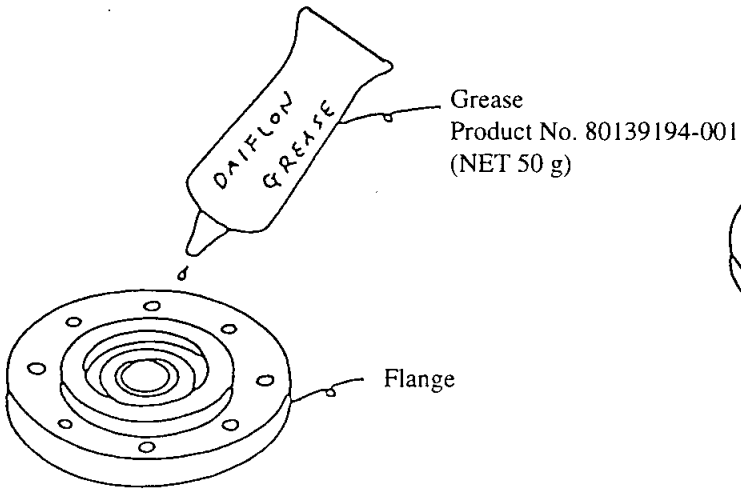



**Figure 5.1**

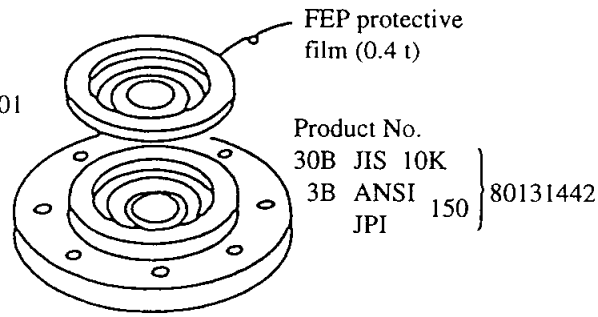



**Figure 5.2**

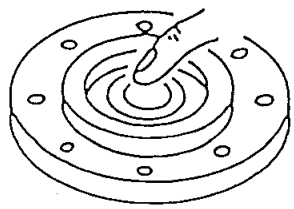


**Figure 5.3**

## 5.2 1 1/2B, 2B flange

Perform the following work immediately before mounting the transmitter pressure receiving unit flange on the process flange.

1. Hold the transmitter with the pressure receiving unit flange diaphragm facing upward.

2. Apply about 10 g (about 1/4 of one tube) of Diaflow Grease (No. DG-203, Daikin Kogyo Co., Ltd.) to the diaphragm surface and the gasket contact surface, spread it with your fingers until the thickness on the gasket surface is about 0.5 mm (refer to Figure 5.4.).
   Note 1) Do not apply excessive force as this may deform the diaphragm.
   Note 2) Make sure that no air bubbles remain in the grease.

3. Fit the FEP protective diaphragm onto the flange diaphragm surface. Lift one side and fit gently from the opposite direction, being careful to exclude all air. (refer to Figure 5.5.)
   Note 1) Keep the FEP protective diaphragm in tight contact with the diaphragm.
   Note 2) Ensure that the wavy part of the FEP protective diaphragm does not form a convex shape.

4. After performing the above work, exclude all air from between the diaphragm and the FEP protective diaphragm. Air trapped under the film can cause large measurement errors. Squeeze out remaining air with your fingers from the central part of the diaphragm toward the perimeter (refer to Figure 5.6.).

5. Lay a FEP-covered gasket or an non-flammable gasket on the flange of the pressure receiving unit and mount it on the process flange.
   The recommended bolt and nut tightening torque (reference values) is shown in Table 1.
   Note 1) Tighten all bolts with uniform torque.

**Table 5.1**

| Flange rating | Tightening torque (N•m{kgf-cm}) |
|---|---|
| JIS10K - 50A | 29.4 {300} |
| JIS10K - 40A | 19.6 {200} |
| 150 # - 2B | 27.4 {280} |
| 150 # - 1.5B | 19.6 {200} |

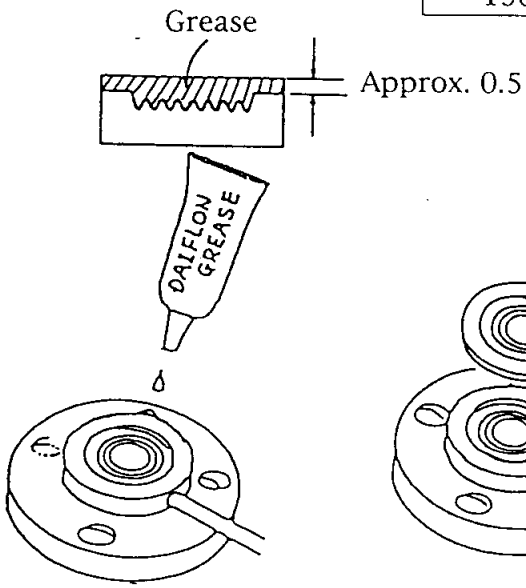



Figure 5.4



Figure 5.5

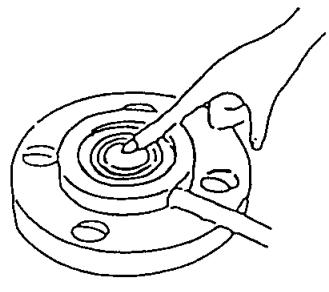


Figure 5.6

# 6. Operation

The S-SFC operating instructions in this section are applicable to S-SFC software version 7.1 and later versions.

Refer to Smart Communicator Operation Manual CM2-SFC100-2001.

During communications, keep the control loop connected to the transmitter in the manual mode.

## 6.1 Preparation

### 6.1.1 Checking the Wiring

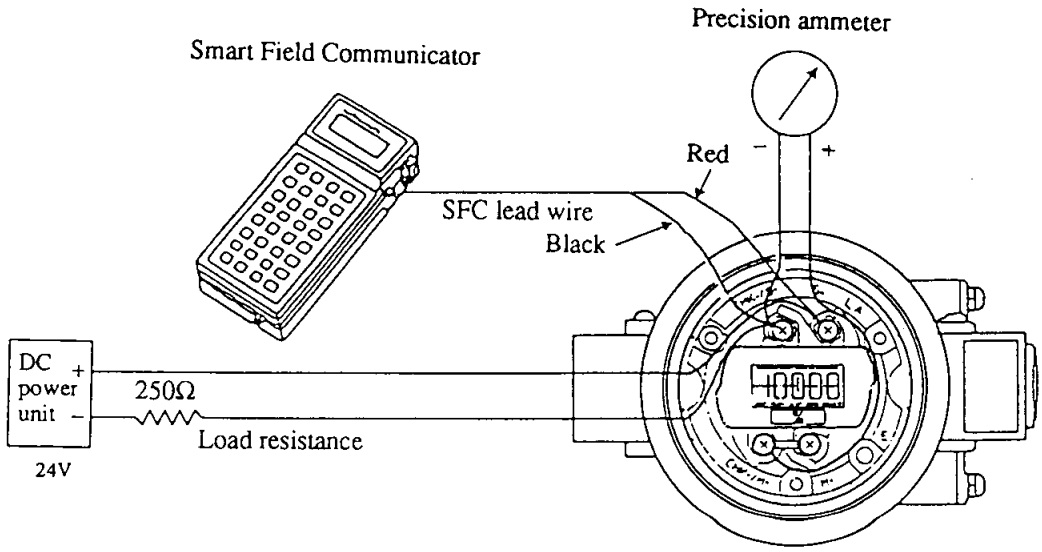
Check to see if the transmitter has been wired correctly.

### 6.1.2 Connecting the SFC (Communicator) and Ammeter Used for Checking

Connect the SFC and a high accuracy ammeter to the terminal board as shown in Figure 6.1. The SFC can be connected to the panel terminal in an instrument room or in the field, according to the purpose.

(Note) It is possible to insert a precision resistor into the line and connect a digital voltmeter instead of an ammeter. In this case, obtain the voltage for that resistance value at 4 to 20 mA. Since a digital signal is superposed on the 4 to 20 mA DC line during communications, keep the process control loop in the manual state in order to prevent their influence.

(1) Dismount the case cover of the transmitter.
(2) Connect the red and black lead wires of the SFC to the + tab and the - tab of the SUPPLY terminal, respectively. Make sure that the polarity is correct.
(3) Connect the lead wires of the meter to the test terminals of the terminal block. Make sure that the polarity is correct.




Note) The load resistance should be at least 250 Ω for performing communications with a SFC.

**Figure 6.1**

### 6.1.3 Checking Communications

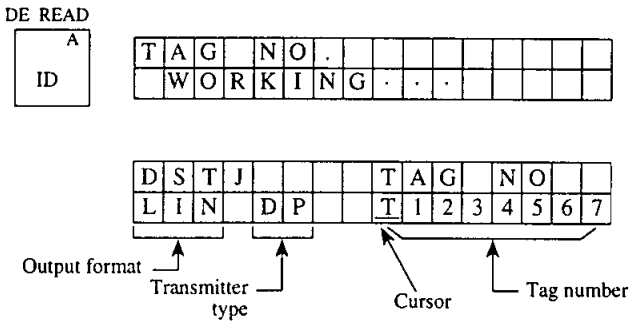
After installing the transmitter, check communications with the SFC and the parameters that must be set.

(Note) After connecting the SFC, be sure to check the tag number of the transmitter by pressing the ID key first. None of the functions will operate until the tag number is checked by pressing this key.

(1) Turn on the power switch of the SFC. The display will ask whether the process control loop is in the manual mode. If it is not in the manual mode, change its mode to the manual mode.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | O | O | P | | I | N | | M | A | N | U | A | L | ? | |
| P | R | E | S | S | | I | D | | | | | | | | |

(2) Press the "ID" key, and the output format, the transmitter type (DP: Differential pressure), and its tag number will be displayed. Check them.




The tag number is "xxxxxxxx" at the time of plant shipment.

(3) If the display is not as shown in step (2), some kind of communication problem exists. Refer to the following diagnosis procedure.

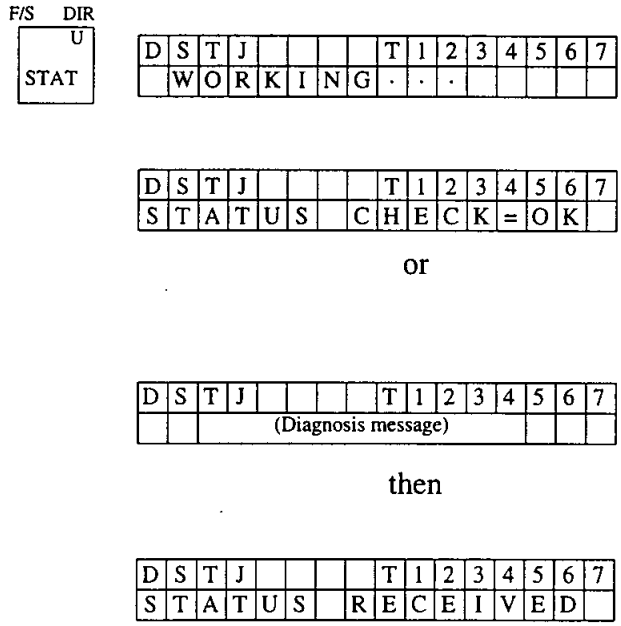
[Example]

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| N | O | | X | M | T | R | | R | E | S | P | O | N | S | E |

### 6.1.4 Diagnosis of Operations

Check the state of the transmitter.

(1) Press the "STAT" key and read the diagnosis information.




Generally, pay attention to the following items.

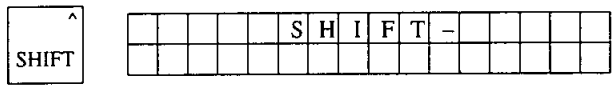
① Are the transmitter and the SFC connected correctly?
② Is the loop functioning correctly?
③ Does the resistance value between the SFC and the power unit satisfy Figure 4.4?

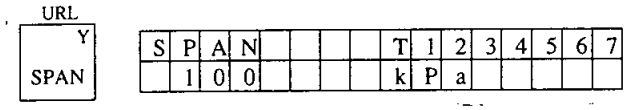
### 6.1.5 Checking Configuration Data (Parameter Values) and Output Signals

Check the high limit of the adjustable range, the configuration data, and the output signals to make sure that the transmitter operates normally and reliably.

(1) Checking the high limit of the adjustable range
Check the high limit of the adjustable range in order to make sure that the set range of the transmitter is adequate.

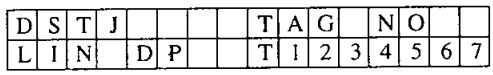
① Display the high limit of the adjustable range of the transmitter.



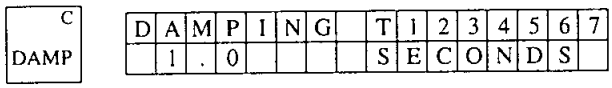




② Check to make sure that the high limit of the set range is not above the high limit of the adjustable range. If it is above the high limit of the adjustable range, replace the transmitter with that for other specifications (higher range limit).

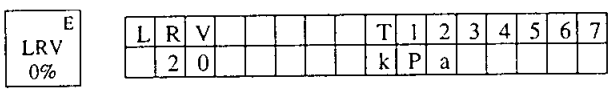
(2) Checking the configuration data
Display the configuration data of the transmitter on the SFC.
① Transmitter output format, transmitter type, tag number
(a) Analog transmission

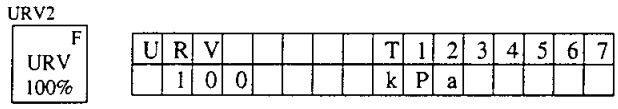

② Damping time constant




③ Low limit of range



④ High limit of range

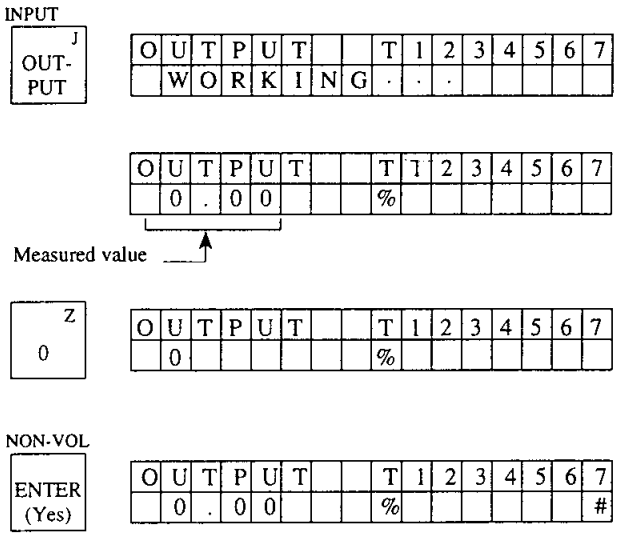



(3) Checking output signals

Set the transmitter to the constant current source mode by the following procedure and check to see if it outputs 0% and 100% signals.

(Note) At the same time, check to see whether the transmitter output is received normally by the receiving equipment.

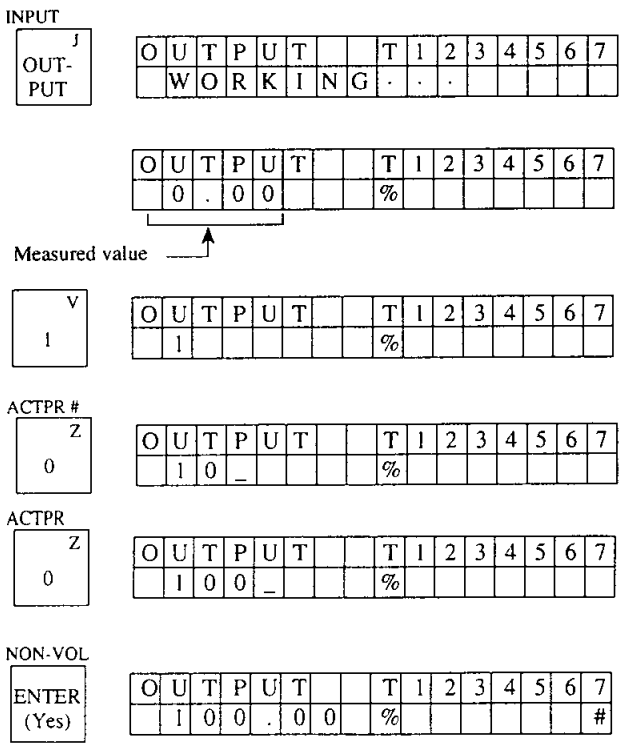
① Set the transmitter to the constant current source mode and transmit a 0% output signal.



