

azbil

**Smart Displacement type
Level Transmitter SLX Series
Model: SLX 110 / 120**

User's Manual



Azbil Corporation

CM2-SLX100-2001

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Thank you for purchasing the Azbil Corporation SLX series smart displacement type level transmitter.

The SLX series offers high performance and highly reliable level transmitters with a microprocessor incorporated in each one.

Most operations such as starting measurement, reading of measured data, check or change of various set values and setting condition, etc. can be easily performed by using the smart communicator SFC.

Safety

About this manual

Correct installation, operation and periodic maintenance are essential to the safe use of this instrument. Carefully read the safety precautions described in this instruction manual and have a thorough understanding before starting installation, operation or maintenance.

When you receive the product, check to see if it is of the correct specifications or if there is any damage caused by transportation. This instrument is shipped after being tested according to a strict quality control program. If you find any omissions in aspects of quality and specifications, inform us of the model number and product number described on the identification plate.

The identification plate is attached to the transmitter part.

WARNING

Indicates a potentially hazardous situation that may result in death or serious injury in the event of improper handling.

CAUTION

Indicates a potentially hazardous situation that may result in light to moderate injuries or only in property damage in the event of improper handling.

For correct and safe use of the instrument, be sure to observe the cautions described on the following pages. Azbil Corporation will not be responsible for any damage that is a result of handling of the product against these cautions.

Safety precautions

Cautions on installation

WARNING

-
- Do not use the instrument beyond the rated pressure, connection specification and rated temperature specified for the instrument. This may result in serious accident due to damage.
 - Wiring in an explosion-proof area should be performed according to the work procedure specified in the explosion-proof guideline.
-

CAUTION

-
- After installation, do not use this instrument as a foothold, etc. This may damage the instrument or may result in physical injury
 - Avoid hitting the glass part of the display with tools. This may damage the glass and result in physical injury.
 - Perform installation correctly. Insufficient installation or no installation may result in output errors or violate applicable regulations.
 - This product is heavy. Pay attention to the scaffolding and wear safety shoes.
-

Cautions on wiring

WARNING

Do not perform wiring with wet hands or with power turned on. This may result in electrical shock. Work with dry hands or wear gloves and turn off power.

CAUTION

-
- Carefully check the specifications and perform wiring correctly. Incorrect wiring may damage the instrument or cause mis-operation.
 - Use a power supply that conforms to the specifications. Using the wrong power supply may damage the instrument.
-

Cautions on maintenance

WARNING

-
- When removing this instrument from the process for maintenance, be especially careful of residual pressure or any residual fluid remaining in the process line or in the instrument.
 - When carrying out venting or draining, check the direction of venting or draining and prevent it from coming into contact with the human body. This may result in burns or physical injury.
 - When the instrument is used in an explosion-proof area, do not leave the transmitter part uncovered for fear of sparks or ignition.
-

CAUTION

This instrument is shipped under strict product control by Azbil Corporation. Do not modify the instrument under any circumstances as this may damage the instrument.

Cautions on use of communication devices

CAUTION

Using a transceiver, cellular phone, pager, etc. near this instrument may prevent the instrument from functioning correctly depending on the transmission frequency being used. Observe the following precautions.

- Check beforehand the distance at which the communication device will not affect the operation of this instrument and use the communication device at a greater distance.
 - Use the communication device after putting the cover on the transmitter part.
-

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Chapter 1 : Installation

1-1 : Names of components and parts

Main unit (external type side - side (S-S), external type side - bottom (S-B), internal type top (T))

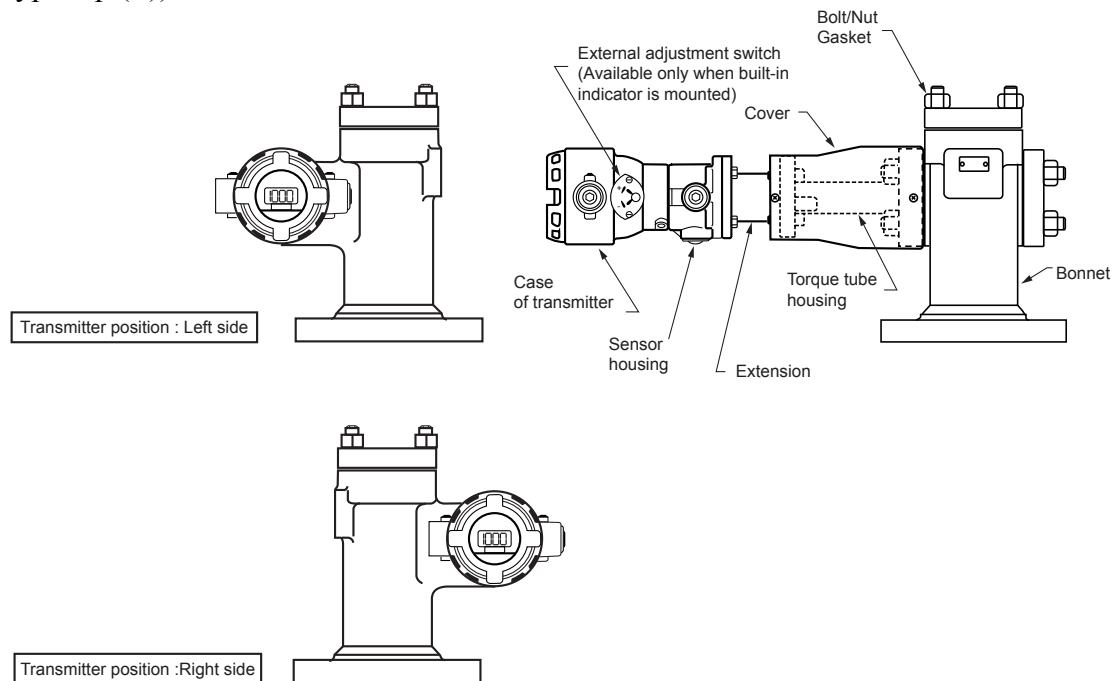


Figure 1-1 Main Unit Section (T type, S-S type, S-B type)

Main unit (external type top - side (T-S), external type top - bottom (T-B))

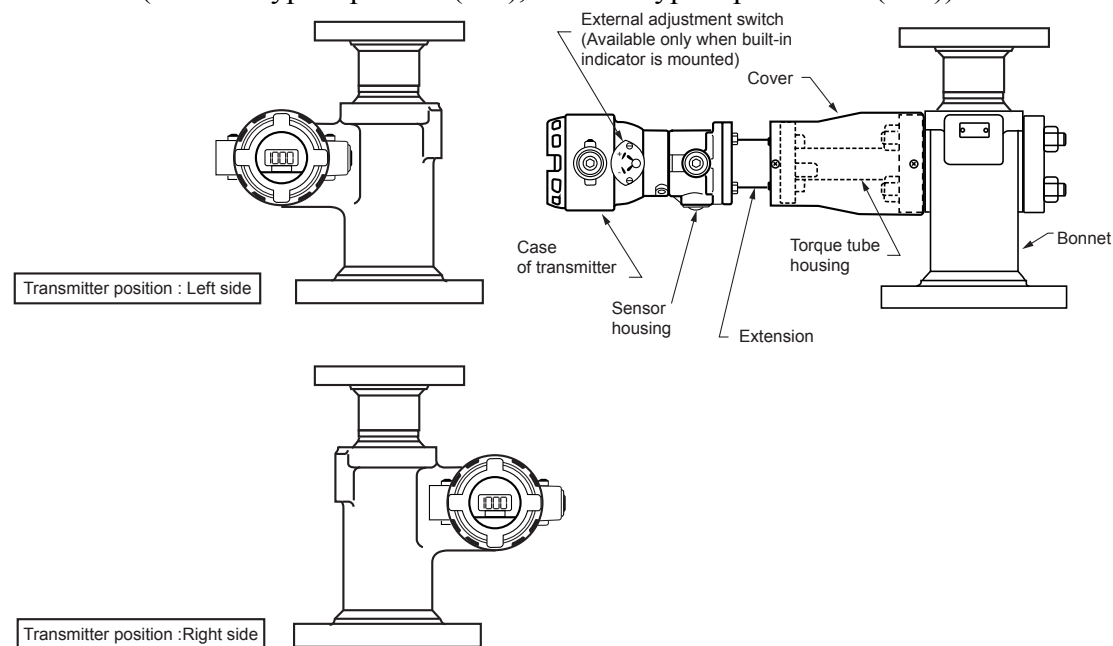


Figure 1-2 Main Unit Section (T-S type, T-B type)