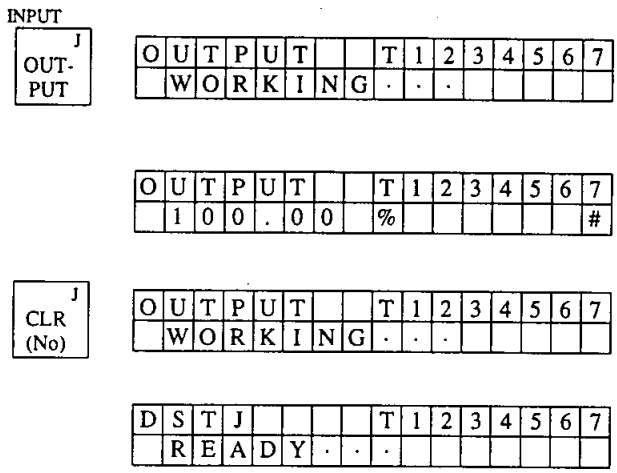

② Read the meter to check to see if it indicates a 0% signal (4 mA).

(Note) A "#" mark indicates that the transmitter is in the constant current source mode.

③ Set the transmitter to the constant current source mode and transmit a 100% output signal.



④ Read the meter to check to see if it indicates a 100% signal (20 mA).
⑤ If the meter indication is correct, release the constant current source mode by the following procedure. If any error is found, refer to 11. "Troubleshooting" or 7.2 "Calibrating Output Signals".




(Note) The "#" mark will disappear, indicating that the constant current source mode has been released.

## 6.2 Adjustment before Operation

Make adjustments under the actual process conditions.

The specific gravity of the fill fluid is 0.935 (at 25°C). The specific gravity varies with change in temperature at the rate of 0.0008/°C. Hereafter, use the capillary tube temperature to calculate the specific gravity.

### 6.2.1 Minimum Liquid Level Position for Liquid Level Measurement (Zero Position)

The zero position of the measured liquid will be the center of the seal diaphragm on the face of the process connection flange of the transmitter. (Refer to Figure 6.2.) Therefore, the measurement range H will be from the center of the transmitter flange to the specified range height.

Check the zero point of the transmitter by lowering the measured liquid level below the lower edge of the diaphragm of the process flange face (high pressure side). The low pressure side diaphragm and the high pressure diaphragm must be mounted at the same height and that must be no liquid head pressure being applied. In other words, check the zero point by equalizing the pressures applied to the low and high pressure side diaphragms.

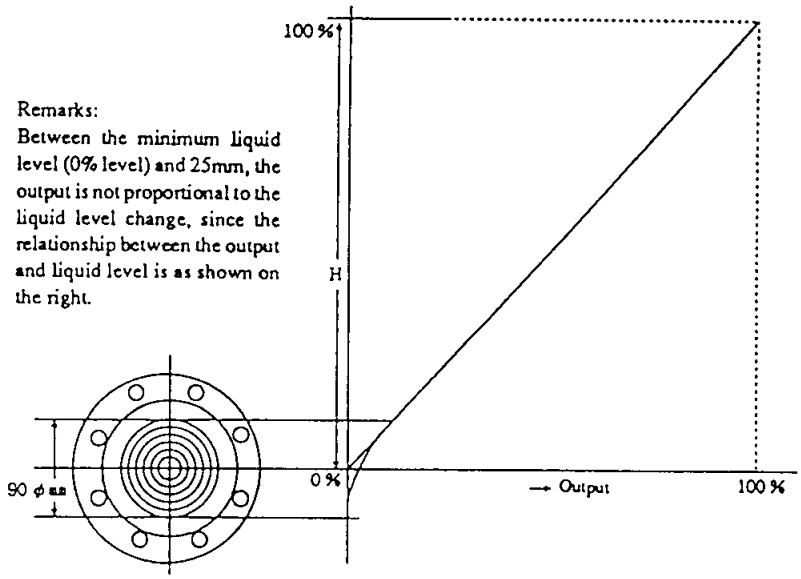



Figure 6.2 Minimum Liquid Level Characteristics

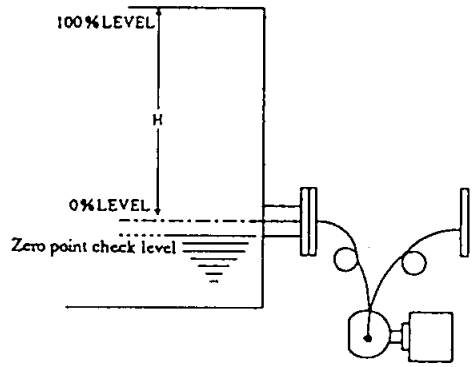



Figure 6.3 Determination of Zero Position

### 6.2.2 Liquid Level Measurement in an Open Tank

If the high pressure side diaphragm and the low pressure side diaphragm are mounted at the same position for the liquid level measurement of an open tank, the sum of the head pressure of measured liquid and the atmospheric pressure is applied directly to the high pressure side diaphragm. Atmospheric pressure is applied to the low pressure side diaphragm, because it is open to the air. This means that only the head pressure of measured liquid is applied to the transmitter. Therefore, the transmitter measurement range is equal to H • $\rho$, and the transmitter output increases as the liquid level rises.

When the liquid level cannot be lowered to the zero point check level, check the output at a known liquid level above the 0% liquid level + 48mm.

When the high pressure side flange is mounted below the minimum measurement liquid level (0% level), the sum of H • $\rho$ and the elevation head E • $\rho$ is applied to the high pressure side diaphragm at the maximum measurement liquid level (100% level). Therefore, the transmitter output should be set to equal 0% at the 0% level by canceling E • $\rho$ at the LRV (0% level value). Also, caution is required when the high pressure side flange and the low pressure side flange are mounted at different positions. For example, when the low pressure side flange is mounted below the high pressure side flange, elevation E' • $\rho$ (E': Difference in position, $\rho$': Specific gravity of fill fluid) is applied. When the high pressure side is mounted above the low pressure side, suppression occurs. Therefore, the transmitter output should be set to 0% by canceling the elevation or suppression.

When the liquid level cannot be lowered to the 0% level, check the output at a known liquid level above 0%.

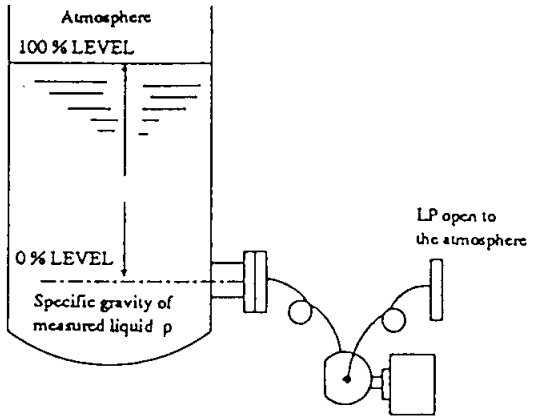



**Figure 6.4 When No Elevation Head Is Applied**

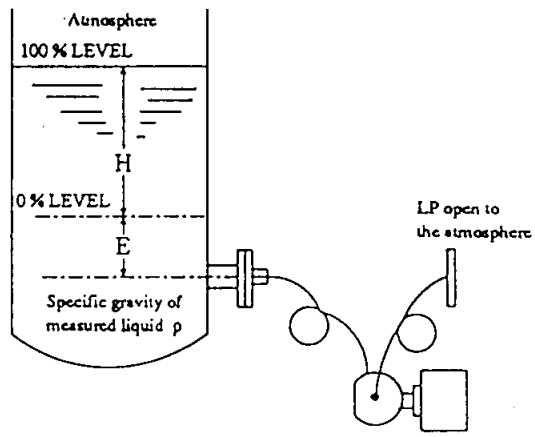
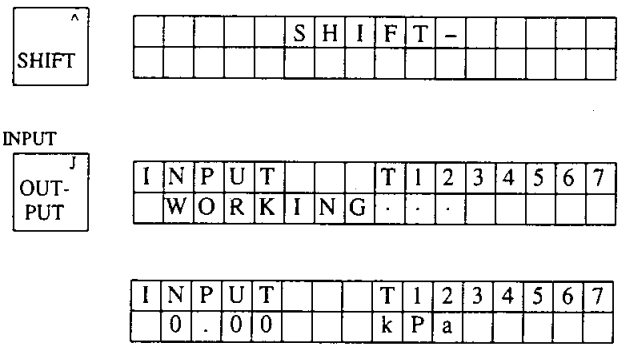
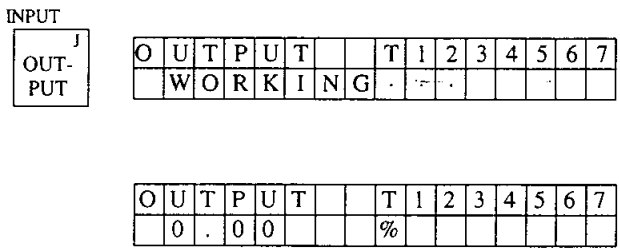



**Figure 6.5 When Elevation Head Is Applied**

(1) Read the input on the SFC.

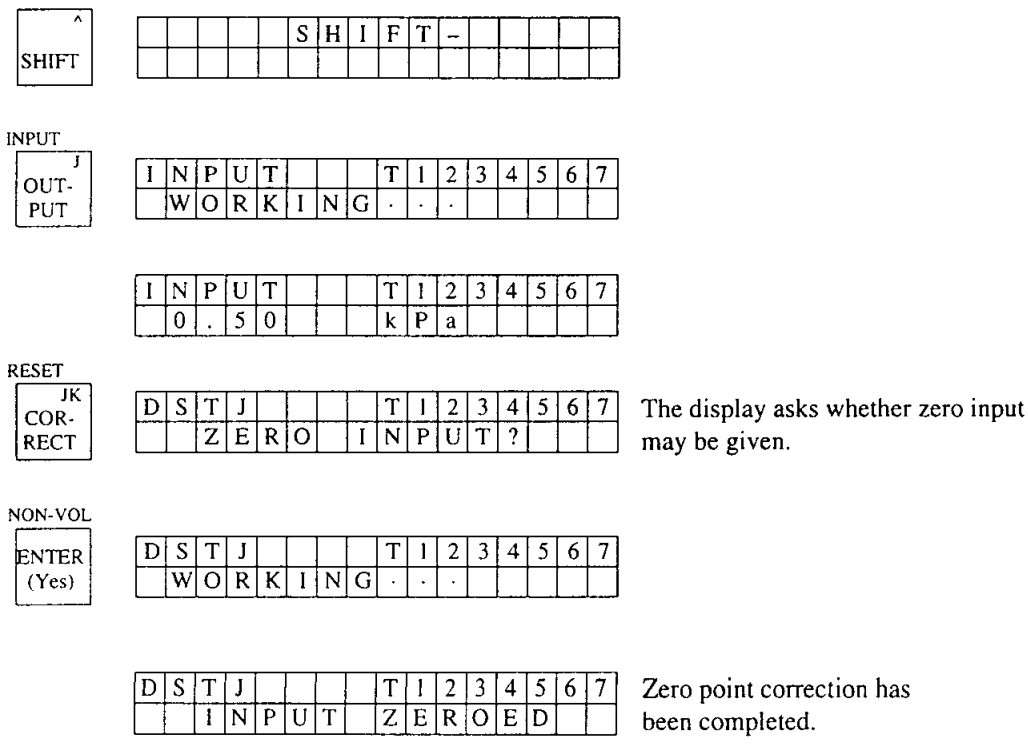



(2) Display % output on the SFC and read the output from the ammeter at the same time. Check both values.




(3) If the values displayed in (1) and (2) are not equivalent to 0 (differential pressure), correct the zero display by the following procedure, using the SFC.

① Read the input on the SFC



(4) Repeat (1) and (2) to make sure that the zero point has been corrected.

(5) Apply the liquid level to the transmitter as pressure.

(6) Read the input and output on the SFC (or the output on the ammeter) and check the relation between the input and output. If the input and output fail to match, check to see if the transmitter is installed and piped adequately. If the input and output fail to have adequate correspondence, check the configuration data base of the transmitter and check to see if the set range of the transmitter is wrong. If the problem cannot be solved by the above method, refer to 11. "Troubleshooting".

### 6.2.3 Liquid Level Measurement in a Closed Tank

In the case of a closed tank, connect the L side flange to the lower part of the tank and the H side flange to the upper part of the tank, because the pressure on the lower side (A side) is lower than that on the higher side (B side).

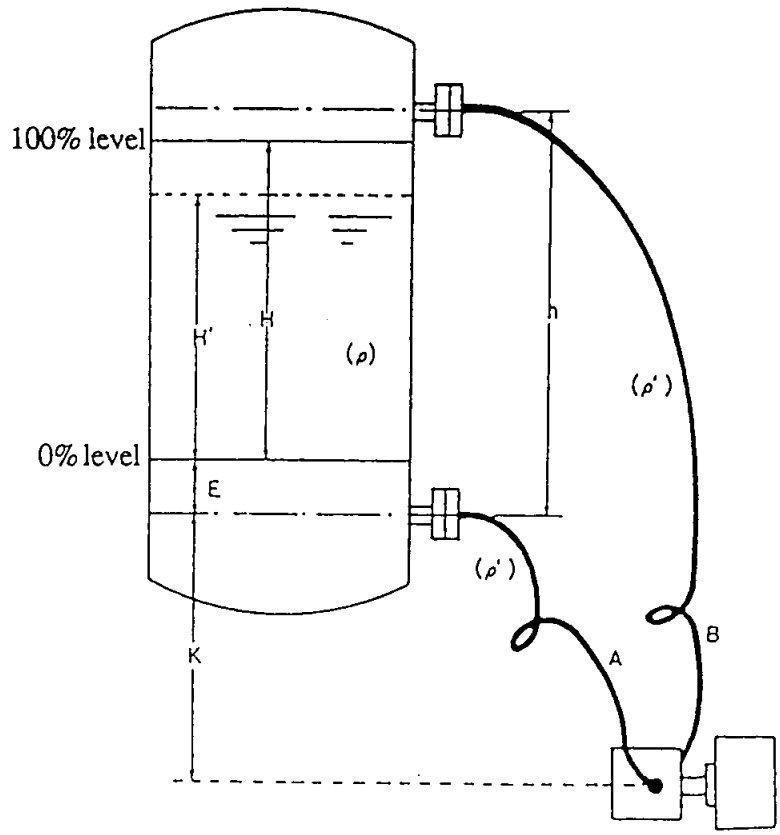



**Figure 6.6 Liquid Level Measurement of Closed Tank**

The pressures in Figure 6.6 are as follows.
Pressure applied to A side: $(H' + E)\rho + K\rho'$ + Pressure in container
Pressure applied to B side: $h\rho' + K\rho'$ + Pressure in container
Since $(H + E)\rho$ is ordinarily smaller than $h\rho'$, $(H' + E)\rho$ is smaller than $\rho'$.

Note) Set the transmitter ranges LRV (0% level value) and URV (100% level value) by referring to the following examples.

[Example]
h=2m, E=0.5m, H=1.5m, $\rho$=0.9m, $\rho'$=0.935
Differential pressure at 0% level: $h \cdot 0.0098 \cdot \rho' - E \cdot 0.0098 \cdot \rho = 13.92$ kPa
Differential pressure at 100% level: $h \cdot 0.0098 \cdot \rho' - (H + E)\ 0.0098 \cdot \rho = 0.69$ kPa
Therefore, LRV and URV should be set as follows.

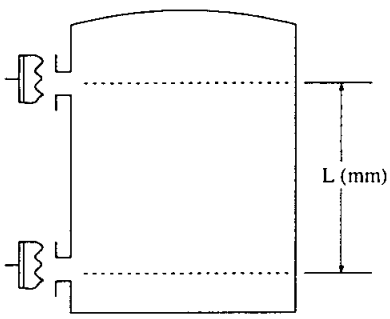
LRV = 13.92 kPa
URV = 0.69 kPa

(1) Apply the liquid level onto the transmitter as pressure.
(2) Read the input and output on the SFC (or the output on the ammeter) and check the relation between the input and output. If the input and output fail to correspond, check to see if the transmitter is installed and piped correctly.
If the input and output fail to correspond even-if the installation and piping are correct, check the configuration database of the transmitter to see if the set range of the transmitter is incorrect. If the problem cannot be solved by the above method, refer to the SFC troubleshooting manual.

### 6.2.4 Temperature Compensation of Fill Fluid in Capillary

When the liquid level of a tank is measured using a remote-seal type differential pressure transmitter, a zero shift of several percent (%) will ordinarily arise because of variation in the density of the fill fluid in the capillary tube.

This transmitter can measure the liquid level accurately because a composite semiconductor sensor is used to measure the temperature and a micro processor is used to compensate for the fill fluid temperature. (The zero shift is 1/5 that of a conventional transmitter.)




Example of zero shift

L (Difference between flanges): 2500mm (2.5m)
R (Measurement span): 2500mm (2.5m)
A (Temperature coefficient of fill fluid): 0.001/°C
T (Ambient temperature change): 55°C

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

From (1)

With no temperature compensation: $\frac{0.001 \times 55 \times 2500}{2500} \times 100 = 5.5\%$
(Conventional transmitter)

ST 3000 with temperature compensation function: 1%

### 6.2.5 Flow Rate Measurement

Refer to "Mounting the Flanges for Flow Rate Measurement" for information about operating the transmitter for flow rate measurement.