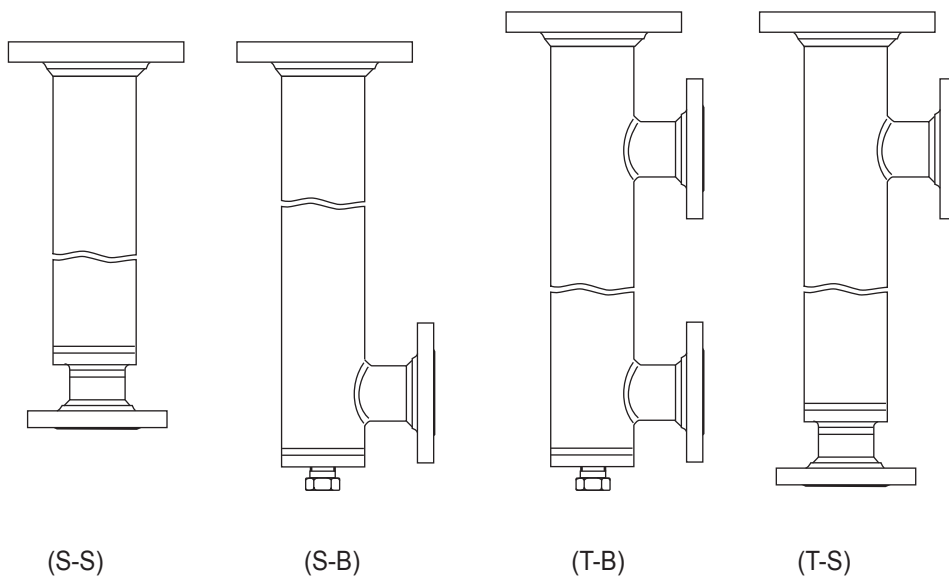


Figure 1-3 Chamber

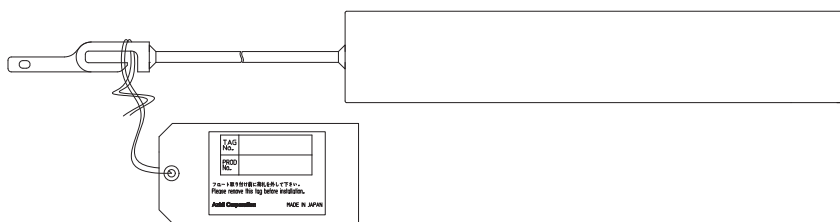


Figure 1-4 Float

Others (accessories)



Figure 1-5 Float mounting tool

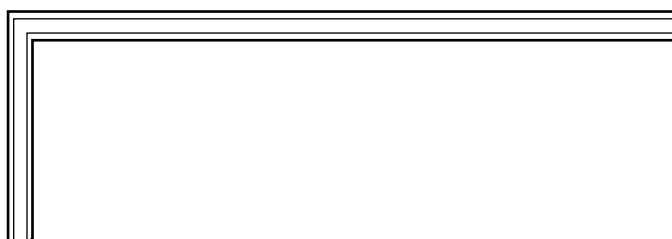


Figure 1-6 Hexagon wrench

| | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------------|--------|-----------------------|---|---------|-----|----------------------|---------|------|--|---------------------|--|---|--|----------------------|---|---|---|---|---|
| 0 | | 50 | | 100 | | 0 | | 50 | | 100 | | | | | | | | | | | |
| <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="4"></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> </table> | | | | | | | | | | | | | | | | ▼ | ▼ | ▼ | ▼ | ▼ | ▼ |
| | | | | ▼ | ▼ | ▼ | ▼ | ▼ | ▼ | | | | | | | | | | | | |
| Pa | hPa | | | kPa | | | MPa | | | kPaG | | | | | | | | | | | |
| MPaG | | | Pa abs | | | hPa abs | | | kPa abs | | | MPa abs | | | | | | | | | |
| mmH ₂ O | | | | mmAq | | | | inH ₂ O | | | | gf/cm ² | | | | kgf/cm ² | | | | | |
| atm | | | | mbar | | | | bar | | | | psi | | | | mmHg | | | | | |
| inHg | | | | kgf/cm ² G | | | | mbar G | | | | bar G | | | | m ³ | | | | | |
| kgf/cm ² abs | | | | mmHg abs | | | | inHg abs | | | | l | | | | kl | | | | | |
| ml/h | | | | l/h | | | | kl/h | | | | Sk l/h | | | | t/h | | | | | |
| m ³ /h | | | | km ³ /h | | | | Nm ³ /h | | | | kNm ³ /h | | | | l/min | | | | | |
| kl/min | | | | m ³ /min | | | | Nm ³ /min | | | | l/min | | | | Nm ³ /min | | | | | |
| kl/D | | | | m ³ /D | | | | t/D | | | | Nm ³ /D | | | | kg/h | | | | | |
| mm | | | | m | | | | kg/m ³ | | | | g/cm ³ | | | | % | | | | | |
| X10 | | X10 ² | | X10 ³ | | | | | | t | | | | | | | | | | | |
| 80370187-001 | | | | | | | | REV 05 | | | | RANGE | | ~ | | | | ~ | | | |

Figure 1-7 Sticker of measuring unit

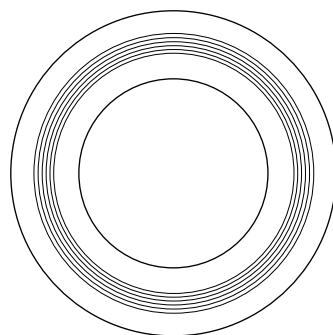


Figure 1-8 Gasket

1-2 : Safety precautions

WARNING

-
- Do not use the instrument beyond the rated pressure, connection specification and rated temperature specified for the instrument. This may result in serious accident due to damage.
 - Wiring in an explosion-proof area should be performed according to the work procedure specified in the explosion-proof guideline.
-

CAUTION

-
- After installation, do not use this instrument as a foothold, etc. This may damage the instrument or may result in physical injury
 - Avoid hitting the glass part of the display with tools. This may damage the glass and result in physical injury.
 - Perform installation correctly. Insufficient installation or no installation may result in output errors or violate applicable regulations.
 - This product is heavy. Pay attention to the scaffolding and wear safety shoes.
-

1-3 : Specifications

Refer to specification sheets No. SS2-SLX100-0100.

1-4 : Installation condition

CAUTIONS

-
- If the instrument receives radiant heat from the plant side, make sure the ambient temperature of the transmitter part meets the operating conditions.
 - Pay attention to the relationship between the fluid temperature and ambient temperature.
 - Avoid installation in a corrosive atmosphere.
 - Install the instrument in an environment with a vibration acceleration of 5 m/s² (9 to 60 Hz) or less.
 - Install the instrument in an environment with a magnetic field of 1 mT or less.
 - Install the instrument in an environment with an electromagnetic induction of 400 A/m or less.
-

Installation standard of explosion-proof type

* Reference material: National Institute of Industrial Safety Technical Guideline/"Factory Explosion-Proof Electrical Installation Guide for Users (Gas Explosion-Proof 1994)" issued by corporate judicial person Technology Institution of Industrial Safety.

Install the instrument in a location that matches the following explosion class, ignition temperature and explosion-proof structure divisions.

(1) Explosion class and ignition temperature of target gas:

II CT3 (IIC: all gases/vapor, T3: gas/vapor with ignition temperature exceeding 200 °C)

II CT4 (IIC: all gases/vapor, T4: gas/vapor with ignition temperature exceeding 135 °C)

II CT5 (IIC: all gases/vapor, T5: gas/vapor with ignition temperature exceeding 100 °C)

II CT6 (IIC: all gases/vapor, T6: gas/vapor with ignition temperature exceeding 85 °C)

(2) Zones

Can be installed in "Zone 1" or "Zone 2",

Can not be installed in "Zone 0".

(3) Ambient temperature: -20 °C to 55 °C

The ambient temperature refers to "temperature in an atmosphere at a distance of 1 m or more from the instrument".

WARNING

The explosion-proof performance cannot be guaranteed at a temperature exceeding 55 °C.

An example of an identification plate and approval mark is shown below. (In the case of IICT6)

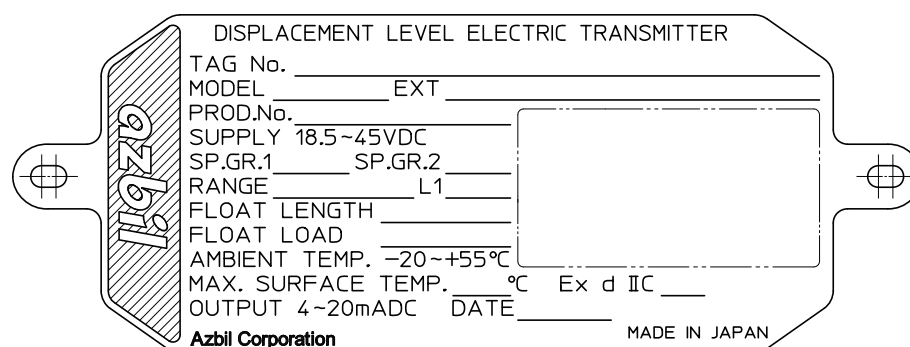


Figure 1-9 Nameplate

1-5 : Unpacking and storage

Unpacking

Unpack the product with care so that no shock is given to the instrument.

Checking instrument

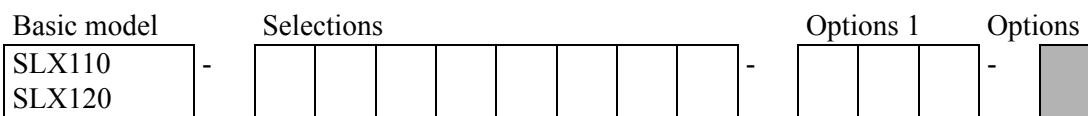
Check to see if the following items are included.

- Main unit (section from bonnet above, including up to transmitter part)
- Float (not provided if “no float” is specified in model number)
- Chamber (not provided in the case of internal type or if “no chamber” is specified in model number)
- Float mounting tool (not provided if “no float” is specified in model number)
- Unit seal (inside transmitter part cover)
- Bolt/nut between chamber/bonnet (when “with external type chamber” is specified)
- Gasket between chamber/bonnet (when “external type chamber” is specified)

Table 1-1: Shipping accessory reference table

| | | External type | | | | Internal type | |
|-------------------------------------------|---------------------|---------------|------|------|------|---------------|------|
| | | | | | | | |
| Model number of options 2 (Refer to Note) | Chamber | - | - | -D | -D | - | - |
| | Float | - | -C | - | -C | - | -C |
| Instrument Accessory shipped | Main unit | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Float | ✓ | None | ✓ | None | ✓ | None |
| | Chamber | ✓ | ✓ | None | None | None | None |
| | Float mounting tool | ✓ | None | ✓ | None | ✓ | None |
| | Unit seal | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Bolt / Nut | ✓ | ✓ | None | None | None | None |
| | Gasket | ✓ | ✓ | ✓ | ✓ | None | None |
| | Hexagon wrench | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

~Note



The option “C” in the options 2 means “without float“.

The option “D” in the options 2 means “without chamber“.

⚠ CAUTION

- In the case of an internal type top type (top mount type) with an extremely long float, the product is shipped with the hanger and float separated as shown in the figure below.
- In this case, the total number of accessories is 3 (hanger, float and assembly pin).
- Please assemble them, referring to the figure below.

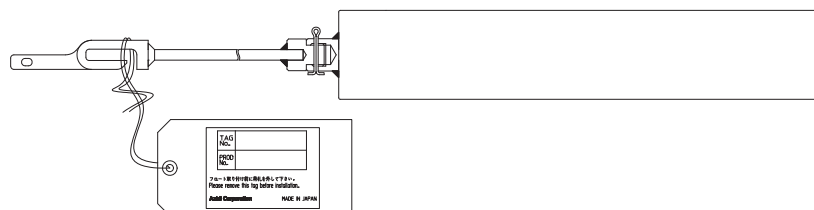


Figure 1-10 Float and hanger

Assembly method:

- (1) Remove the tag.
- (2) Engage the hanger with the float so that the assembly pin can be inserted.
- (3) Insert the assembly pin and adequately bend it using pliers so that the pin does not come out.

Checking specification

Make sure the specifications on the identification plate conform to your requirements.

Make sure the model number and product number of the main unit, float and chamber match.

- Tag No. (TAG No.)
- Model number (MODEL)
- Product number (PROD No.)
- Measuring range (RANGE)
- Supply voltage (SUPPLY)
- Explosion-proof certification approval mark (in the case of explosion-proof specification)

For any inquiries, contact your nearest Azbil Corporation branch or sales office and be sure to inform us of the model number and product number described on the identification plate.

Storage

(In the case of long-term storage after purchase)
Store the product as it was delivered.

Store the product indoors at normal temperature, normal humidity (approximately 25°C, 65%RH), and free from vibration or shock.

1-6 : Installation method

External type

- Install the chamber in a vertical position.
- If the chamber installed on an angle, the float will contact the chamber, preventing correct output from being obtained.
- If viscosity of the liquid to be measured increases in the chamber due to a temperature drop or if heat loss becomes a problem, it is recommended to keep the chamber and connection pipe path warm with a heat insulating material.

Internal type

If the liquid level changes violently, prepare a guide pipe to prevent the float from vibrating.

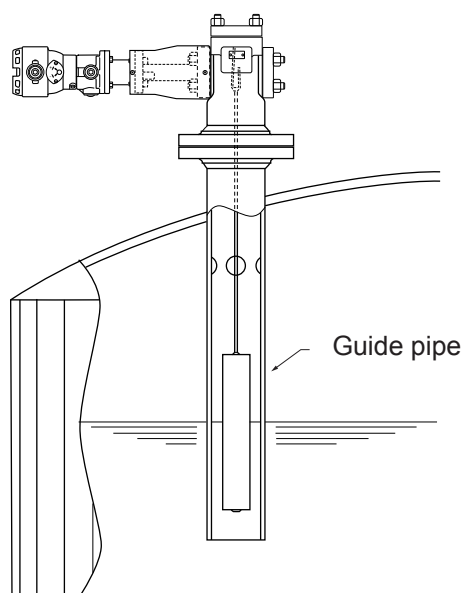


Figure 1-11 4 view of an internal type installation

Heat insulation

CAUTION

Do not apply heat insulation to the transmitter part and extension section under any circumstances. This may cause an increase in temperature at the transmitter part resulting in insufficient performance and early deterioration of component parts, etc.

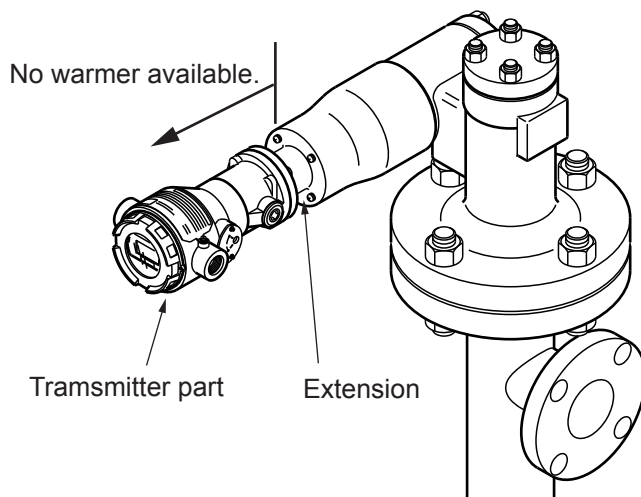


Figure 1-12 Applying heat installation

Main unit, float mounting procedure

CAUTION

The provided float mounting tool does not fully support installation to chambers made by other manufacturers. When the main unit and float are installed in chambers of other manufacturers, check the possibility of installation beforehand.

In case of external type (* when float is set after main unit is fixed)

1. Remove the blind flange.

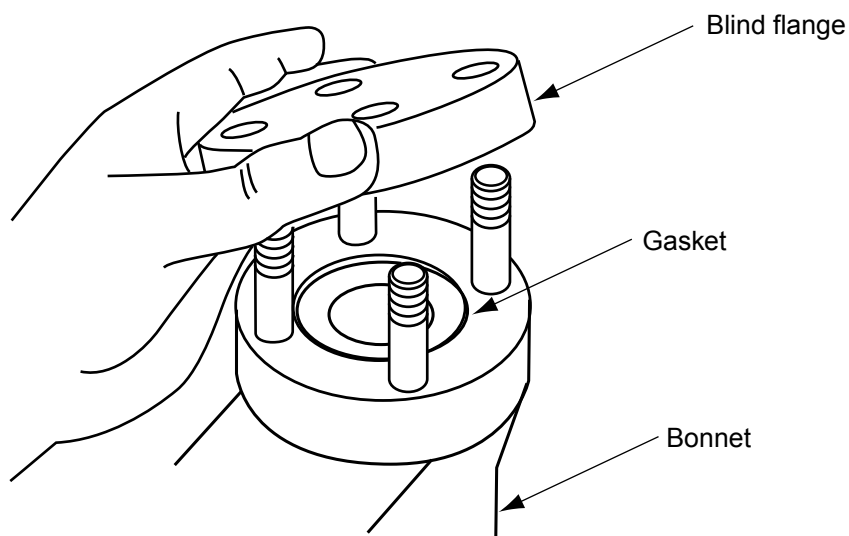


Figure 1-13 Removing a bling flange

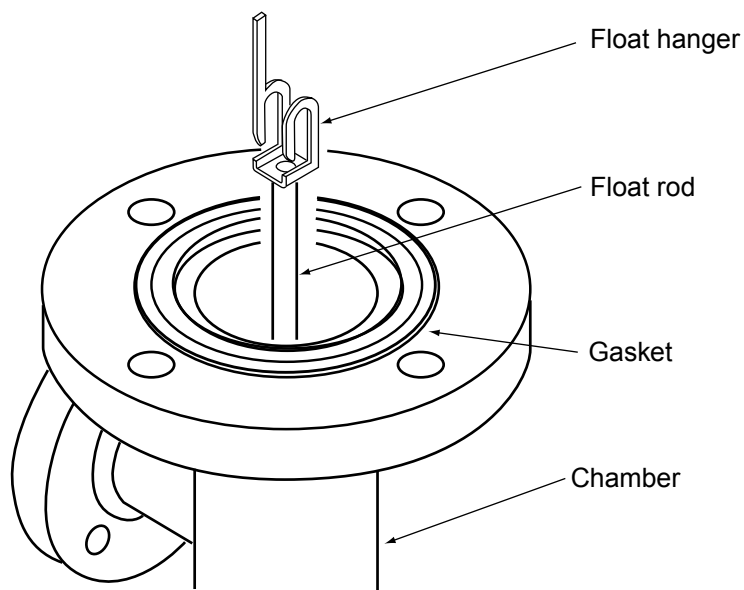


Figure 1-14 Inside the chamber

 **CAUTION**

Caution on installation using float mounting tool (external type S-B type, T-B type)

- When the float is inserted into (placed below) the chamber first with some external type S-B type, T-B type, the float may drop into the lower section connection flange.
- In the case of an external type S-B type, T-B type, be sure to check whether the float drops or not when the float is installed in the chamber (see Table 1-2: Azbil Corporation standard product external type S-B type, T-B type).
- If the float drops into the lower section connection flange, tilt the float so that it does not drop and carefully mount it or do not install it using the float mounting tool.