Since neither an equalizer valve, nor a stop valve can be installed in this case due to the structural nature of the instrument, check the zero point before allowing fluid to flow into the main pipe.

When the differential pressure outlet flange port is mounted on a vertical pipe, there will be a difference in height between the high and low pressure side flanges. In this case, determine the zero point by setting the LRV.

Start operation immediately after performing the above preparations.

Remarks:

The product of the specific gravity of the fill fluid in the capillary tube and the relative positions (high, low) of the flange installation and the pressure receiving unit of the transmitter has an effect on the pressure receiving unit as a pressure in accordance with the relative positions. This is applicable to both liquid level measurement and flow rate measurement as well as to both the high pressure side flange and the low pressure side flange.

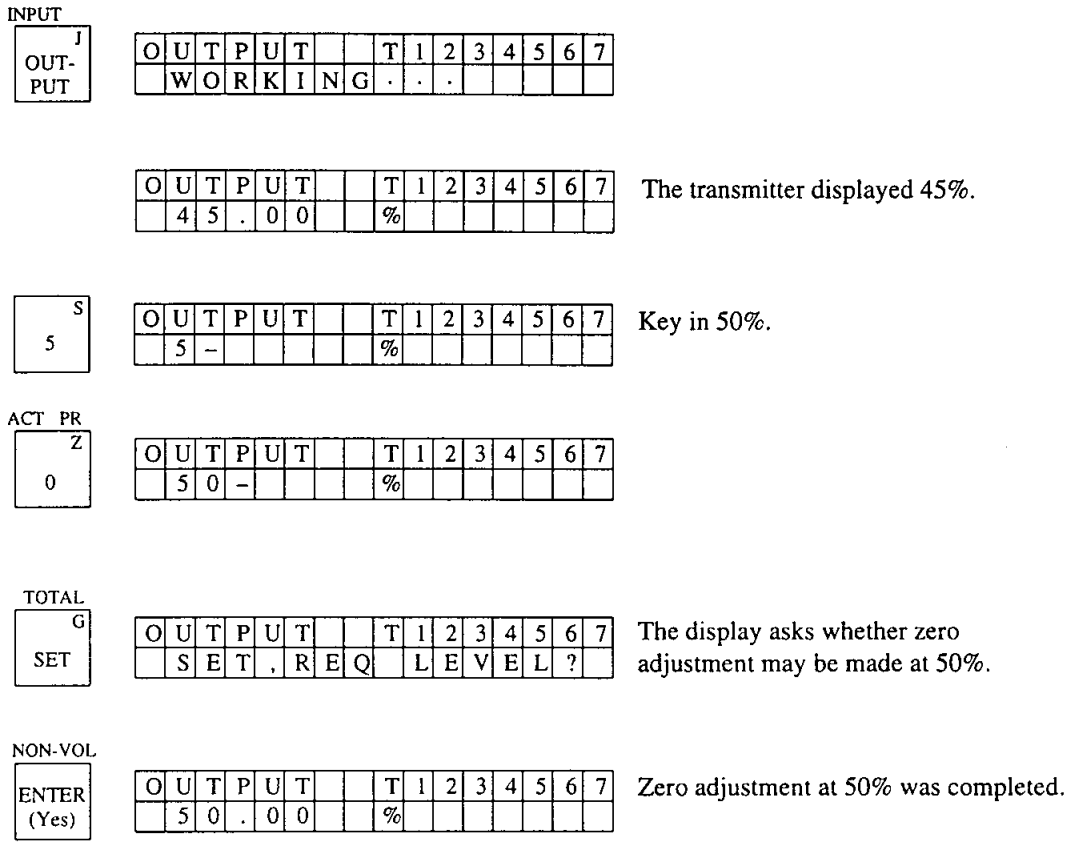
This effect must be corrected for by addition when the flange position is higher than the pressure receiving unit and by subtraction in the opposite case. However, values outside the range given in the "Specifications" cannot be corrected for. No measurement can be made in such cases.

It is recommended that the pressure receiving unit be mounted below the two flanges if possible. It is especially important to mount it below the high and low pressure side flanges when the pressure in the tank is a vacuum.

## 6.3 Zero Adjustment for Liquid Level Measurement (Intermediate Level)

It is easy to adjust the zero point of a level gauge to an intermediate level between 0 and 100 (50% for example).

Read the actual level value using the level gauge. (This is assumed to be 50% here.)




## 6.4 Starting Operation

When the power is turned on, or when the power is turned off for more than 1 second, the output will first be set to about 4 mA and often several seconds it will begin to change according to the input.

## 6.5 Configuration (Setting)

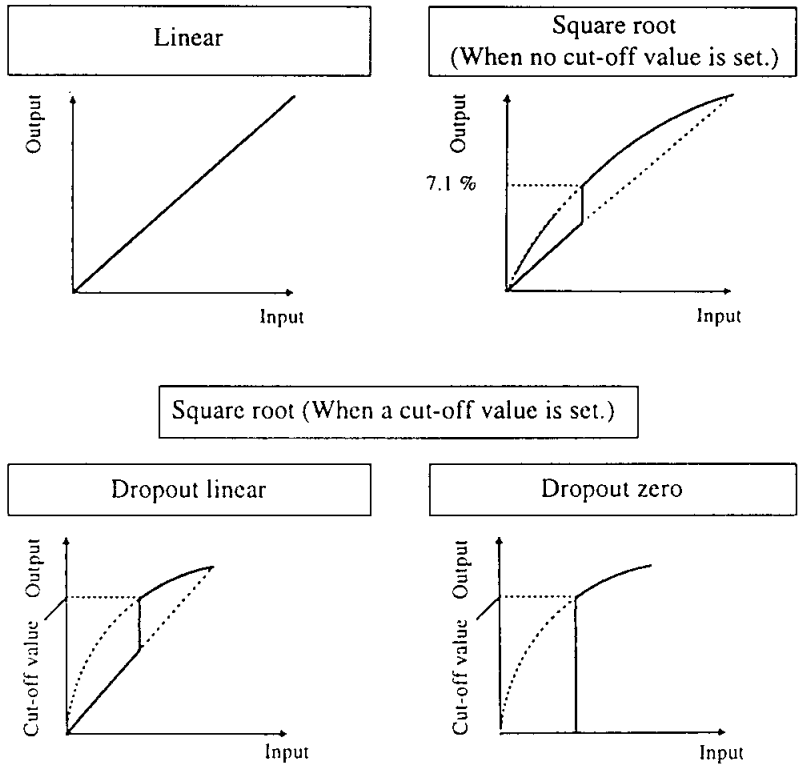
This section is concerned with the configuration data parameters of the transmitter. It explains how to write data into the memory of the transmitter using the SFC (Smart Communicator).

### 6.5.1 Configuration Data Parameters (Various Settings)

The configuration data parameters of a transmitter are shown in Table 6.1.

Since the SFC supports various types of transmitters, some of the data are not necessary for a differential pressure or pressure transmitter. Select the necessary data.

**Table 6.1 (The item numbers correspond to the title numbers in 6.4.3.)**

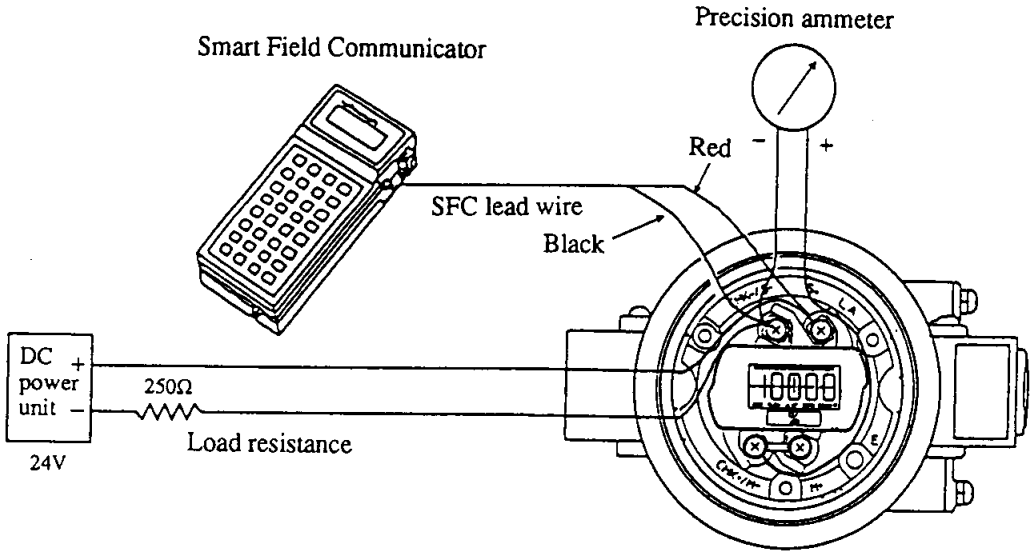
| Data parameter | Selections |
|---|---|
| (1) Output signal type | Analog transmission |
| (2) Transmitter tag No. registration | 8 characters or less |
| (3) Output format | Select LINEAR or SQUARE ROOT.<br>When SQUARE ROOT is selected, a cut-off value (0 to 20%), a dropout format (linear/zero) and a flow rate mode (DEFAULT/EXPAND) etc. can be selected.<br>  <br>Note) Flow rate mode<br>DEFAULT : This mode is used in most cases.<br>EXPAND : This mode is selected when the range is expanded (for example, when the range is set near the normal flow rate) or when reverse flow rate output must be obtained using a reversible orifice. |

| Data parameter | Selections |
|---|---|
| (4) Damping time constant | Can be selected from the following 10 values (Unit : second). However, the actual response time is the value obtained by adding 0.4 sec. to the selected value.<br>0.00 1. 16.<br>0.16 2. 32.<br>0.32 4.<br>0.48 8. |
| (5) Pressure unit | One of the following units can be selected.<br>kPa MPa hPa Pa mbar bar $inH_2O$<br>inHg PSI $mmH_2O$ $mH_2O$ $kgf/cm^2$ $gf/cm^2$ mmHg |
| (6) Low limit of set range LRV (measured value for outputting 0% (4 mA DC)) | Set a value using the keys or set the pressure value outputted to the SFC. |
| High limit of set range URV (measured value for outputting 100% (20 mA DC)) | Set a value using the keys or set the pressure value outputted to the SFC. |
| (7) Saving data to SFC (save) and restoring to transmitter (re-input) | Data can be saved and restored from the SFC to the transmitter and vice versa. |

(Notes) (1) Transmitter tag No. registration: A maximum of 8 characters can be inputted using numerics, characters and symbol marks on the keyboard of the SFC.
(2) The set range is displayed in 4.5 digits.

### 6.5.2 Connecting the SFC (Smart Field Communicator) and External Meter

(1) Connect the SFC and a high precision ammeter to the terminal board as shown in Figure 6.6. The SFC can be connected to the panel terminal in an instrument room or in the field, according to the purpose. Dismount the case cover of the transmitter.
Connect the lead wires of the SFC to the + and the - tabs of the SUPPLY terminal. Make sure that the polarity is correct. Connect the lead wires of the meter to the test terminals CHK+ and CHK-. Make sure that the polarity is correct.
At the same time, refer to Smart Communicator Operation Manual OM2-5254-0800.




Note) The load resistance should be at least 250 Ω for performing communications with a SFC.

**Figure 6.6 Connecting SFC and External Meter**

(2) Turn on the SFC.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | O | O | P | | I | N | | M | A | N | U | A | L | ? | |
| P | R | E | S | S | | I | D | | | | | | | | |

The display asks to press the ID key.

(3)

DE READ
A
ID

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | A | G | | N | O | . | | | | | | | | | |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

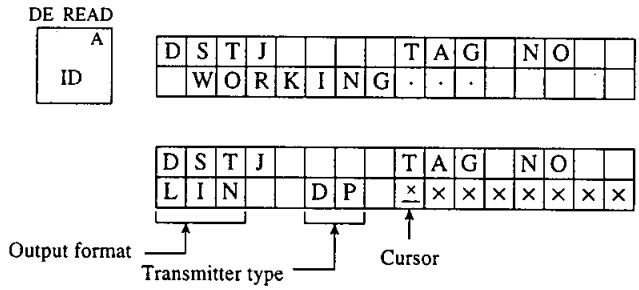
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | A | G | | N | O | . | |
| L | I | N | | | D | P | | × | × | × | × | × | × | × | |

## 6.5.3 Writing Configuration Data

Configuration data can be written to the memory of the transmitter or the memory of the SFC.

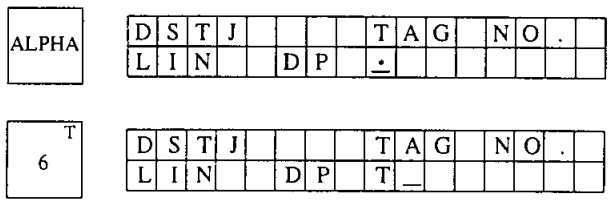
(1) Registering the transmitter tag number

Turn on the SFC.

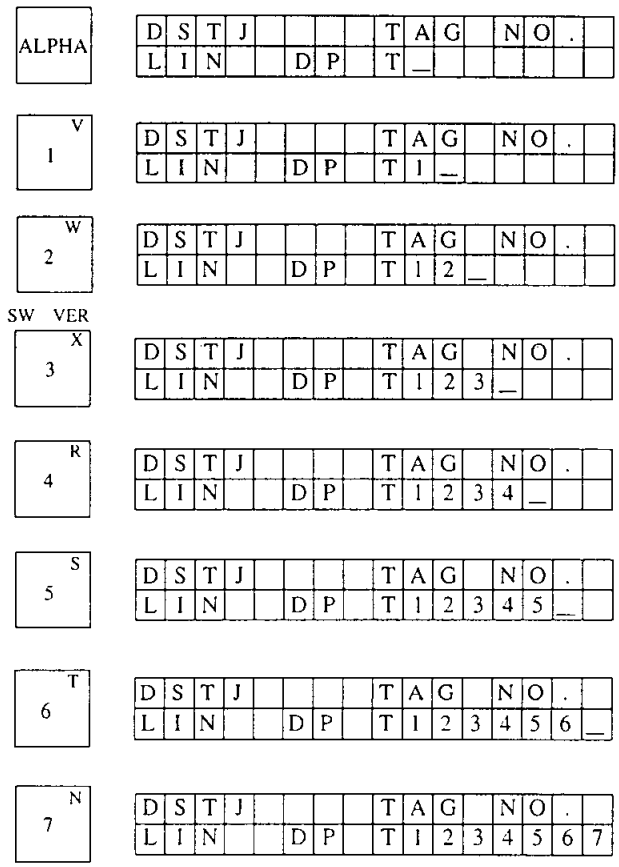



Note 1. The tag number is "xxxxxxxx" at the time of plant shipment.
Note 2. LIN (output format) means linear output.
(SQRT means square root output.)
Note 3. DP (transmitter type) means a differential pressure transmitter. (GP and AP mean a process pressure transmitter and an absolute pressure transmitter, respectively.)

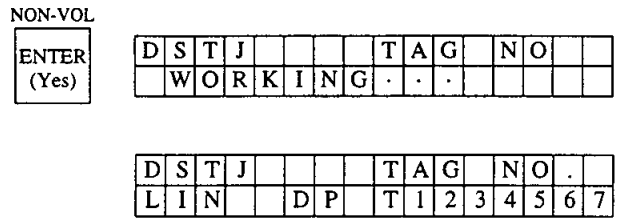
Select the alphabet mode.




Release the alphabet mode.

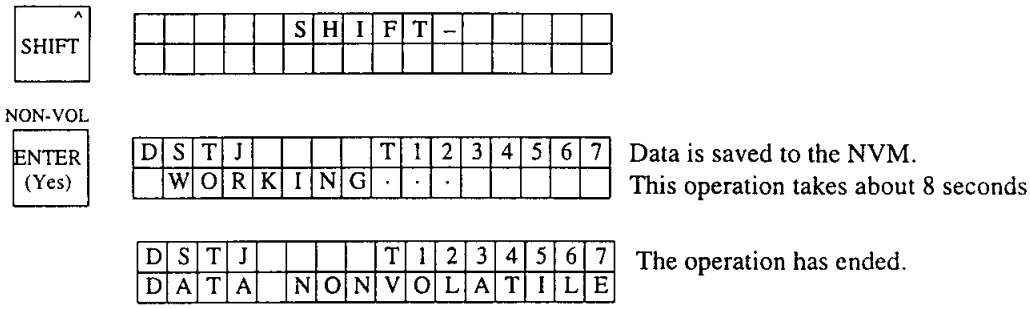



Write the data to the memories of the transmitter and the SFC.



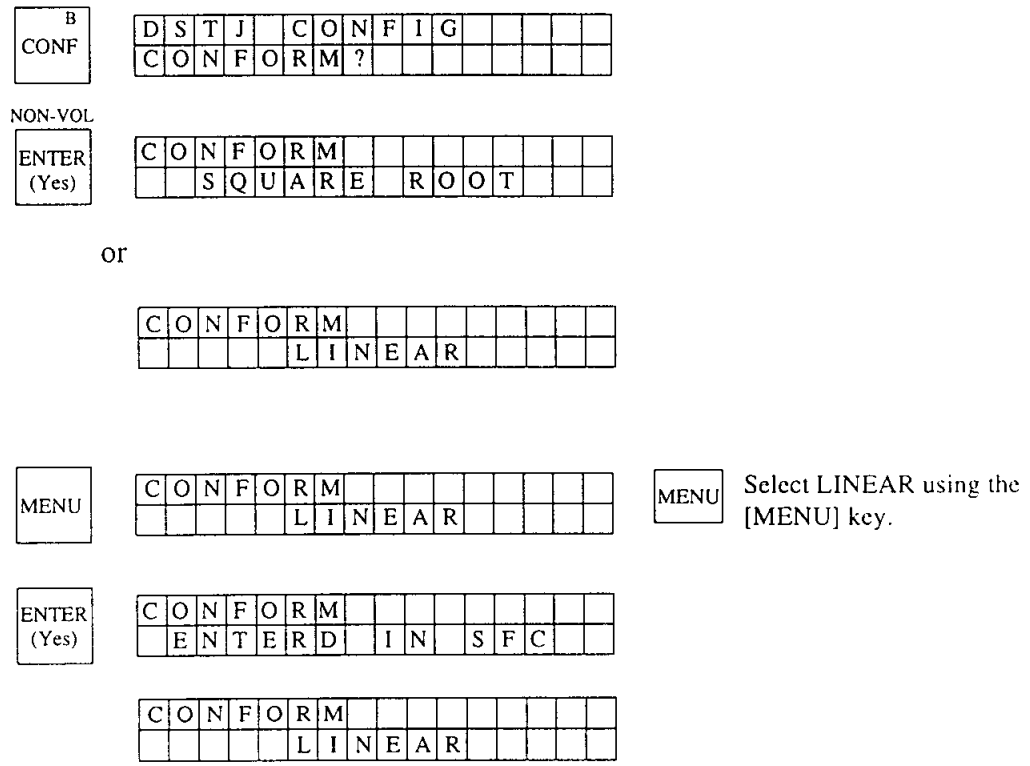

(2) Saving data in the non-volatile memory (NVM) of the transmitter

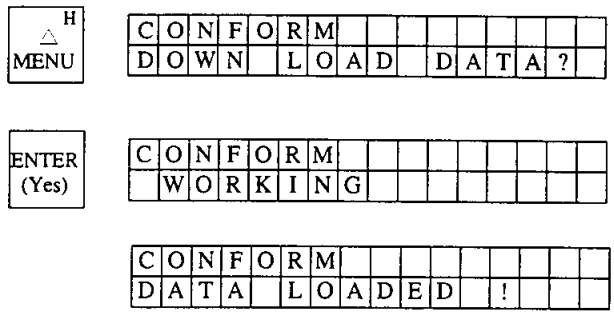
After zero and span calibration, save the calibration data in the non-volatile memory of the transmitter by the following procedure. The data in the work memory of the transmitter can be saved with high priority. The data will not be lost even if the transmitter is turned off. When any value in the work memory is changed, ST3000 automatically saves data from the work memory to the NVM in about 30 seconds, even without this operation.




(3) Output format

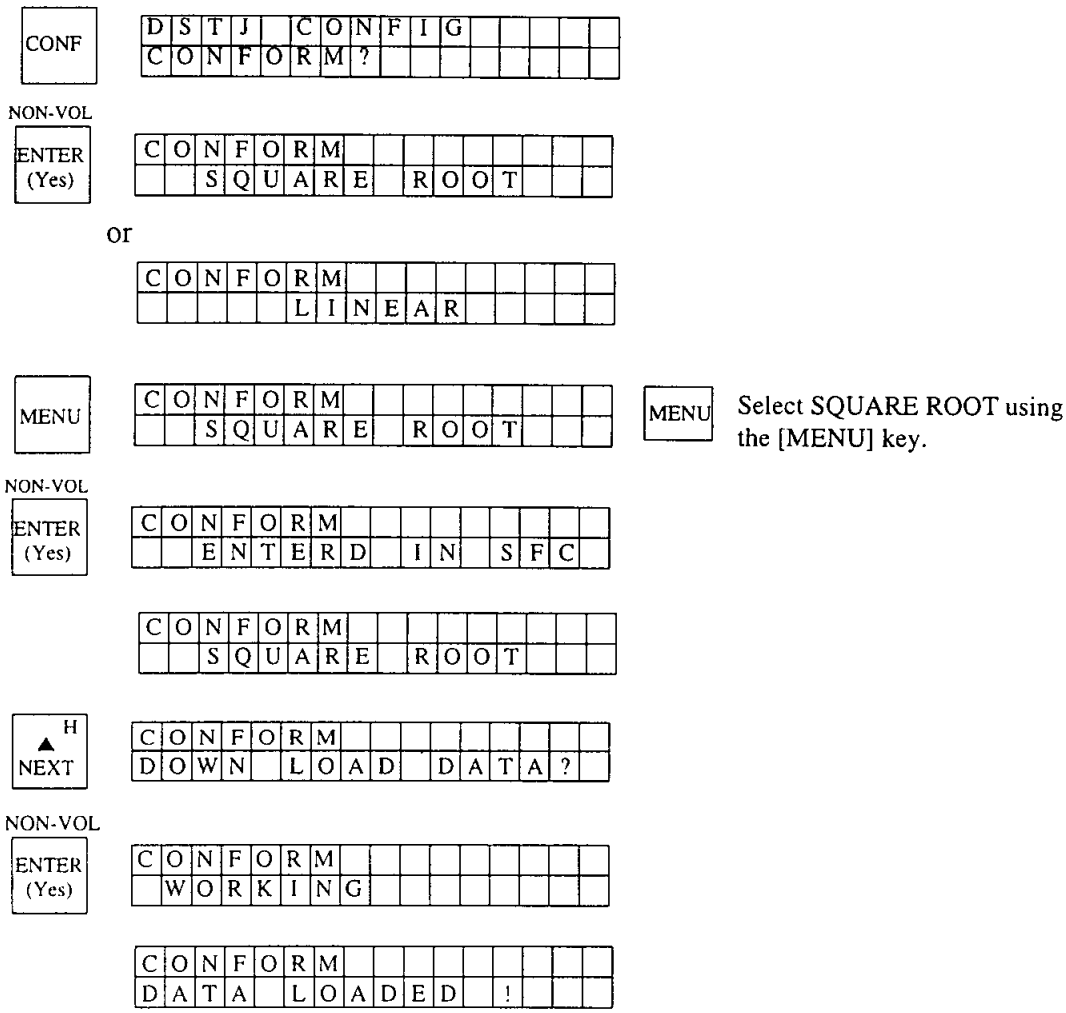
① Linear output



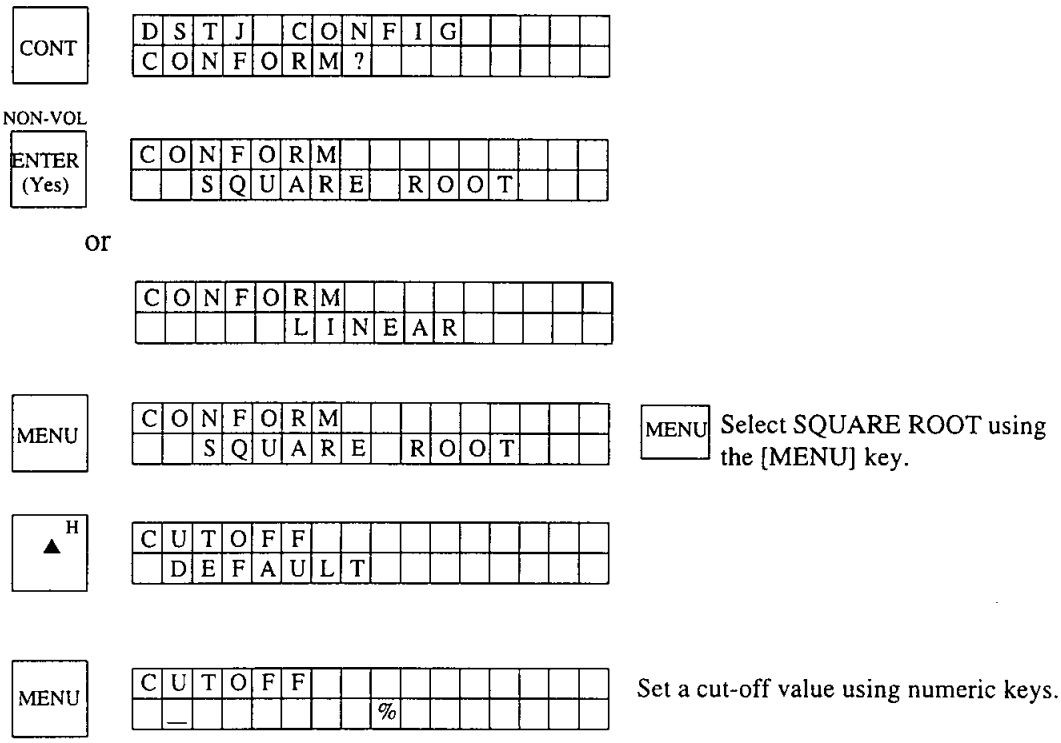



② Square root output

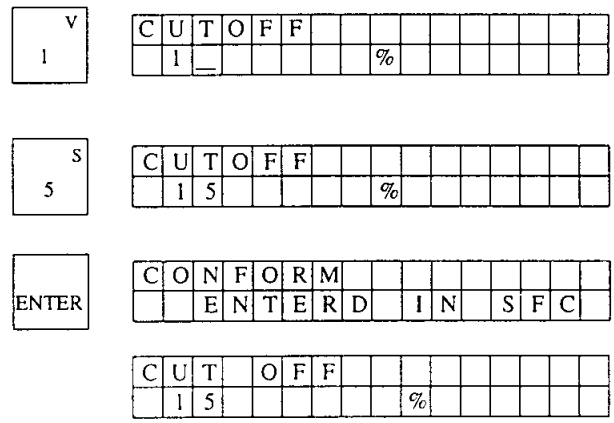
②-1 When no cut-off value is set:



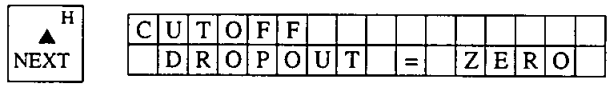
②-2 When a cut-off value is set:

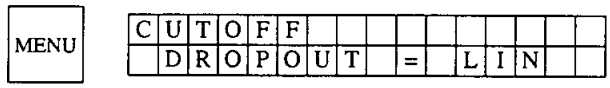



Set 15% as the cut-off value in this example.



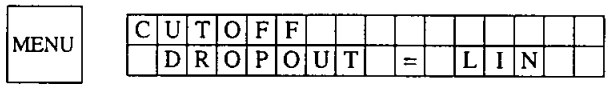
②-3 Setting a dropout format (LINEAR/ZERO)
After setting a cut-off value in ②-②



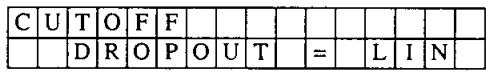




MENU Select LINEAR or ZERO using the [MENU] key.

Select LINEAR in this example.

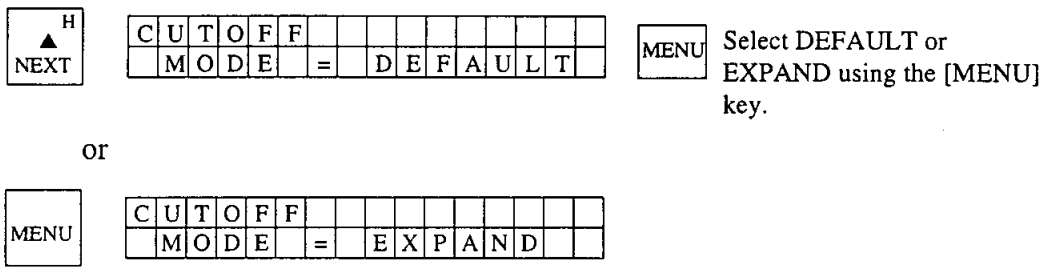




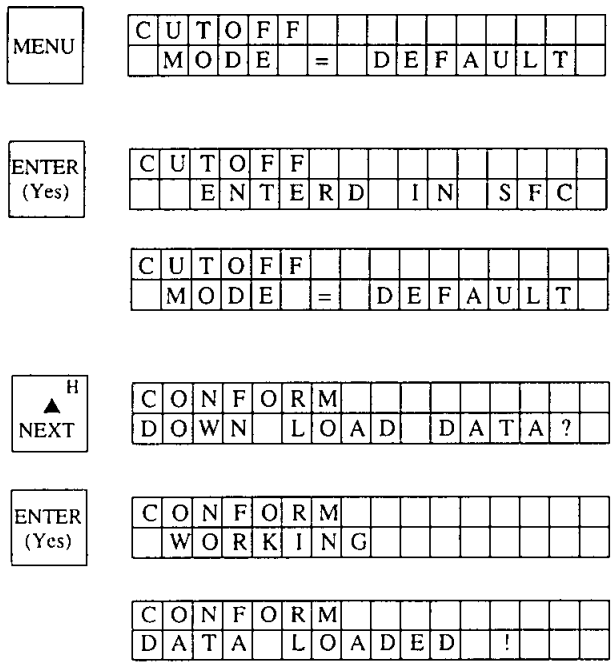


②-4 Setting a flow rate mode (DEFAULT/EXPAND)

After setting a cut-off value and a dropout format in ②-2 and ②-3 respectively




Select DEFAULT in this example.



(4) Displaying and changing the indicator display format

## Introduction:

The procedure for displaying and changing the indicator display format is explained here.

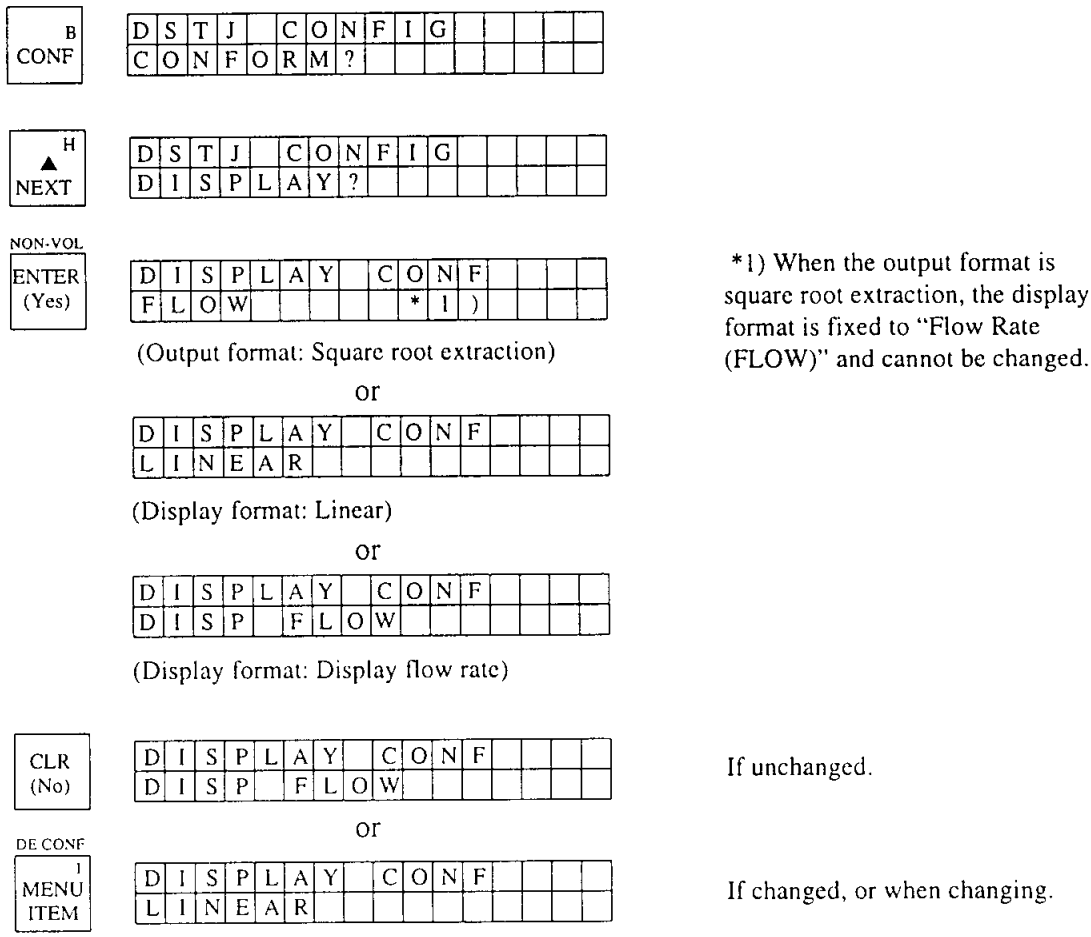
- When the output format is "Square Root Extraction," the display format is fixed to "Flow Rate."
- When the output format is "Linear," either "Linear" or "Display Flow Rate" can be selected for the display format.