Table 1-2: Azbil Corporation standard product external type S-B type, T-B type

| Basic model number | Chamber size (in.) | Lower section connection flange outer diameter | Lower section connection flange inner diameter |
|---------------------------------------|--------------------|------------------------------------------------|------------------------------------------------|
| SLX 110 | 3 | 1.5 in. / 40 mm 2 in. / 50 mm | 39.6 mm 50.7 mm |
| SLX120 (range 2000mm or more only) | 4 | 1.5 in. / 40 mm 2 in. / 50 mm | 39.6 mm 50.7 mm |
| SLX 120 | 5 | 1.5 in. / 40mm 2 in. / 50 mm | 39.6 mm 50.7 mm |

- For the float diameter, see Specification sheets No. SS2-SLX100-0100.

2. Slowly lower the main unit from the upper section of the chamber and fix it to the flange using bolts and nuts.

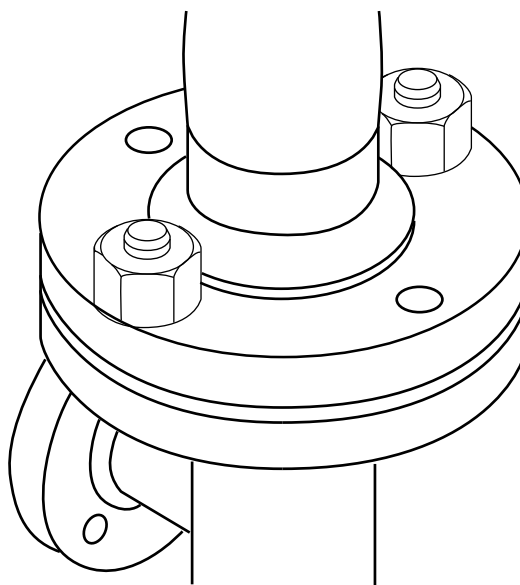


Figure 1-15

- ~Note**
- *Check that the gasket has been inserted*
 - *Be careful not to bend the float rod.*
 - *For the tightening torque, See “Table 1-3: Tightening Torque” on page 1-17.*

- When viewed from the bonnet head, one can see that the bonnet interior is divided into 4 areas by the torque arm and pin (see the figure below). Insert the float mounting tool from the bonnet head, and adjust the float hanger so that it sits in a position as shown in case 1 or 2 (Figure 1-18).

~Note *If the bonnet interior is dark, illuminate it with a flashlight.*

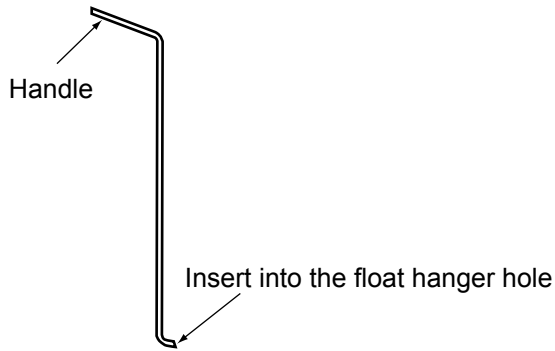


Figure 1-16 Float mounting tool

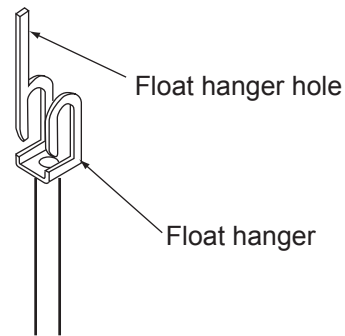


Figure 1-17 Float hanger section

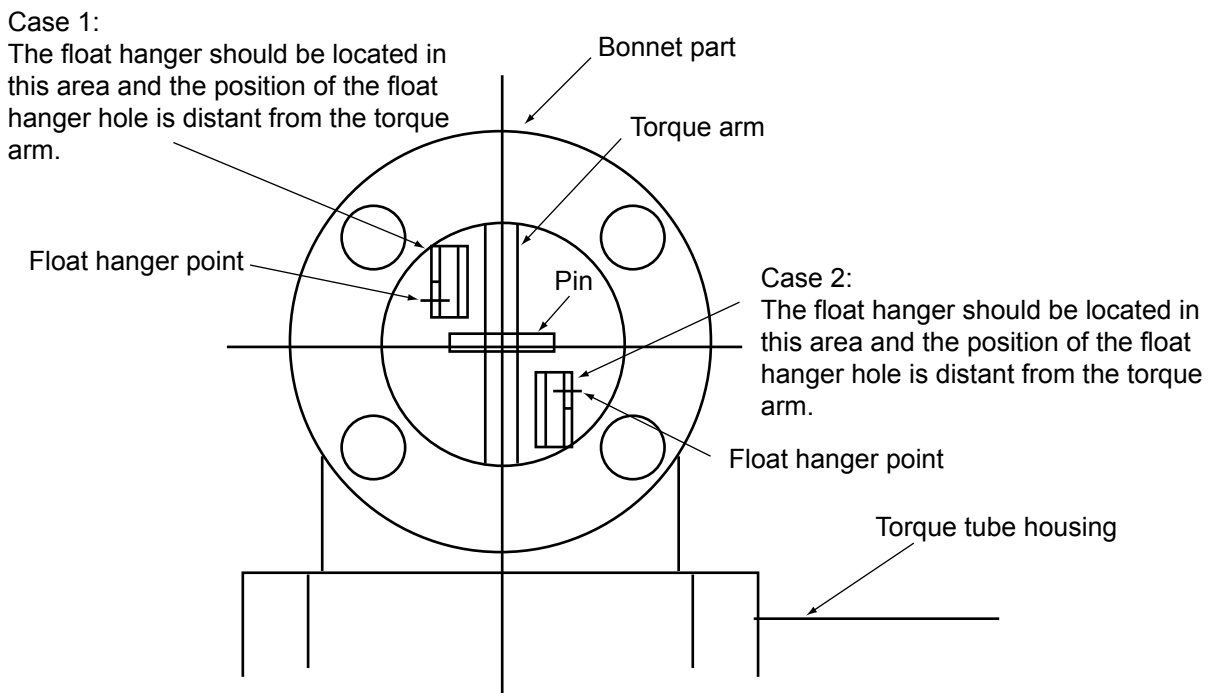


Figure 1-18 View from bonnet head

4. Hook the float mounting tool through the float hanger hole by introducing the tool from the center outward, lift the float and hook the float hanger notch over the pin.

- ~Note**
- When lifting the float, be careful not to apply excessive force to the torque arm.
 - Make sure the hanger is hooked over both sides of the pin.

Case 1

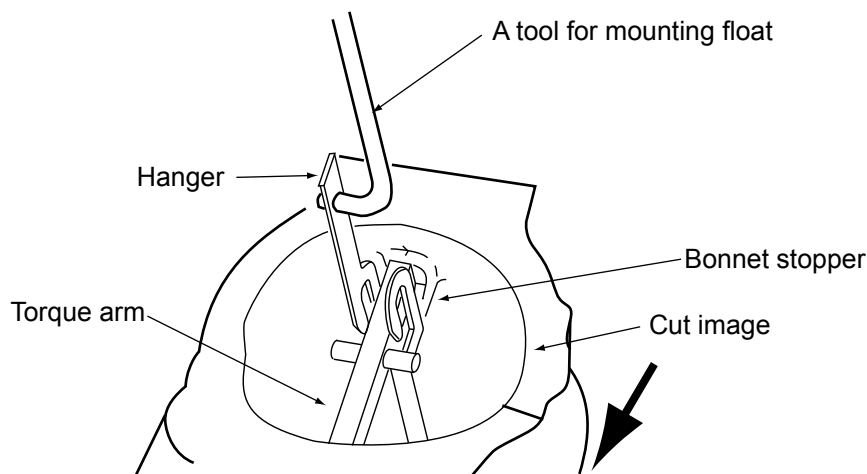


Figure 1-19 Mounting the float hanger (Case 1)

Hook the float hanger over the pin while moving it forward the torque tube housing. (direction of arrow in the Figure 1-19)

Case 2

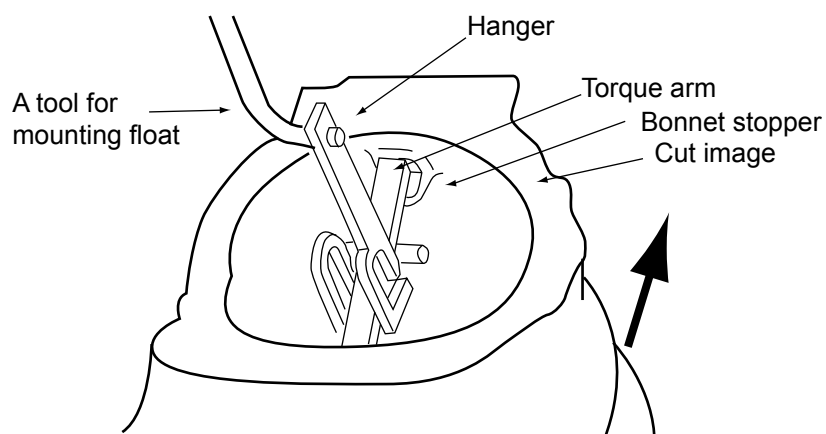


Figure 1-20 Mounting the float hanger (case2)

Hook the float hanger notch over the pin in the direction away from the torque tube housing (direction indicated by an arrow in the Figure 1-20).