## Remarks:

- Display Flow Rate: In some cases, the transmitter must output "linear" data as required by higher level equipment that perform arithmetic operations for flow rate control. In such cases, select "Display Flow Rate" to display the flow rate on the display only.
- For detailed information on the indicator display, refer to Item 13.

Procedure

Check and change the display format (linear/display flow rate) of the transmitter indicator using the following procedure:




*1) When the output format is square root extraction, the display format is fixed to "Flow Rate (FLOW)" and cannot be changed.

NON-VOL

ENTER (Yes)

| DISPLAY CONF |
|---|
| ENTERED IN SFC |

| DISPLAY CONF |
|---|
| DISP FLOW |

H ▲ NEXT or CLR (No)

| DISPLAY |
|---|
| DOWN LOAD DATA? |

NON-VOL

ENTER (Yes)

| DISPLAY |
|---|
| WORKING... |

| DISPLAY |
|---|
| DATA LOADED! |

• The display format changes to "Linear" or "Display Flow Rate."

SHIFT

| DISPLAY |
|---|
| SHIFT- |

CLR (No)

| DSTJ FIT-1234 |
|---|
| READY |

SHIFT

| DSTJ FIT-1234 |
|---|
| SHIFT- |

NON-VOL

ENTER (Yes)

| DSTJ FIT-1234 |
|---|
| WORKING... |

| DSTJ FIT-1234 |
|---|
| DATA NONVOLATLE |

• The data has been saved in the transmitter.

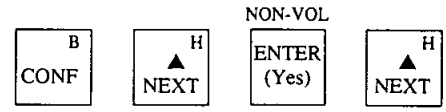
(5) Displaying and changing the engineering unit high and low limits

Introduction:

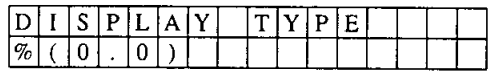
The procedure for setting the high and low limits for the engineering unit is explained here.

Procedure:

Display and change the high and low limits for the engineering unit displayed on the indicator using the following procedure:

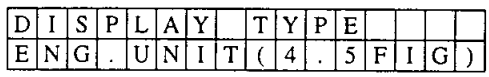



The present indication type (engineering unit or % ) is known.

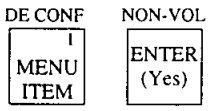



Indication in %

or

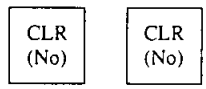



Indication in engineering units



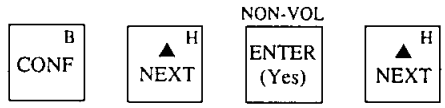

If changed, or when changing

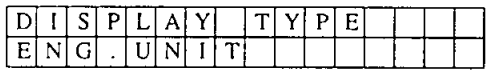
or

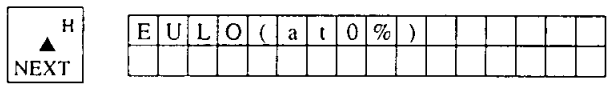



If unchanged

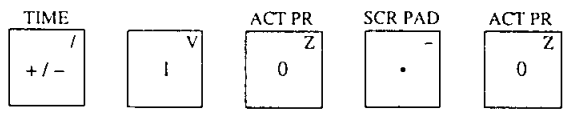
Changing the high and low limits

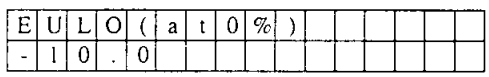


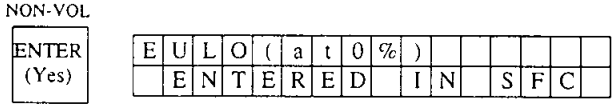



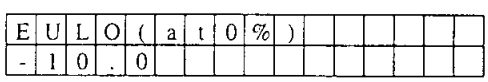




• Following shows how to set -10.0 as the low limit for the engineering unit.

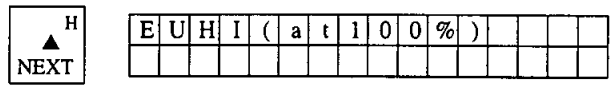


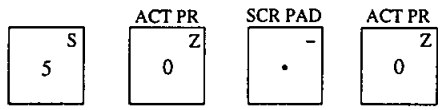



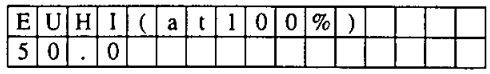



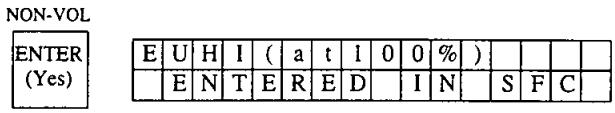

• The low limit (-10.0) for the engineering unit has been set.

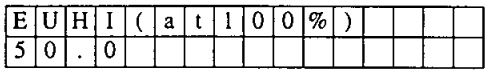



• Steps 7 and 8 show how to set 50.0 as the high limit for the engineering unit.

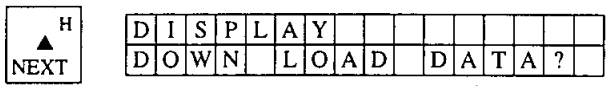


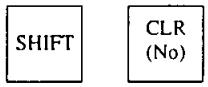



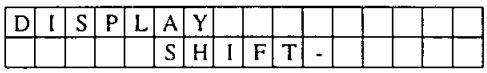

• The high limit (50.0) for the engineering unit has been set.

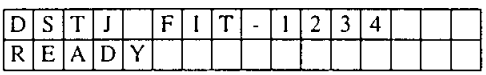


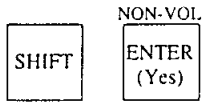


• The high and low limits for the engineering unit have been changed to the newly set values.

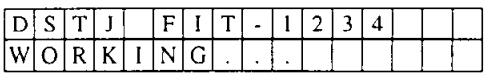


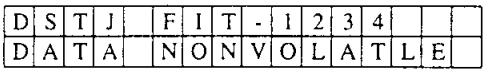



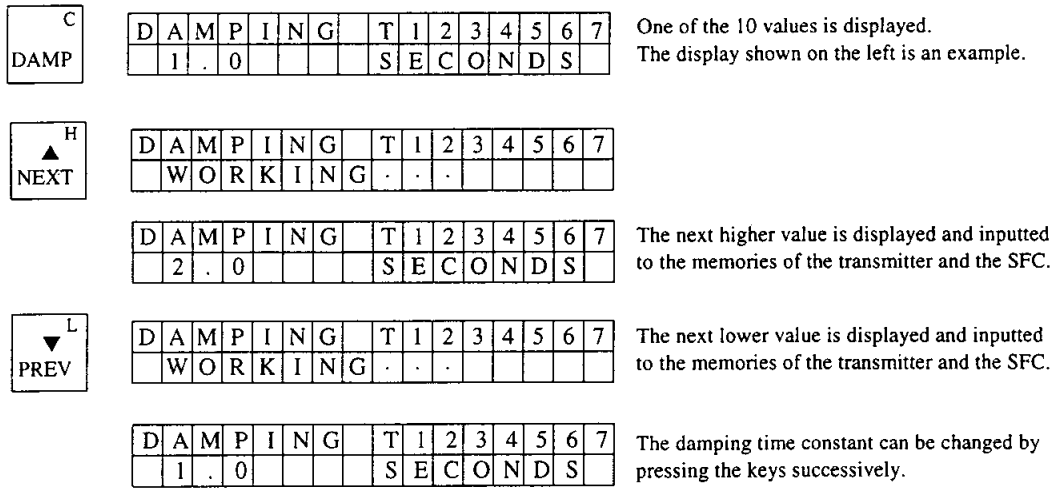




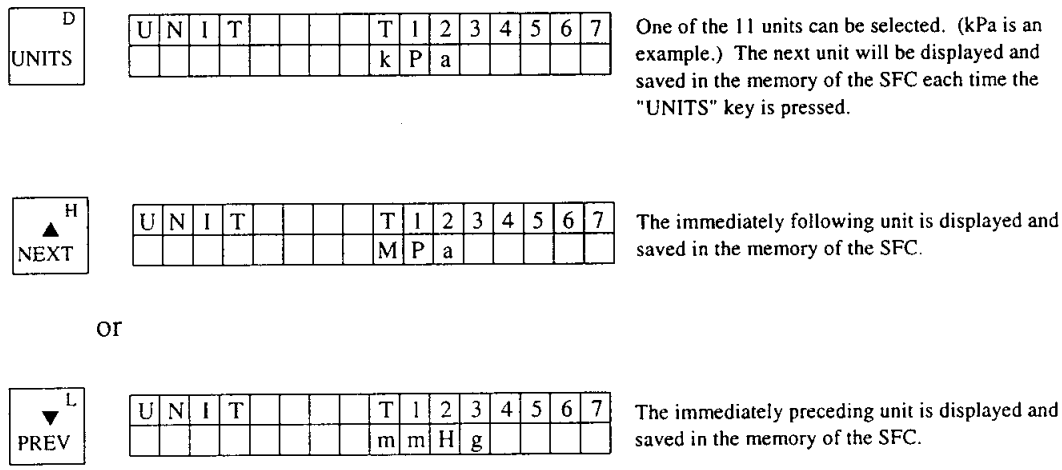

• The data has been saved in the transmitter.

(6) Damping time constant




Save the data to the non-volatile memory by referring to section (3).

(7) Engineering unit



(8) Range

The low limit (LRV) and the high limit (URV) of the range can be set by two methods. In other words, they can be set by keying in numerical values or by applying a pressure that is equal to the high and low limit values, and those values are set.

(Note) ① In order to reverse the range, set the high limit as the LRV and the low limit as the URV. For example, if the range is from 50 kPa to 0kPa {5000 $mmH_2O$ to 0 $mmH_2O$}, set 50{5000} as the LRV and 0 as the URV.

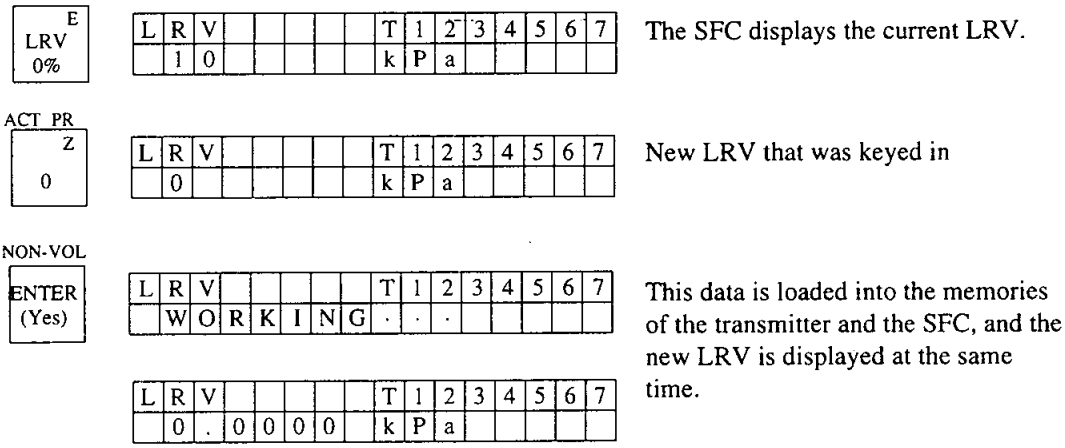
② When the LVR is changed, the URV value is automatically ranged, leaving the span unchanged.

③ To change both the LRV and the URV, set the value for the LRV before setting the value for the URV.

① Setting by keying-in operation

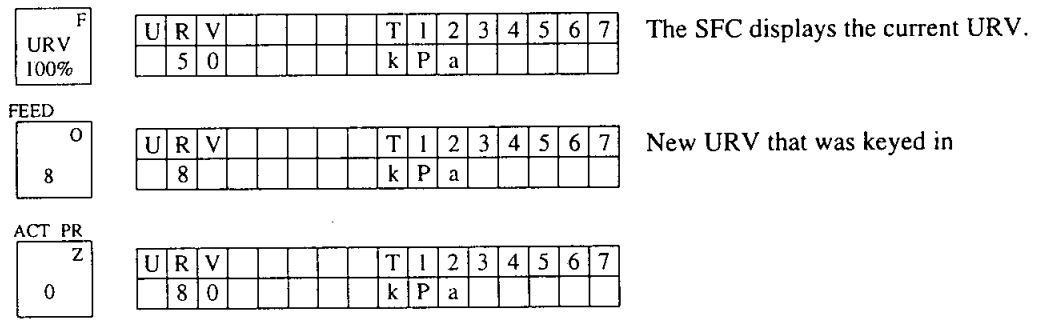
Setting the LRV {Measured value for outputting 0% (4 mA DC)}

Example : Change from 10kPa to 0 kPa.




Setting the URV {Measured value for outputting 100% (20 mA DC)}

Example: Change from 50kPa to 80kPa.



ENTER (Yes)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

This data is loaded into the memories of the transmitter and the SFC, and the new URV is displayed at the same time.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 8 | 0 | | | | | | k | P | a | | | | | |

Save the data to the non-volatile memory by referring to (2).

② Setting by input pressure

Setting the LRV {Measured value for outputting 0% (4 mA DC)}

Apply the liquid level or input value that is equal to the target LRV to the transmitter, and set it after checking the input value.

E LRV 0%

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 0 | . | 0 | | | | | k | P | a | | | | | |

The SFC displays the current LRV.

G SET

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | S | E | T | | L | R | V | | ? | | | |

The SFC asks whether to set the currently applied pressure as the LRV.

NON-VOL ENTER (Yes)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

Press the "ENTER" key, and the data will be loaded into the memories of the transmitter and the SFC.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 0 | . | 0 | | | | | k | P | a | | | | | |

After the data is loaded to the memory, the new LRV is displayed.

Setting the URV {Measured value for outputting 100% (20 mA DC)}

Apply the liquid level or input value that is equal to the target URV to the transmitter, and set it after checking the input value.

F URV 100%

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 8 | 0 | | | | | | k | P | a | | | | | |

The SFC displays the current URV.

G SET

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | S | E | T | | U | R | V | | ? | | | |

The SFC asks whether to set the currently applied pressure as the URV.

NON-VOL ENTER (Yes)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

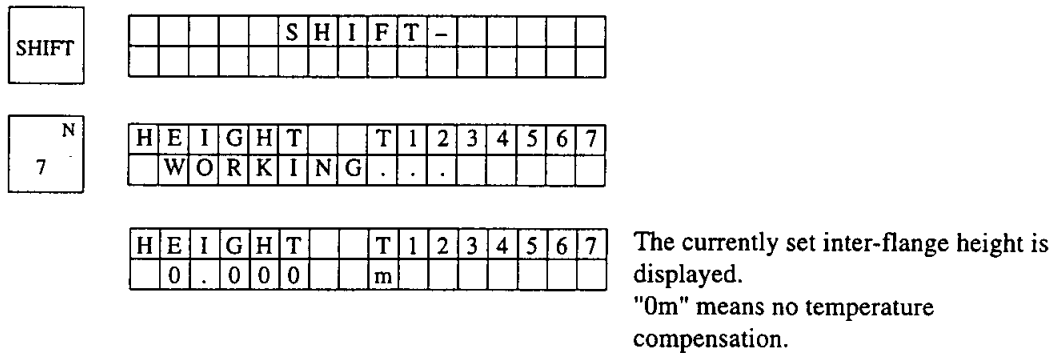
Press the "ENTER" key, and the data will be loaded into the memories of the transmitter and the SFC.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 8 | 0 | | | | | | k | P | a | | | | | |

After the data is loaded to the memory, the new LRV is displayed.

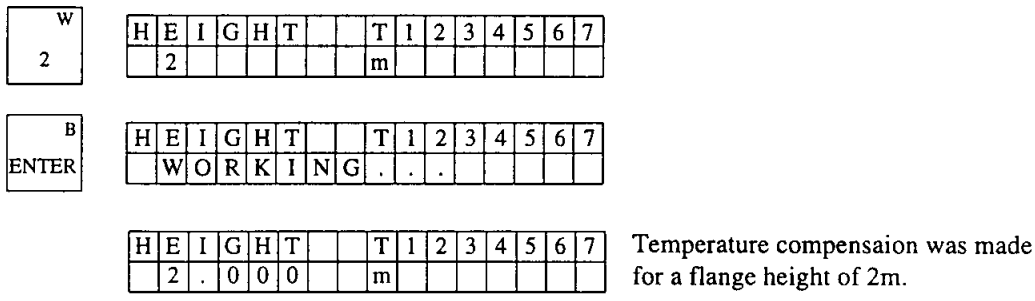
Save the data to the non-volatile memory by referring to (2).

(9) Compensating for the temperature of the fill fluid in the capillary.




The currently set inter-flange height is displayed.
"0m" means no temperature compensation.

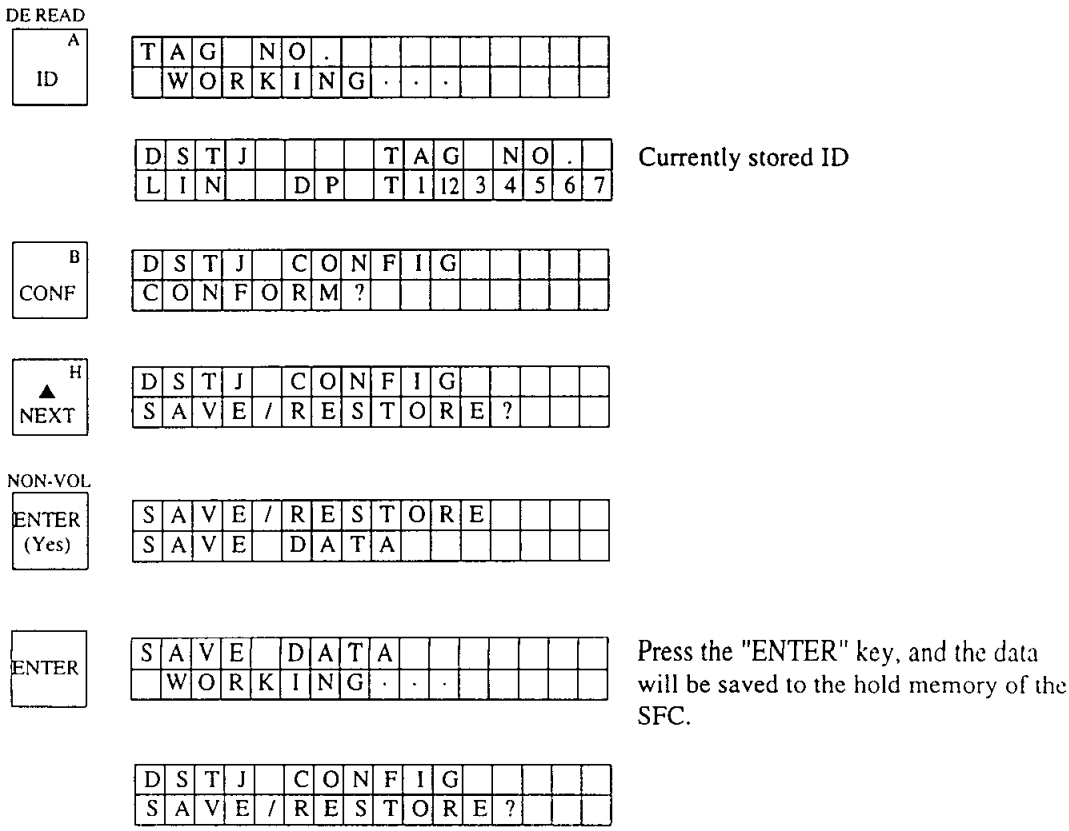
Input the inter-flange height. ("2m" is inputted here as an example.)




Temperature compensaion was made for a flange height of 2m.

(10) Saving (storing) configuration data from the transmitter to the SFC and restoring (re-entering) data saved in the SFC to the transmitter

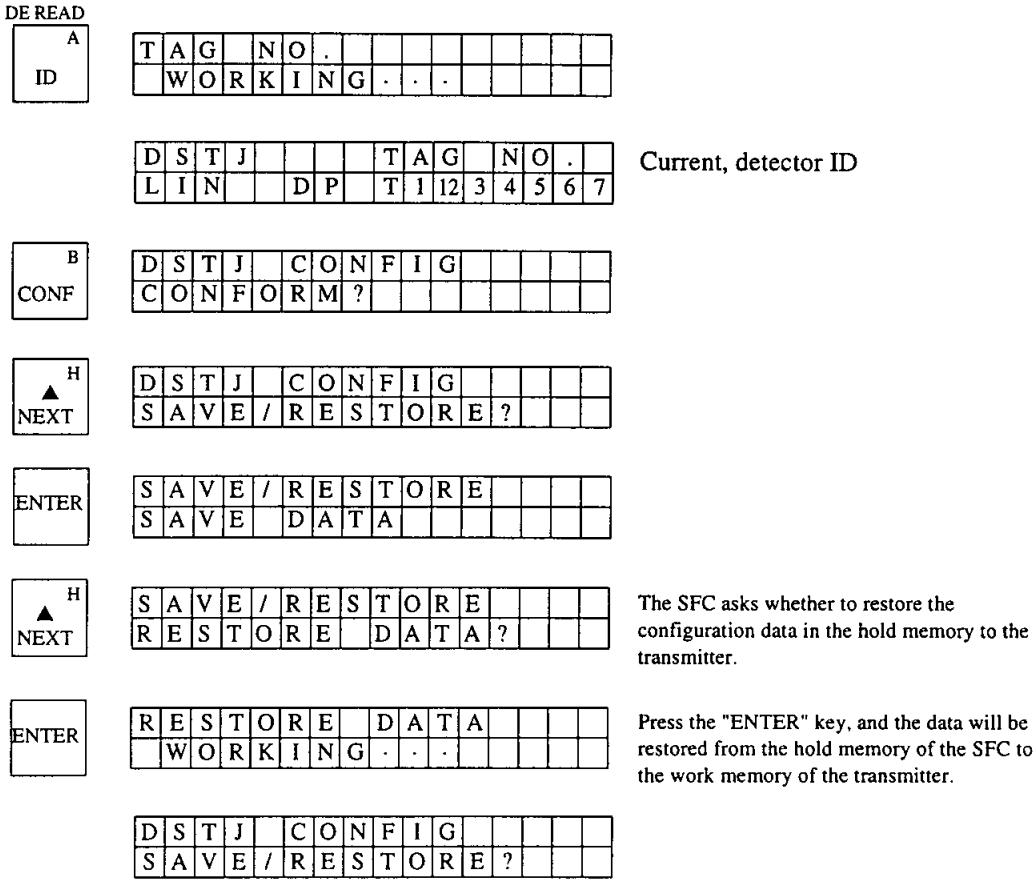
① Saving (storing) all the data in the work memory of the transmitter to the hold memory of the SFC




Currently stored ID

Press the "ENTER" key, and the data will be saved to the hold memory of the SFC.

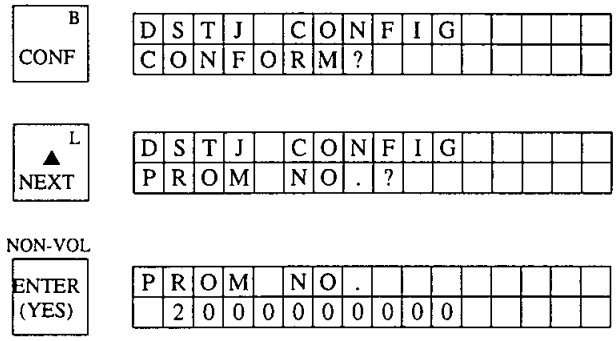
② Restoring (re-entering) all the data in the hold memory of the SFC to the work memory of the transmitter



## 6.6 Checking PROM NO and Software No.

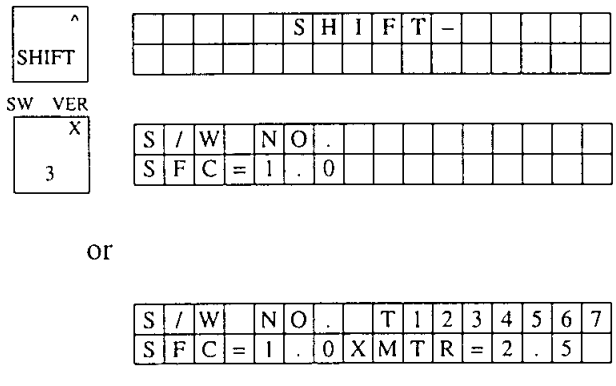
### 6.6.1 Checking PROM NO

The PROM NO is marked on the plate of the meter body. It can be checked from the SFC by the following procedure.




### 6.6.2 Checking Software No.

The software Nos. of the SFC and the transmitter can be checked by the following procedure.

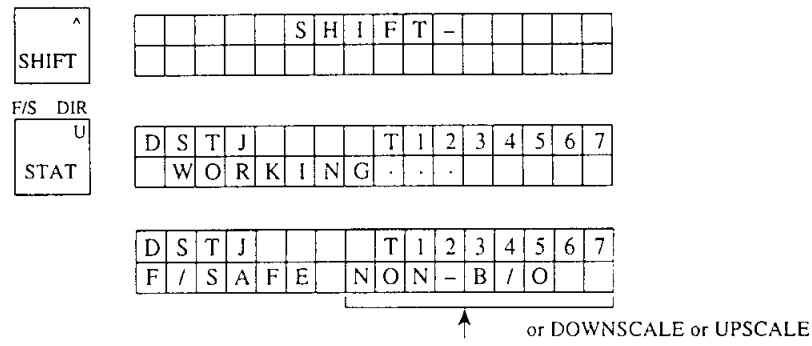



When the SFC is not connected to a transmitter, the software No. of the SFC is displayed.

When the SFC is connected to a transmitter, the software Nos. of the SFC and the transmitter are displayed.

## 6.7 Checking Burnout Direction

The burnout direction can be checked from the SFC by the following procedure.



## 6.8 Constant Current Source Mode

The transmitter can be used as a constant current source (4 to 20 mA). A constant current can be generated from the SFC by the following procedure.

(Note) When the constant current source mode is selected, the transmitter does not perform pressure measurement.

(Note) The constant current source outputs a value set in the % display.

### 6.8.1 Generating Constant Current

INPUT
J
OUT-PUT

| OUTPUT T1234567 |
|---|
| WORKING··· |

| OUTPUT T1234567 |
|---|
| 10.00 % |

The output signal (%) corresponding to the current input pressure is displayed.

Keying in the target output (%) (Example : 50%, 12 mA)

S
5

| OUTPUT T1234567 |
|---|
| 5_ % |

Key in an output value (%) for the low current mode.

ACT PR
Z
0

| OUTPUT T1234567 |
|---|
| 50_ % |

| OUTPUT T1234567 |
|---|
| WORKING··· |

NON-VOL
ENTER (Yes)

| OUTPUT T1234567 |
|---|
| 50.00 % # |

The "#" mark indicates that the transmitter is in the constant current source mode.
In this example, the transmitter generates a 12 mA constant current.

### 6.8.2 Releasing Constant Current Source Mode

INPUT
J
OUT-PUT

| OUTPUT T1234567 |
|---|
| WORKING··· |

In order to release the constant current source mode, press the "OUTPUT" key.

| OUTPUT T1234567 |
|---|
| 50.00 % # |

The SFC displays the output signal in %.

CLR (No)

| OUTPUT T1234567 |
|---|
| WORKING··· |

Then, press the "CLR" key.

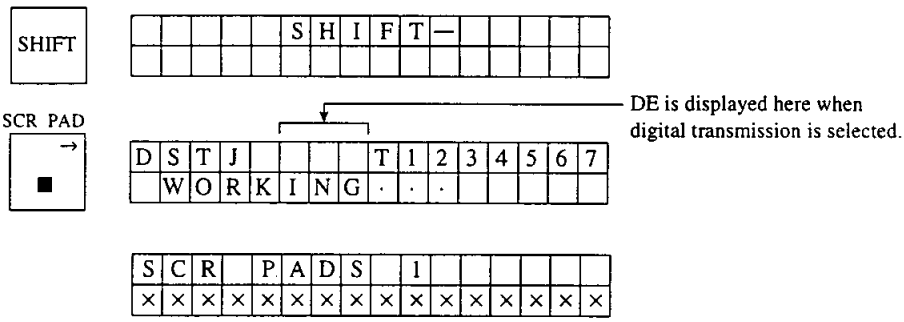
| OUTPUT T1234567 |
|---|
| READY··· |

The constant current source mode has been released. (Make sure that the "#" mark has disappeared.)

## 6.9 Scratch Pad (Memo Function to Transmitter)

Two scratch pads, No.1 and No.2, are available. Sixteen alphanumeric characters can be recorded in each of them as memos. The service name, details of operations, trouble history, fixed asset No., etc., can be recorded as memos for each transmitter.

### 6.9 .1 Entry to Scratch Pad No.1




Here, let's enter "90 - 4 ZERO CHECK" as an example.

PRINT

P

9

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | × | × | × | × | × | × | × | × | × | × | × | × | × | × |

ACT PR

Z

0

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | × | × | × | × | × | × | × | × | × | × | × | × | × |

TIME

I

+/-

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | × | × | × | × | × | × | × | × | × | × | × | × |

R

4

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | × | × | × | × | × | × | × | × | × | × | × |

ALPHA

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | × | × | × | × | × | × | × | × | × | × | × |

ACT PR

→

■

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | × | × | × | × | × | × | × | × | × | × |

ACT PR

Z

0

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | × | × | × | × | × | × | × | × | × |

E

LRV

0%

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | × | × | × | × | × | × | × | × |

R

4

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | × | × | × | × | × | × | × |

O

8

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | × | × | × | × | × | × |

ACT PR

→

■

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | | × | × | × | × | × |

SFM CONF

C

DAMP

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | | C | × | × | × | × |

H

NEXT

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | | C | H | × | × | × |

E

LRV

0%

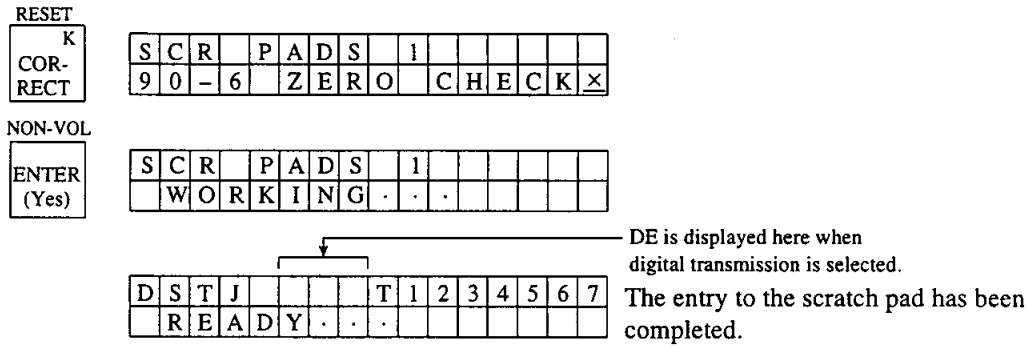
| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | | C | H | E | × | × |

SFM CONF

C

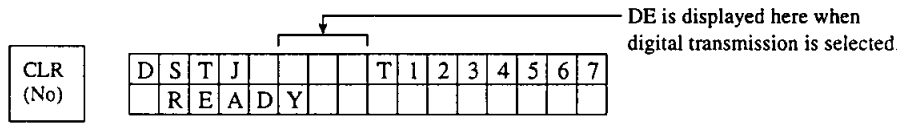
DAMP

| S | C | R | | P | A | D | S | | 1 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 0 | - | 4 | | Z | E | R | O | | C | H | E | C | × |

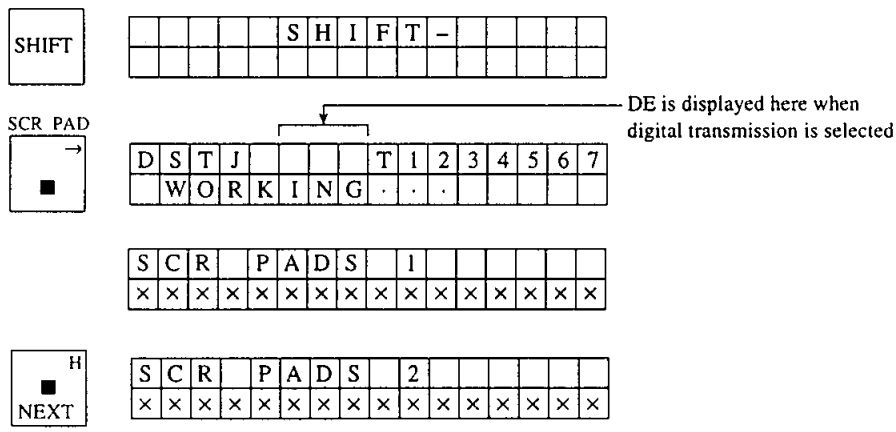



## 6.9.2 Releasing the Scratch Pad

The scratch pad can be released by pressing the CLR key.




## 6.9.3 Entry to Scratch Pad No.2




For the subsequent key operations, refer to the instructions for entry to scratch pad No. 1.

# 7. Calibration

The S-SFC operating instructions in this section are applicable to S-SFC software version 7.1 and later versions.

The transmitter must be calibrated whenever input/output characteristics are abnormal and need to be corrected.