5. Fix the blind flange with a nut.
 - Do not forget to put the gasket on.
 - For the tightening torque, see Flange bolt tightening torque.

In the case of internal type (when float is set before main unit is fixed)

- (1) Remove the blind flange.
- (2) Insert the float into the liquid tank but make sure it doesn't fall.
- (3) Move the main unit above the liquid tank and hold it from directly above.

~Note *Use a crane pulley, etc. to lift it.*

- (4) Lift the float and hook the float hanger over the pin of the torque arm inside the main unit.

~Note • *The float hanger can be oriented in any direction.*
 • *Make sure the hanger is hooked over both sides of the pin.*

- (5) Slowly lower the main unit from above the liquid tank and fix it to the flange using bolts and nuts.

~Note • *Make sure the gasket is inserted in between.*
 • *For the tightening torque, see Table 1-3: Tightening Torque.*

- (6) Fix the blind flange with a nut.

~Note • *Do not forget to put the gasket on.*
 • *For the tightening torque, see Table 1-3: Tightening Torque.*

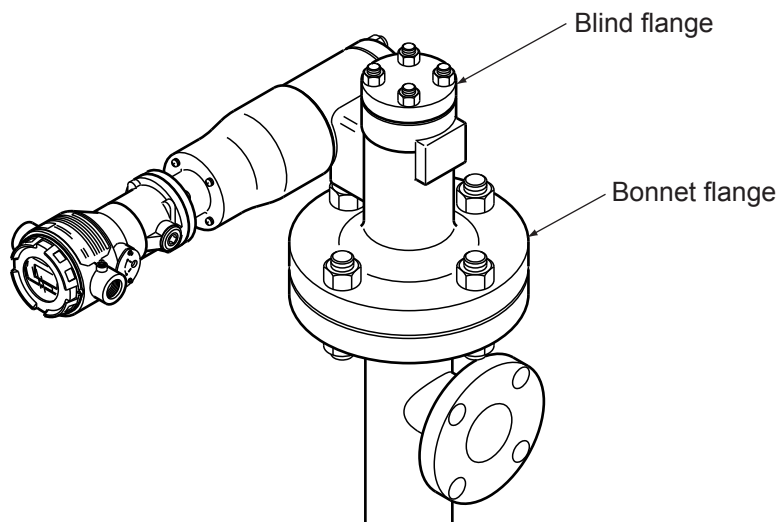
Flange bolt tightening torque

Figure 1-21 Blind flange and bonnet flange bolts

Table 1-3: Tightening Torque

| Flange position | Bolt size | Tightening torque (N.m) |
|------------------------------------------------------------------------------------------------------------|------------------|--------------------------------|
| Blind flange | M14 | 127 +/-20 |
| Bonnet flange (3in. CLASS 150) (4in. CLASS 150) | M16 | 147 +/-20 |
| Bonnet (3in. CLASS 300) (3in. CLASS 600) (4in. CLASS 300) (5in. CLASS 150) (5in. CLASS 300) | M20 | 245 +/-20 |

Electrical wiring

Wiring for waterproof model

This section describes the wiring to which the explosion-proof standard is not applicable.

- Conduct wiring as shown in the figure below. An external load resistor of 250Ω or more is required for communication with the SFC.
- Both right and left conduits can be used.
- Put a plug into the conduit that is not used to prevent moisture or precipitation from entering.

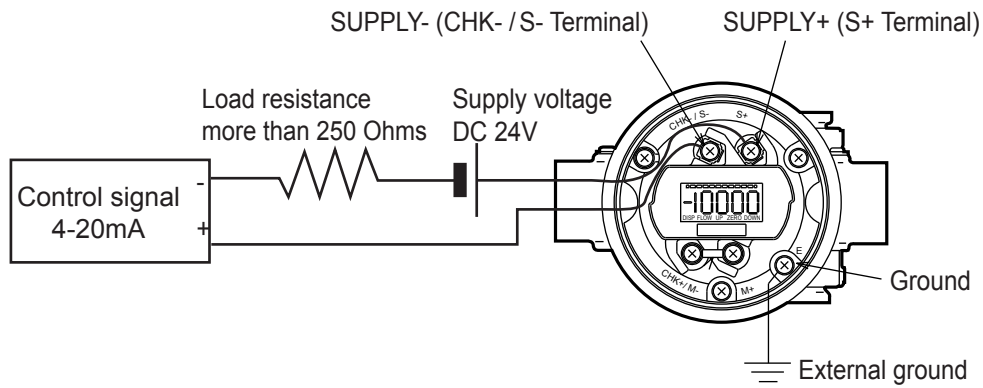


Figure 1-22 Electrical wiring

In the case of a receiver with voltage input (1 to 5 V), conduct wiring as shown in the figure below.

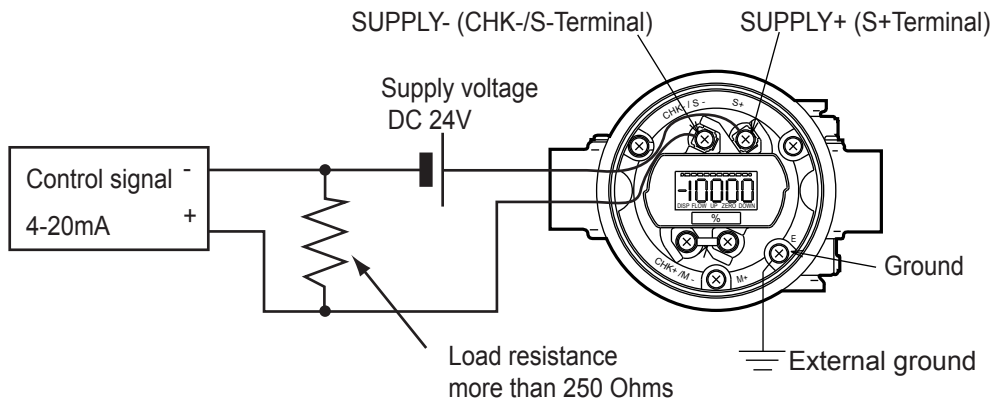


Figure 1-23 Electrical wiring when voltage input (1 to 5 V)

Piping for wiring

Draw wires into the transmitter part case as follows:

- Draw wire into the terminal section of this instrument by setting a conduit pipe in the conduit hole (G1/2 internal screw) next to this instrument and passing it through this pipe.
- To prevent precipitation from getting into this instrument, plug the conduit coupling section with a sealant or plug.
- Route the wiring cable in such a way so as it enters the main unit of this instrument from the lower section.
- Use a pressure-proof elbow to change the electrical wiring direction (1, 2, 3 indicated in additional specification) if required.

Grounding

There are two grounding terminals; one on the terminal block of this instrument (internal grounding terminal) and the other on the transmitter part case (external grounding terminal). Ground either one.

- Use a grounding terminal with a resistance to ground of 100 ohms or less or connect it to ground of good quality.
- The explosion-proof type absolutely requires grounding.
- Cautions when welding is performed near the transmitter part
- Ground the welding machine and the welding power supply transformer to a place different from the one for grounding of this instrument. The welding current may have adverse effects.

Power supply and external load resistance

It is necessary to determine the relationship between the external load resistance used for this instrument and power supply voltage in such a way as it falls within the shaded area in the figure below.

The external load resistance refers to a sum total of resistances connected to the output terminal of this instrument such as the resistance of cables making up the loop and the internal resistance of the instruments connected at some midpoints.

The horizontal axis and vertical axis in the figure below are the power supply voltage and external load resistance respectively.