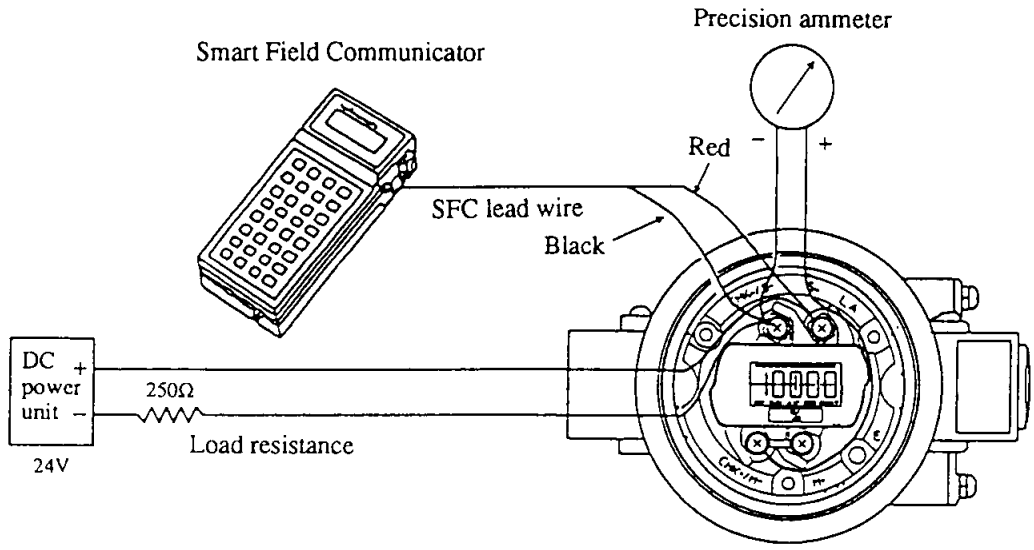
This section explains how to calibrate the ST 3000 transmitter. To ensure the most accurate calibration, calibrate it in the range where it is used. The power unit warm-up time (about 30 minutes) is one of the important factors in calibration accuracy.

If digital transmission is selected, be sure to select ananlog transmission before calibration.

## 7.1 Preparation and Setup

- Required preparation
  - ① A reference input source having an accuracy of at least 0.04% FS
  - ② A voltmeter or precision ammeter having an accuracy of at least 0.03% FS
  - ③ Precision resistance (250 Ω)
  - ④ SFC (Smart Field Communicator)

- Setup
  Set up the equipment as shown in Figure 7.1 Check the connections to make sure that they are correct, and check to make sure that the SFC and the transmitter are in the communication state. (Refer to 6.1.3 Checking Communication.)




Note: The load resistance must be at least 250 Ω for performing communications with the SFC.

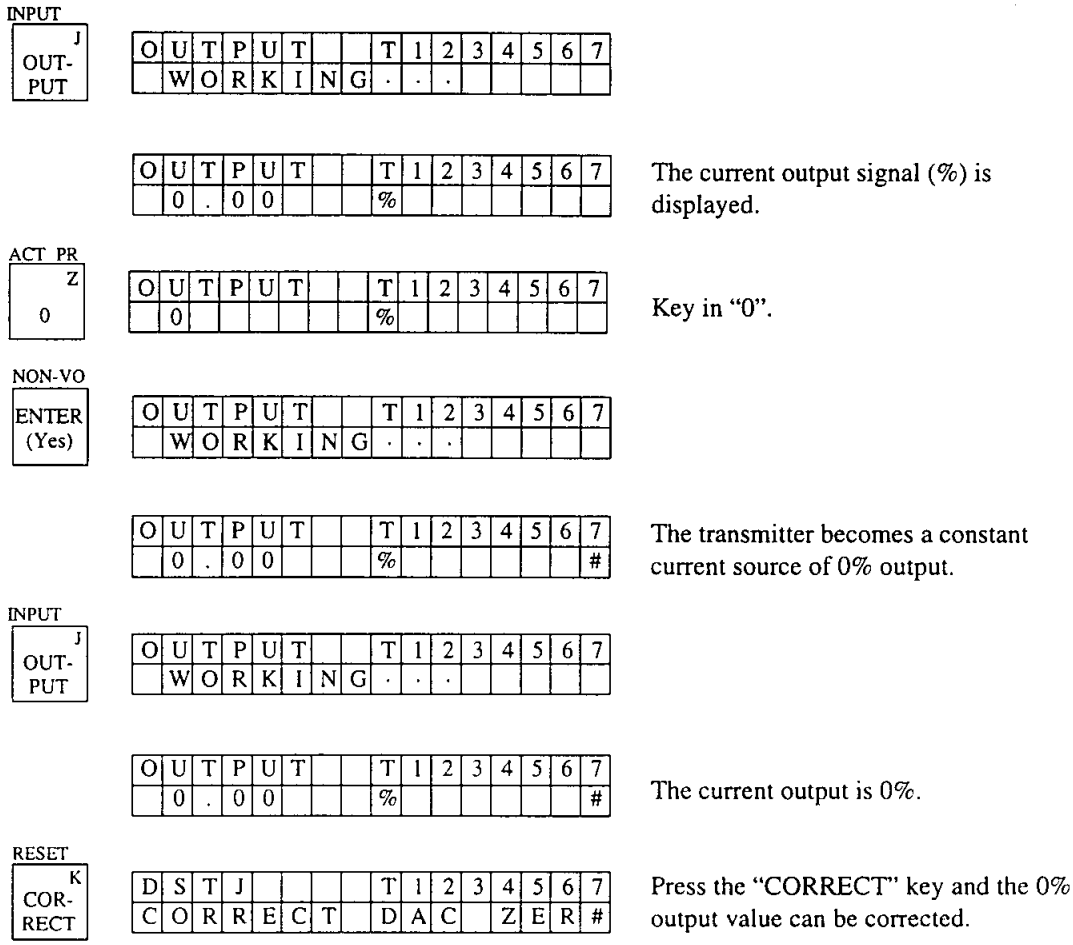
**Figure 7.1 Connections for Calibration**

Check the configuration data by following the instructions in 6.1.3 through 6.1.5.

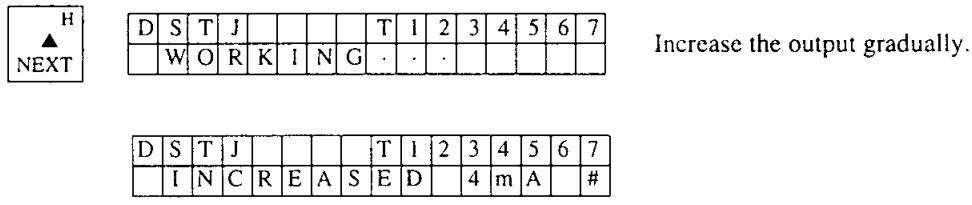
## 7.2 Calibrating Output Signals

### 7.2.1 Adjusting Output Signal 0%

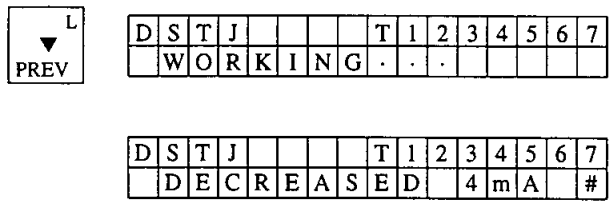
(1) Key in 0%.




(2) When the value indicated by the meter is lower than 4 mA or 1V (when the resistance for voltage conversion is 250 ), make an adjustment by the following procedure.



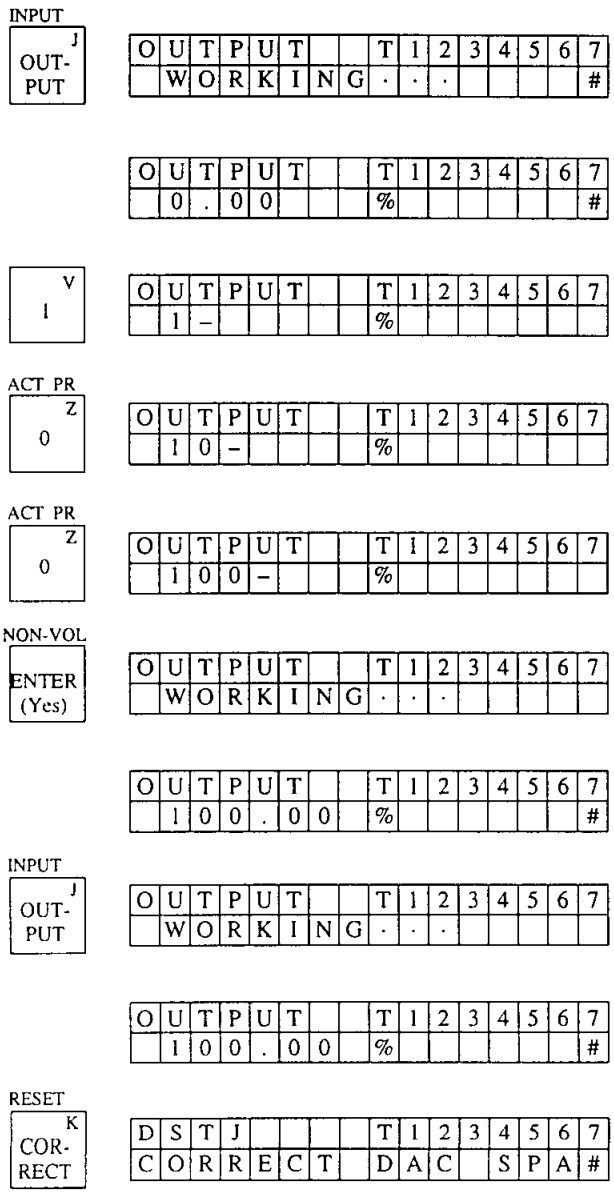
(3) When the value indicated by the meter is higher than 4 mA or 1V, make an adjustment by the following procedure.




Decrease the output gradually.

## 7.2.2 Adjusting Output Signal 100%

(1) Key in 100%.



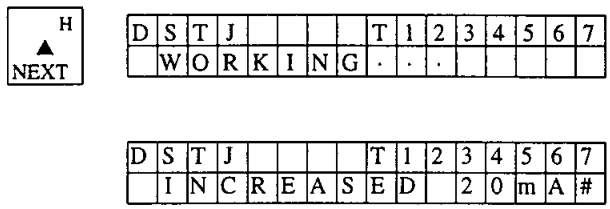

The current output signal (0%) is displayed.

Key in "100".

The transmitter becomes a constant current source of 100% output.

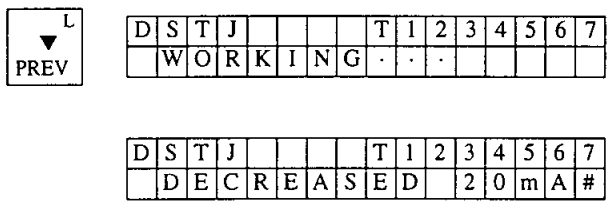
Press the "CORRECT" key and the 100% output value can be corrected.

(2) When the value indicated by the meter is lower than 20 mA or 5 V (when the resistance for voltage conversion is 250 Ω), make an adjustment by the following procedure.



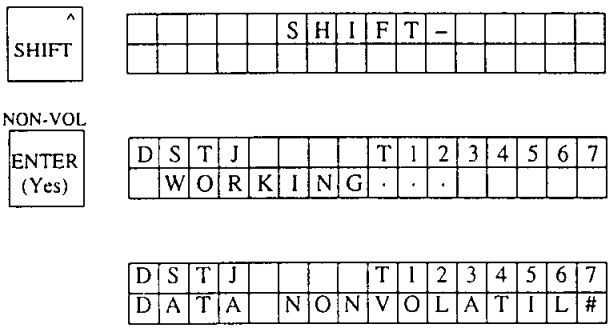

Increase the output gradually.

(3) When the value indicated by the meter is higher than 20 mA or 5 V, make an adjustment by the following procedure.




Decrease the output gradually.

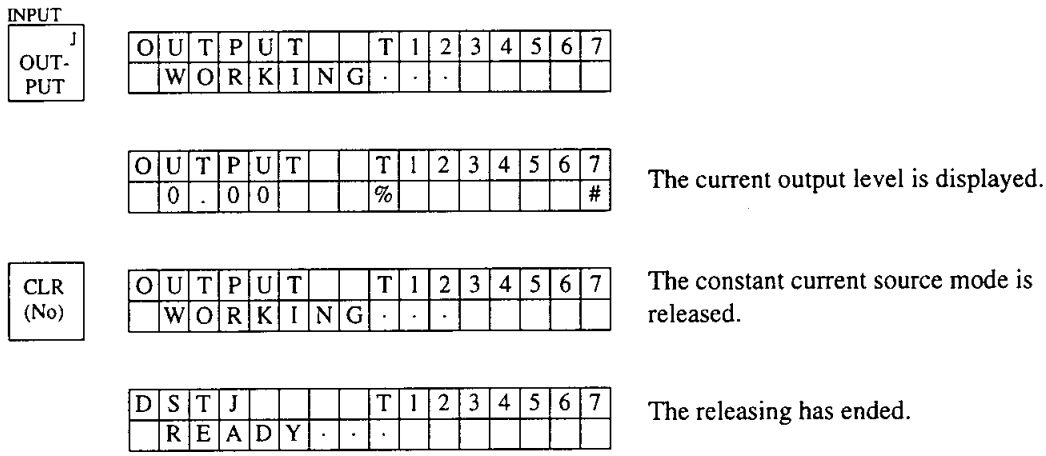
(4) Saving data to the non-volatile memory (NVM) of the transmitter
After adjusting the output signals of 0% and 100%, save the data to the non-volatile memory of the transmitter by the following procedure.
The data in the work memory of the transmitter can be saved with high priority. The data will not be lost even if the transmitter is turned off. When any value in the work memory is changed, ST 3000 automatically saves data from the work memory to the NVM in about 30 seconds, even without this operation.




Data is saved to the NVM. This operation takes about 8 seconds.

The operation has ended.

(5) Releasing the constant current source mode




(Note 7.2) The "#" mark disappears, indicating that the constant current source mode has been released.

## 7.3 Calibration Range

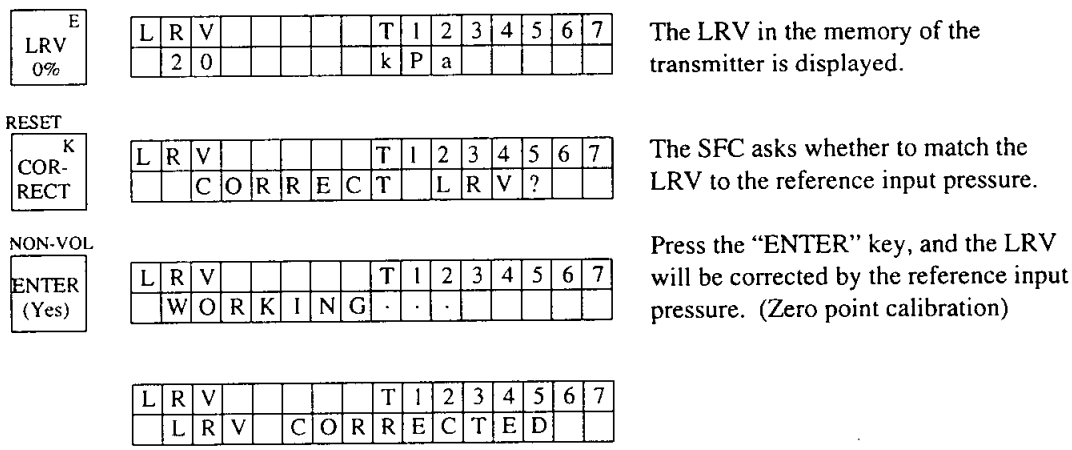
Next, calibrate the zero point and the span.

### 7.3.1 Calibrating the Low Limit (LRV)

In order to calibrate the low limit (LRV) of the range, apply the reference input pressure of the LRV to the transmitter. Then, correct the LRV using the SFC.

If the LRV and the reference input pressure are not the same, set the LRV to the reference input pressure.

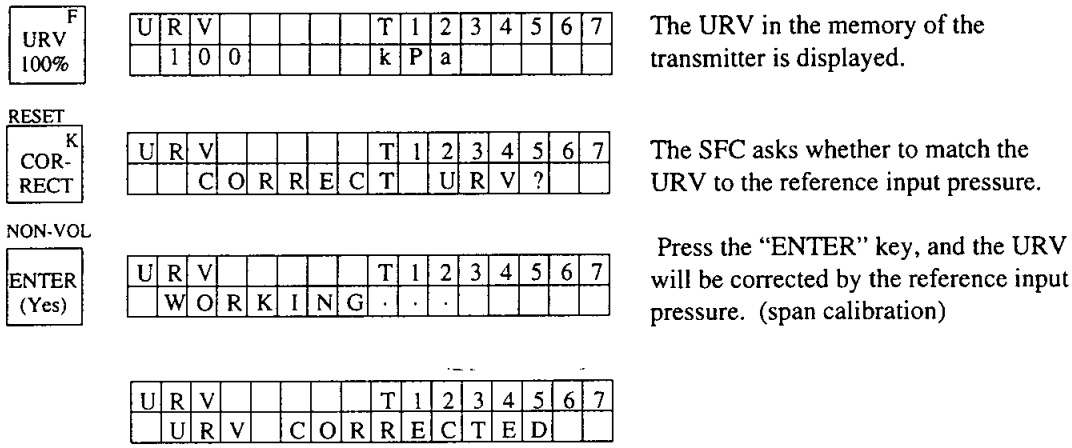
(Note) Be sure to start with the LRV even if the operations are reversed.