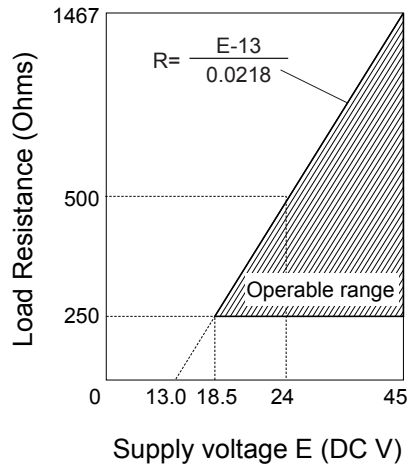


Figure 1-24 Relationship between Supply Voltage and External Load Resistance

Note) A load resistance of at least 250Ω is required for communication with the SFC.

Wiring for explosion-proof model

For explosion-proof type wiring, see instructions on Wiring for waterproof model and the following instructions.

See National Institute of Industrial Safety technical guideline/"Factory Explosion-Proof Electrical Installation Guide for Users (Gas Explosion-Proof 1994)" issued by corporate judicial person Technology Institution of Industrial Safety, for details.

WARNING

- The pressure-proof packing type cable adapter provided for this instrument was subjected to a certificate examination as part of the transmitter part case and obtained a certificate of conformance. Therefore, note that conducting drawing of external wires in combination with a cable adapter other than the provided cable adapter will not be covered by the certificate.
- Fasten the transmitter part cover and lock it.
It is mandatory to lock the cover of the explosion-proof transmitter part case.

This instrument has a locking structure. First, unlock the transmitter part case using a hexagonal-head wrench (for fixing screw female M3 with hexagonal hole, across flats S=1.5 mm) and conduct wiring.

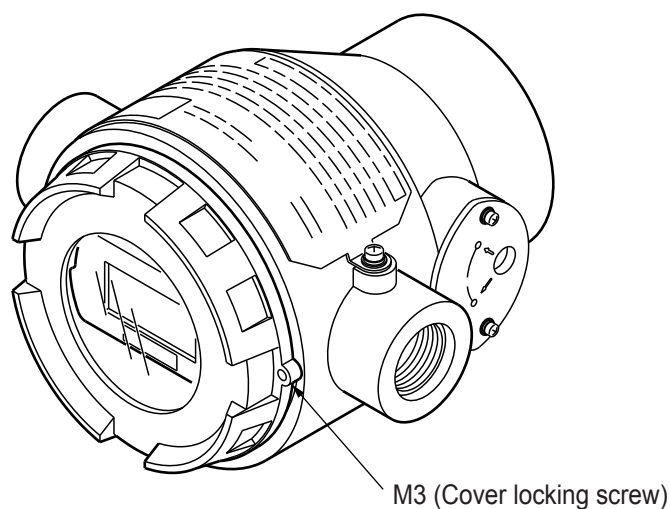


Figure 1-25 Locking of transmitter part Case

Draw the cable into this instrument using the provided pressure-proof packing type cable adapter as shown in the figure below and secure the connection space. For the maximum allowable temperature for the wiring cable used, see Table 1-4: Temperature level for Explosion-proof.

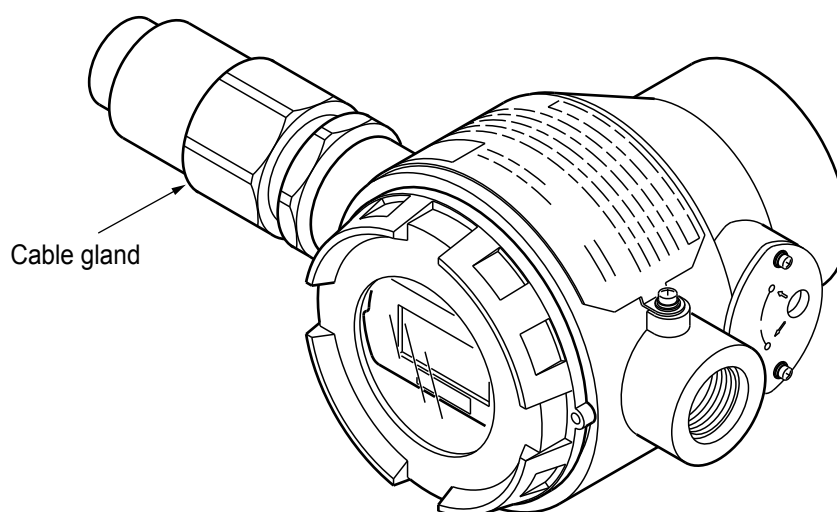


Figure 1-26 Cable gland

Table 1-4: Temperature level for Explosion-proof

| Level | Allowable Max. temperature |
|-------|----------------------------|
| T3 | 70°C |
| T4 | 65°C |

Cable gland and flameproof universal elbow for JIS Flameproof apparatus

The cable gland is used to seal the terminal section of the cable, maintain the explosion-proof performance and improve the insulation performance and mechanical strength.

If it is necessary to change the orientation of the cable, use a pressure-proof elbow.

Structure of cable gland

An overall view and exploded view of the cable gland are shown below.

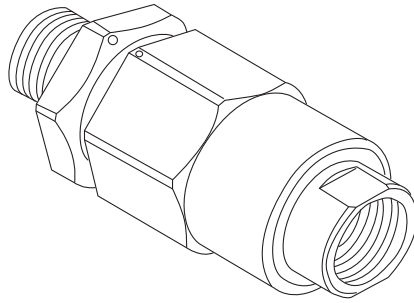


Figure 1-27 Overall view of cable gland

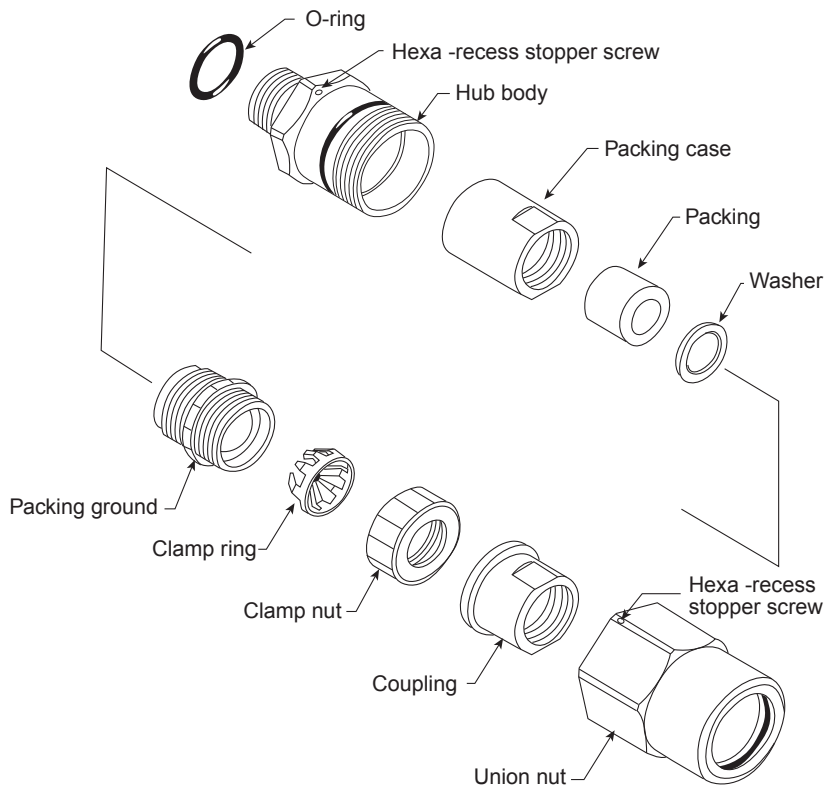


Figure 1-28 Exploded view of cable gland

Flameproof universal elbow

The structure of the pressure-proof elbow is shown below.

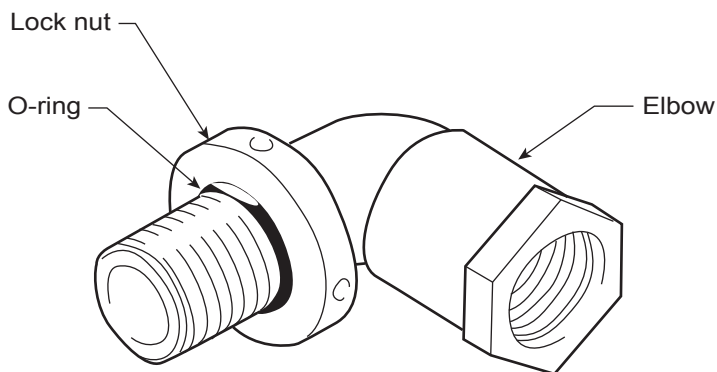


Figure 1-29 Structure of Pressure-Proof Elbow

Mounting example

Attach the cable gland and pressure-proof elbow to the conduit coupling opening of the terminal box as shown in the figure below.