### 7.3.2 Calibrating the High Limit (URV)

In order to calibrate the high limit (URV) of the range, apply the reference input pressure of the URV to the transmitter. Then, correct the URV using the SFC.

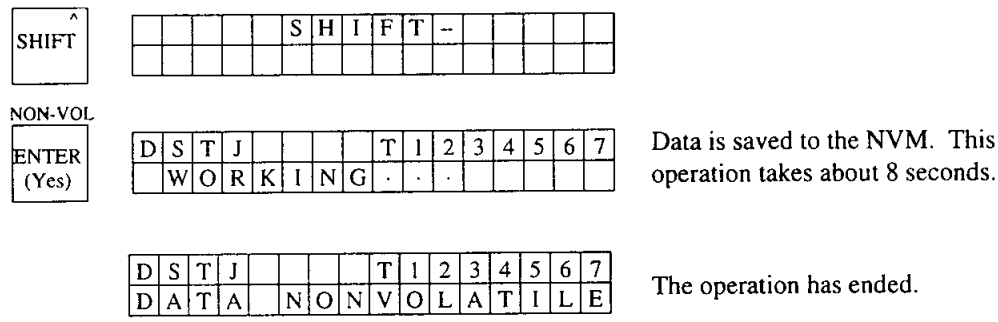
If the URV and the reference input pressure are not the same, set the URV to the reference input pressure.




### 7.3.3 Saving Calibration Data

After zero and span calibration, save the calibration data to the non-volatile memory by the following procedure.

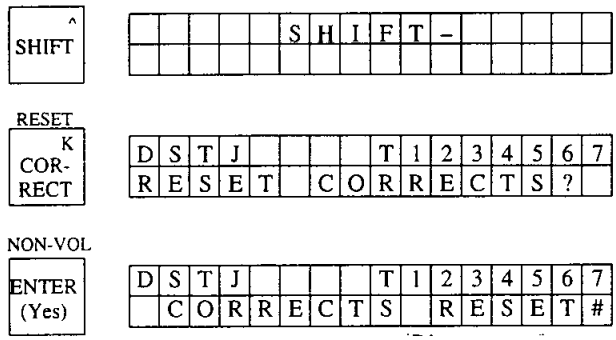
Note) Save the data to the non-volatile memory by referring to 7.2.2 (4).



## 7.4 Erasing Calibration Data

### 7.4.1 Erasing Calibration Data

When the transmitter is given a wrong calibration, the calibrated values and set values can be restored to the initial values by the following procedure.




The SFC asks whether to restore the calibrated values and set values to the initial values.

The values were restored to the initial values.

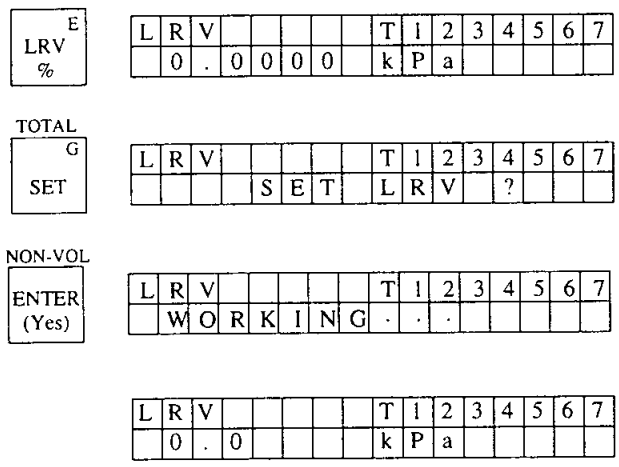
### 7.4.2 Erasing the "#" Mark

After restoring the calibrated values and the set values to the initial values, erase the "#" mark by the following procedure.

Perform calibration by inputting a real pressure by referring to "7.3 Calibrating Range".

Note : When calibrating, turn off the temperature compensation.

(1) Set the LRV using a real pressure.



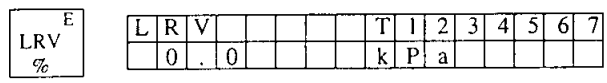

The SFC displays the current LRV.

The SFC asks whether to set the LRV at the current pressure.

Press the "ENTER" key, and the data will be loaded into the memories of the transmitter and the SFC.

After the data is loaded to the memories, the new LRV is displayed.

(2) Correct the LRV using a real pressure.




The LRV in the memory of the transmitter is displayed.

RESET
K
COR-
RECT

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | C | O | R | R | E | C | T | | L | R | V | ? | | |

The SFC asks whether to match the LRV to the reference input pressure.

ENTER
(Yes)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

Press the "ENTER" key, and the LRV will be corrected by the reference input pressure.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | R | V | | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | L | R | V | | C | O | R | R | E | C | T | E | D | | |

The LRV has been corrected.

SHIFT

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | S | H | I | F | T | - | | | | | |

NON-VOL
ENTER
(Yes)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

Data is saved to the NVM. This operation takes about 8 seconds.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| D | A | T | A | | N | O | N | V | O | L | A | T | I | L | E |

The data has been saved to the NVM.

(3) Turn off the transmitter.

(4) Turn on the transmitter.

DE READ
A
ID

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | A | G | | N | O | | |
| L | I | N | | D | P | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

F/S DIR
U
STAT

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | W | O | R | K | I | N | G | · | · | · | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | S | T | J | | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| S | T | A | T | U | S | | C | H | E | C | K | = | O | K | |

The "#" mark has disappeared.

# 9. Maintenance and Inspection

## 9.1 Maintaining the Meter Body

The meter body dose not need any special routine maintenance/inspection. When the flange is dismounte for maintenance, wash the diaphragm using a soft brush and solvent. Work carefully without deforming or damaging the diaphragm.

## 9.2 Insulation Resistance Test and Dielectric Strength Test

As a general rule, neither insulation resistance nor dielectric strength test should be performed. These tests can destroy the built-in varistors used for absorbing surge voltage. When the tests must be performed, follow the following procedure.

(1) Disconnect the external wiring from the transmitter.

(2) Create a short-circuit between the transmission line +, - connection terminals and the external ammeter + connection terminal.

(3) Perform the tests between the short-circuited section described in step (2) and the ground terminal.

(4) The voltage to be applied and the criteria are given below. To prevent damage, do not apply a higher voltage.

Insulation resistance test: $2 \times 10^7$ or over , 25 VDC (when 25°C ± 5°C, not over 60%R.H.)
Dielectric strength test: 50 VAC for 1 minute, set current 2 mA
If a higher voltage test must be performed (Insulation resistance: 500 VDC; dielectric strength: 500 VAC for 1 minute or 600 VAC for 1 second), separate the connection plate and the case.

# 10. Self-diagnosis

The ST3000 Ace Smart Transmitter has a self-diagnosis function. The communication, loop and operation states of the transmitter can be checked via this self-diagnosis function by using the SFC.

## 10.1 Contents of Diagnosis

The contents of the diagnosis can be classified into the following four types.

### 10.1.1 Non-critical Errors

(1) Description

① The function requested from the SFC is executed.

② The tag No. of the transmitter is displayed in the upper line of the LCD screen and an error message is displayed in the lower line. At the same time, # is displayed in the 16th column of the lower line.

(2) Messages

| Display | Description |
|---|---|
| • CORRECT RESET # | Re-calibration is necessary. |
| • EXCESS ZERO CORR # | The amount of zero calibration is too large. |
| • EXCESS SPAN CORR # | The amount of span calibration is too large. |
| • M.B. OVERLOAD or METER BODY FAULT # | The input pressure exceeds (allowable range × 2) or the meter body of the transmitter has a fault. |
| • NO DAC TEMP COM # | The temperature compensation data in the electronics module has been lost. |
| • SENSOR OVER TEMP # | The sensor temperature is too high. |
| • STATUS UNKNOWN # | The current status is unknown. |

### 10.1.2 Critical Errors

(1) Description

① Even if the status of the information from the transmitter is critical, the ID, OUTPUT and STATUS functions operate.

② A critical status message is displayed for 3 seconds and, then, PRESS STATUS is displayed.

③ The tag No. of the transmitter is displayed in the upper line of the LCD screen and an error message is displayed in the lower line.

(2) Messages

| Display | Description |
|---|---|
| • CHAR PROM FAULT | The sensor characterization PROM has a fault. |
| • ELECTRONIC FAULT | The electronic system has a fault. |
| • METER BODY FAULT | The meter body of the transmitter has a fault. |
| SUSPECT INPUT | Input error |

### 10.1.3 Communication Errors

(1) Description

① A communication request function is not executed.
② The contents of the communication error are displayed entirely every 2 seconds.
③ NO XMTR RESPONSE is displayed in the upper line of the LCD screen and an error message is displayed in the lower line.

(2) Messages

| Display | Description |
|---|---|
| • FAILED COMM CHK | Communication is not possible. |
| • HI RES/LOW VOLT | The load resistance of the loop is too large./ The supply voltage is too low. |
| • ILLEGAL RESPONSE | The SFC and the transmitter are not communicating normally. |
| • INVALID REQUEST | A function that cannot be executed has been requested. |
| • LOW LOOP RES | The resistance value of the loop is too small. |
| • NO XMTR RESPONSE | The transmitter gives no response. |

### 10.1.4 Operational Errors

(1) Description

① The requested function is not executed because the error is attributable to a mistake in SFC operation.
② Nothing is displayed in the upper line of the LCD screen and an error message is displayed in the lower line.

(2) Messages

| Display | Description |
|---|---|
| • ENTRY > SEN RANGE | The range that was entered exceeds (high limit of range × 1.5). |
| • EXCESSIVE OUTPUT | The set value for constant current exceeds the allowable range. |
| • KEY NOT ALLOWED ! | Wrong key operation |
| > RANGE | The result of arithmetic operations by the SFC exceeds the display range. |

## 10.2 Method of Diagnosis

Connect the SFC and check the operational status of the transmitter according to the following operation.

F/S DIR U
STAT

| DSTJ | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WORKING | | | | · | · | · | | | | | |

The fault state of the meter body is not displayed in detail. Judge this from the state of the diaphragm and the sensor.

① When normal

| DSTJ | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATUS | | CHECK | | = | | OK | | | | | |

The transmitter and SFC are operating normally.

or

② When abnormal

| DSTJ | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SENSOR | | OVERTEMP | | | | | | | | | # |

The current status of the transmitter is displayed. The meanings of the messages are explained in "Display Messages".

then

| DSTJ | | | | T | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATUS | | RECEIVED | | | | | | | | | . |

This indicates the end of a message statement. Press the "STAT" key again, and a new message statement will be displayed or the current message statement will be displayed again. When more than one fault exist, each fault message will be displayed for 5 seconds.

## 10.3 Display Messages

The following three messages interrupt the display of the SFC.

| Message | Description | Action |
|---|---|---|
| DSTJ T 1 2 3 4 5 6 7<br>CRITICAL STATUS | Refer to the message table. | Press the "STAT" key and refer to the message table. |
| :<br> | A colon indicates that the SFC has a low battery level. | Charge the SFC. |
| #<br> | This indicates a non-critical status. | Press the "STAT" key and refer to the message table. After eliminating the cause of the problem, make sure that the "#" mark has disappeared by pressing the "STAT" key. |

## 10.4 Messages and Required Actions

(The messages are listed in the table in alphabetic order.)

| No. | Message | Description | Action |
|---|---|---|---|
| 1 | CHAR PROM FAULT<br>(Critical fault) | The PROM is not functioning correctly. | Replace the PROM. When replacing the PROM, check its serial No. by pressing the "SHIFT" key and the "1" key in that order. Replace it with a PROM with the same specifications. (When replacing the meter body, use a PROM with the same number.) |
| 2 | CORRECT DAC SPAN | The output circuit 20 mA is being adjusted. | Correct the output signals. |
| 3 | CORRECT DAC ZERO | The output circuit 4 mA is being adjusted. | Correct the output signals. |
| 4 | CORRECT LRV ? | Is the 0% range input value correct? | Refer to the input value. |
| 5 | CORRECT URV ? | Is the 100% range input value correct? | Refer to the input value. |
| 6 | CORRECT RESET # | Re-calibration is necessary to maintain accuracy. | Correct the LRV and URV. |
| 7 | DATA NON - VOLATILE | Data has been stored in the non-volatile memory. | Check the differential pressure input value. |
| 8 | DATA RESTORED | Saved data has been restored to the transmitter. | |
| 9 | DATA SAVED | Data has been saved from the transmitter to the SFC. | |
| 10 | DOWN SCALE | The burnout direction at the time of a critical fault is downward. | |
| 11 | ENTRY > SEN RANGE | A value exceeding (high limit of transmitter range × 1.5) has been entered. | Check the numerical value by pressing the "CLR" key and input a value again. |
| 12 | EXCESS SPAN CORR # | The amount of span calibration is too large. | Check the input pressure to see if it matches the corrected value. Correct the URV. |
| 13 | EXCESS ZERO CORR # | The amount of zero calibration is too large. | Check the input pressure to see if it matches the corrected value. Correct the LRV again. |
| 14 | EXCESSIVE OUTPUT | The requested output value exceeds the output range (between -1.25% and 105%) in the constant current source mode. | Check the numerical value by pressing the "CLR" key and input a valid value. |
| 15 | FAILED COMM CHK | Communications have failed. The SFC has an electronic fault or is not connected correctly. | 1. Check the polarity.<br>2. Press the "STAT" key. If the COMM ERROR display does not disappear, replace the SFC. For other messages, refer to their descriptions. |

| No. | Message | Description | Action |
|---|---|---|---|
| 16 | HI RES/LOW VOLT | The loop resistance is too large (including wire breakage) or the impressed voltage is too low. | |
| 17 | ILLEAGAL RESPONSE | Communications are not taking place normally between the SFC and the transmitter. | Check the polarity, wiring and power. |
| 18 | IN OUTPUT MODE # | The transmitter is functioning as a constant current source. | In order to release the constant current source mode, press the "OUTPUT" key and the "CLR" key in that order. |
| 19 | INPUT ZEROED | Calibration in the sensor balanced state (atmospheric pressure) has been completed. | |
| 20 | INVALID DATABASE | When the transmitter was turned on, its database was invalid. | 1. Perform communications again.<br>2. Check the database, calibrate the transmitter again and load data to the non-volatile memory. |
| 21 | INVALID REQUEST | A function that cannot be executed has been requested. | Check the SFC operation procedures. |
| 22 | KEY NOT ALLOWED ! | A wrong key was pressed or the sequence of key operations was wrong. | Press the "CLR" key and perform the key operation again. |
| 23 | LINEAR | The output characteristic is linear. | |
| 24 | LOOP IN MANUAL? | Is the loop for communications in the manual mode? | Select the manual mode. |
| 25 | LOW LOOP RES | The resistance value on the communication loop is too small. | Check the resistance value. |
| 26 | LRV CORRECTED | Calibration of the 0% range has been completed. | |
| 27 | M.B. OVERLOAD OR<br>METER BODY FAULT | The input pressure exceeds (allowable range × 2). | Check the PV value. Replace the transmitter by a model with a larger range if necessary.<br>Since the meter body of the transmitter may have been damaged, check the performance. |
| 28 | MDU/DACCOMPFAULT | MDU/DAC fault | Replace the electronics module. |
| 29 | NON-B/O | The burnout for critical faults has no direction. | |

| No. | Message | Description | Action |
|---|---|---|---|
| 30 | NO XMTR RESPONSE | The transmitter gives no response. The transmitter may have a fault or the loop may not be correct. | 1. Perform communications again. 2. Press the "STAT" key and perform the actions correctly. 3. Check the transmission line and the connection of the SFC. |
| 31 | NO DAC TEMP COM # | The temperature compensation data on the electronics module has been lost. | Replace the electronics module. |
| 32 | NOT SUPPORT | Wrong key operation. The key operation is not supported. | |
| 33 | NVM FAULT | Non-volatile memory fault | Replace the electronics module. |
| 34 | PAC FAULT | PAC fault | Replace the electronics module. |
| 35 | PRESS STATUS | Press the self-diagnosis key (STAT). | |
| 36 | PRINTER FAIL ! # | The printer fails to operate. | |
| 37 | RAM FAULT | RAM fault | Replace the electronics module. |
| 38 | READY ··· | Ready status | |
| 39 | RESET CORRECT ? | Do you want to erase the correction data? | |
| 40 | RESTORE DATA ? | Do you want to restore saved data to the transmitter? | |
| 41 | ROM FAULT | ROM fault | Replace the electronics module. |
| 42 | SAVE DATA ? | Do you want to save transmitter data? | |
| 43 | SENSOR OVER TEMP # | The sensor temperature is too high. This will lower the accuracy and shorten the service life. | Change the mounting in order to lower the temperature. |
| 44 | SET LRV? | Do you want to set the 0% range at the present input pressure? | |
| 45 | SET URV? | Do you want to set the 100% range at the present input pressure? | |