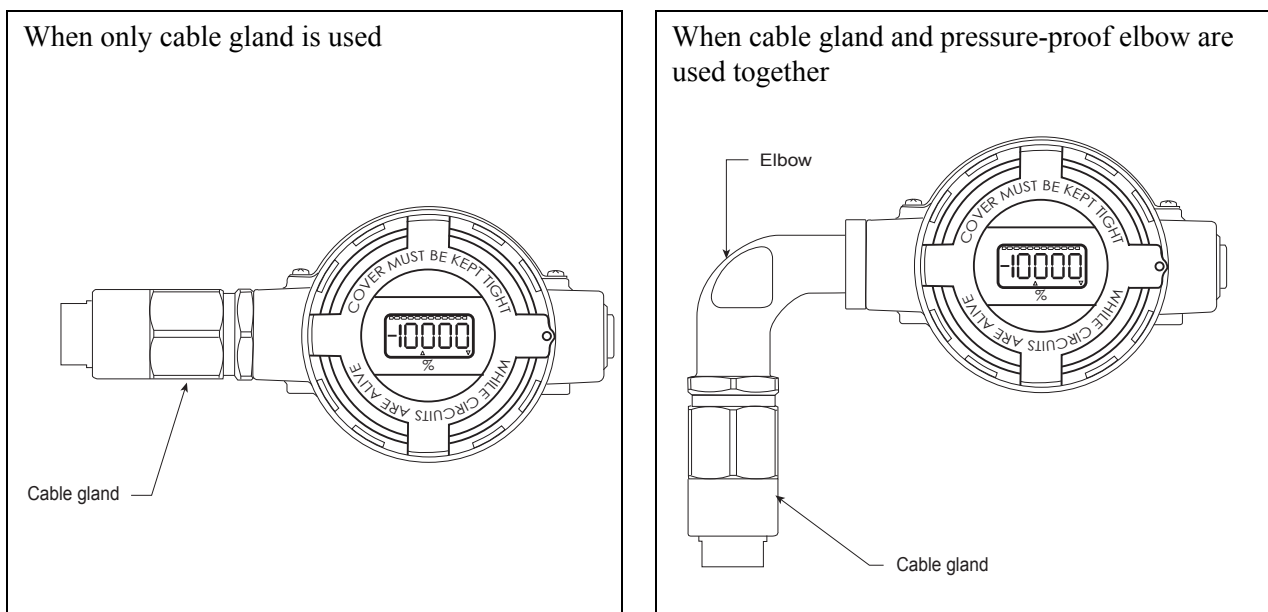





Figure 1-30 Cable gland connections

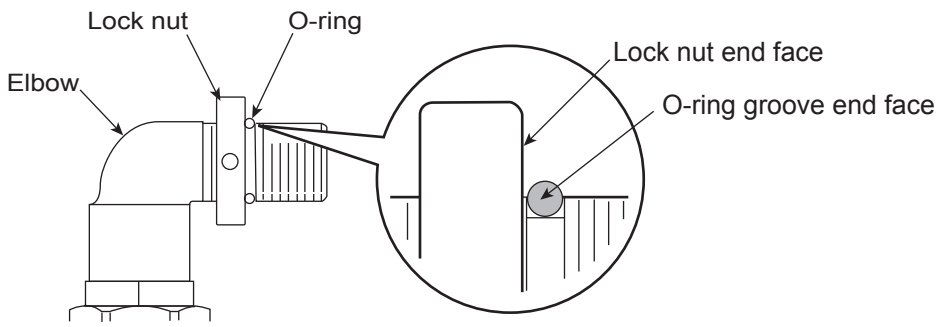
Cable gland mounting procedure

The procedure for mounting the cable gland is given below.

| Step | Procedure | | | | | | | | | |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|---------|-------------|----|----------|--------------|----|--------------|
| 1 | <p>Secure the hub body to the conduit coupling opening of the transmitter part or pressure-proof elbow coupling opening and fix them. When they are fixed, tighten the fixing screws on the hexagonal hole of the hub body.</p> <p> CAUTION</p> <hr/> <p style="text-align: center;">Apply sufficient waterproof treatment. It is recommended to use silicon resin-based non-hardening sealant.</p> <hr/> | | | | | | | | | |
| 2 | <p>Insert the union nut, coupling, clamp nut, clamp ring, packing gland, washer, packing, packing case, in that order from the cable end with reference to the exploded view, paying attention to their orientations.</p> <p> WARNING</p> <hr/> <p>The diameter of the cable and that of the packing may not match, which may cause flames to flow out, resulting in humidity injury. Be sure to use the packing with an inner diameter that fits to the outer diameter of the cable by referring to the table below.</p> <hr/> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Cable outer diameter (mm)</th> <th style="text-align: center;">Packing inner diameter (mm)</th> <th style="text-align: center;">Remarks</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">7.0 to 10.0</td> <td style="text-align: center;">10</td> <td style="text-align: center;">provided</td> </tr> <tr> <td style="text-align: center;">10.1 to 12.0</td> <td style="text-align: center;">12</td> <td style="text-align: center;">incorporated</td> </tr> </tbody> </table> <hr/> | Cable outer diameter (mm) | Packing inner diameter (mm) | Remarks | 7.0 to 10.0 | 10 | provided | 10.1 to 12.0 | 12 | incorporated |
| Cable outer diameter (mm) | Packing inner diameter (mm) | Remarks | | | | | | | | |
| 7.0 to 10.0 | 10 | provided | | | | | | | | |
| 10.1 to 12.0 | 12 | incorporated | | | | | | | | |
| 3 | Fit the clamp nut into the packing gland, fasten it to fix the cable. | | | | | | | | | |
| 4 | <p>Fit the packing case into the packing gland, fasten it to fix.</p> <p> WARNING</p> <hr/> <p style="text-align: center;">To prevent physical injury due to flow of flames, sufficiently fasten the packing.</p> <hr/> | | | | | | | | | |
| 5 | Pass the cable end through the hub body and insert it into the transmitter part. | | | | | | | | | |
| 6 | Screw the union nut into the hub body, firmly fix and then tighten the screw with a hexagonal hole of the union nut. | | | | | | | | | |

The flameproof universal elbow mounting procedure

The procedure for mounting the pressure-proof elbow is given below.

| Step | Procedure |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>Match the end face of the lock nut with the end face of the O-ring groove, referring to the figure below.</p>  <p><i>Figure 1-31 Matching lock nut end face and O-ring groove end face</i></p> |
| 2 | <p>Screw the pressure-proof elbow into the conduit coupling opening of the transmitter part until the lock nut end face touches the end face of the coupling opening.</p> <p>⚠ CAUTION</p> <hr/> <p>Apply sufficient waterproof treatment.</p> <hr/> |
| 3 | <p>Turn the pressure-proof elbow to loosen it then set it to the desired position.</p> <p>⚠ CAUTION</p> <hr/> <p>Do not loosen more than one turn.</p> <hr/> |
| 4 | <p>Firmly fasten the lock nut using a dedicated tool to fix.</p> |

* The dedicated tool includes a hook spanner pin type, etc. (e.g., FP3438 manufactured by ASAHI, JAN code 006454, etc.

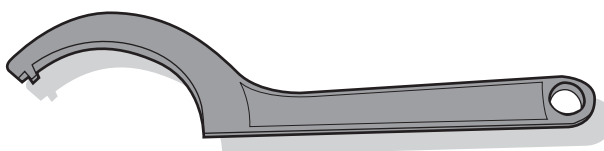


Figure 1-32 Hook spanner pin type -FP

Chapter 2 : Operation

2-1 : Principles of operation

Figure 2-1 is a schematic structural drawing of the SLX.

One end of the torque tube is fixed to the torque tube housing with a fixing screw and the other end is assembled with a torque arm supported by a knife edge fulcrum. At the time of installation or operation, the float is suspended from the end of the torque arm and the SLX is used with the torque tube twisted by the weight of the float.

Figure 2-2 is a signal block diagram of the SLX.

When the level of a process liquid changes, a buoyant force is produced on the float according to Archimedes' principle (the displacement type float is heavy and the level of the float shows little displacement even if the level of the liquid changes. In general, the instrument is designed to meet: “buoyancy with liquid level 100% < self weight of float”).

The buoyant force generated in proportion to the liquid level is converted to torque by the torque arm/knife edge from which the float is suspended and transmitted to the torque tube. The torque tube has a dual-function as sealing of the process liquid and torsional spring and converts torque to an angle. This angle is detected by an angle sensor and further A/D-converted and sent to the CPU as a liquid level signal.

When the torque tube contacts the process liquid, the torsional spring constant changes because the modulus of transverse elasticity of the torque tube material changes with the liquid temperature, producing an output shift. To compensate this output shift by the liquid temperature, the temperature near the torque tube is detected by the temperature sensor and further A/D-converted and sent to the CPU as a temperature signal.

The liquid level signal and temperature signal are processed by the CPU into a digital signal that fits into a set range. This value is converted to a 4 to 20 mA DC analog signal by a D/A converter and then outputted.

The SLX also provides parameters that can be set by the SFC to compensate the output shift with the liquid temperature (these are set to default values at the time of shipment). This is because some applications cannot be compensated enough with default values alone. See “3-3 : When output shift is large” on page 3-8, for details.

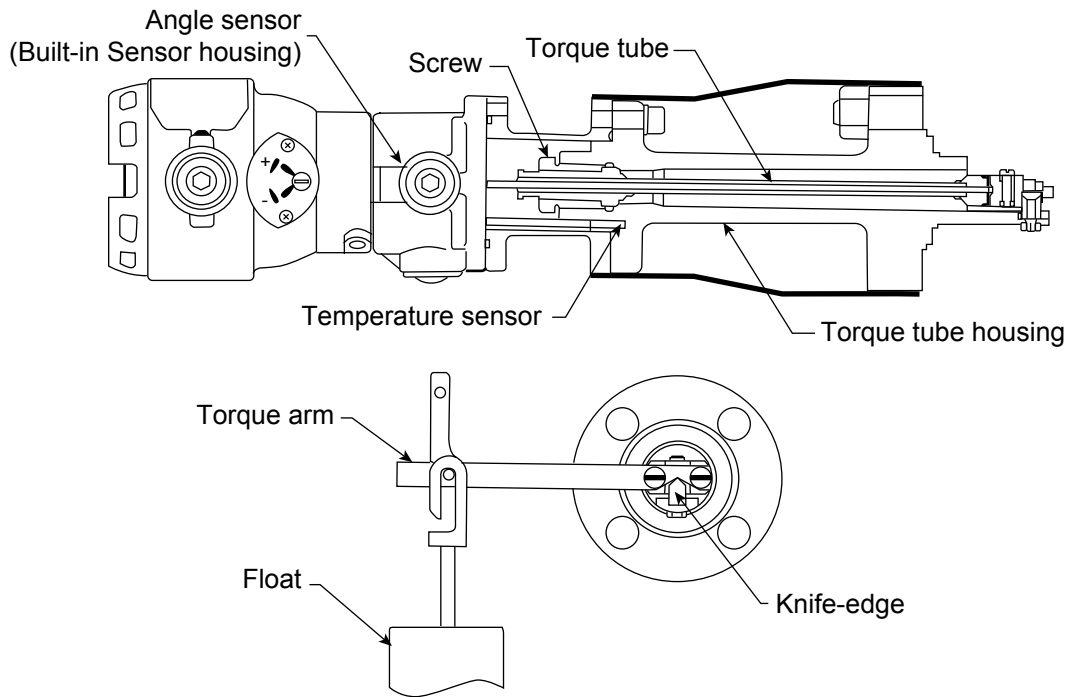


Figure 2-1 Schematic Structural Drawing

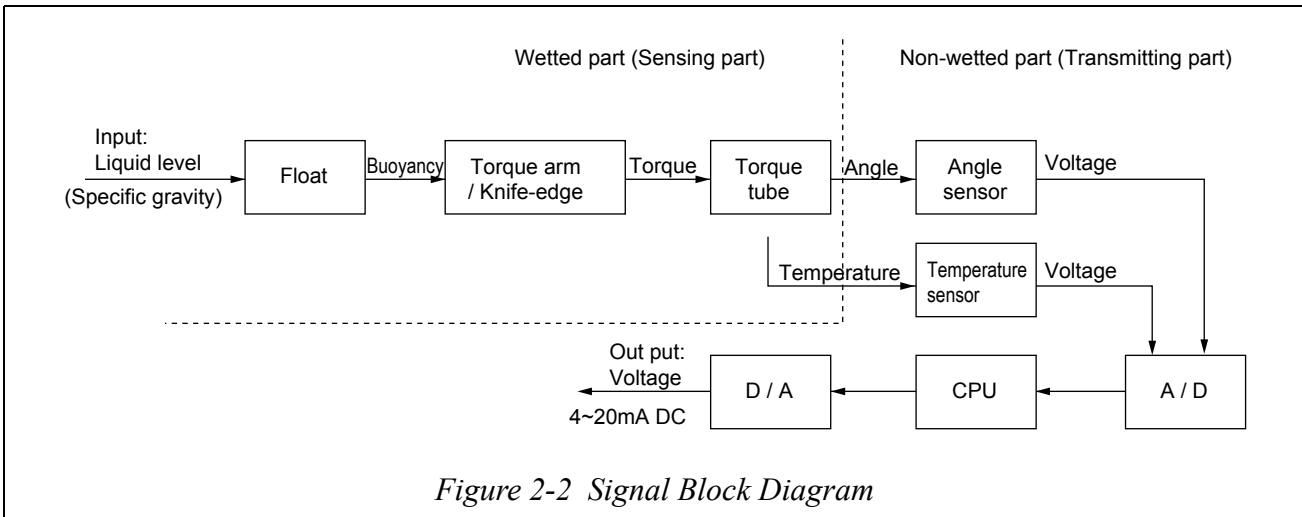


Figure 2-2 Signal Block Diagram

2-2 : Indicator (optional)

Component part names of indicator

The names of the parts of the indicator display section are as follows.

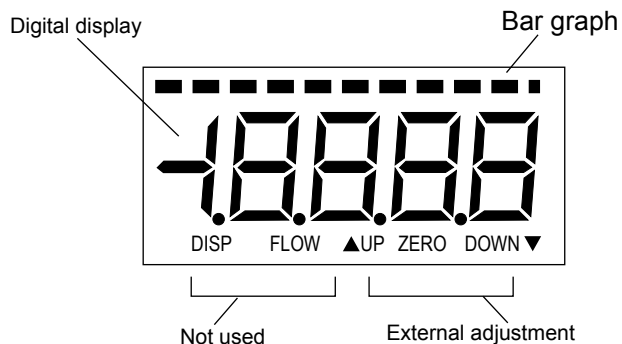


Figure 2-3 Names of Parts of Indicator Display Section

Digital display

Output values of this instrument are digital-displayed in percentage or arbitrary engineering unit values. The digital display of this instrument uses a 4.5-digit 7-segment LCD as shown below and the following points should be noted.

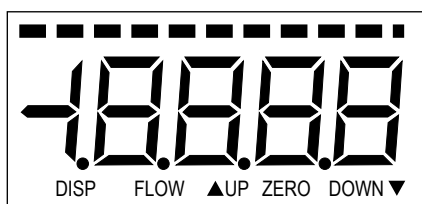


Figure 2-4 4.5 digit 7 segment LCD

- When the display value falls within the following range, a display limit value appears blinking.

| Display value range | Display |
|------------------------|---------|
| Display value < -19999 | 1999 |
| Display value > 19999 | 1999 |

- In the event of any malfunction, the display of this instrument may appear as follows. If this happens, see “Indicator (option) error messages” on page 4-8” and take the appropriate action according to the error content.

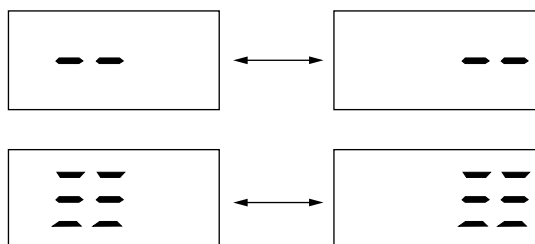













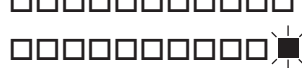


Figure 2-5 Error Display on Indicator

Analog bar graph display

Output values of this instrument are displayed in a 11-segment analog bar graph. The ON/blink statuses of the bar graph segments at this time are as follows.

| Output (OUT) | | | Blink | Segment display status |
|--------------|--------|-------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| OUT< | 0% | ON | |  |
| 0% | <=OUT< | 5% |  |  |
| 5% | <=OUT< | 15% | |  |
| 15% | <=OUT< | 25% | |  |
| 25% | <=OUT< | 35% | |  |
| 35% | <=OUT< | 45% | |  |
| 45% | <=OUT< | 55% | |  |
| 55% | <=OUT< | 65% | |  |
| 65% | <=OUT< | 75% | |  |
| 75% | <=OUT< | 85% | |  |
| 85% | <=OUT< | 95% | |  |
| 95% | <=OUT< | 100% | |  |
| 100% | <=OUT< | Only rightmost segment blinks |  | |

In constant current mode, the entire bar graph blinks.

When blinking, the bar graph display and digital display blink alternately.

Display during external adjustment switch operation

During an external adjustment switch operation, the following operation status is displayed. The judgment criteria corresponding to the display status are shown below.

Table 2-1: Display during external adjustment switch operation

| Adjustment mode | Indicator display |
|----------------------|-------------------|
| Normal status | (None) |
| Pinpoint adjustment | ZERO DOWN ▼ |
| Damping adjustment | ▲UP ZERO |
| Zero-span adjustment | ZERO |

For the adjustment method, see “2-7 :Operation of external adjustment switch (with indicator)” on page 2-74.

2-3 : Items to be checked before operation

General checking procedure

It is recommended to use the following checking procedure.

Make sure the SFC is a SFC160/260 Ver.8.0 or newer.

- 1 Turn on DC power.
- 2 Check that the instrument LCD displays some data.
- 3 Connect the SFC and check the specification (see).
- 4 Print out the initial setting data.
- 5 Carry out a zero-span adjustment (see).
- 6 Print out the final adjustment data.
- 7 Remove the SFC and close the cover.
- 8 Open the valve of the process connection piping section.

Checking set data

SFC connections

- Connect the SFC as shown in the figure below.
- Be sure to connect the SFC communication cable and terminals of this instrument as follows.

Red wire: Supply + terminal

Black wire: Supply - terminal

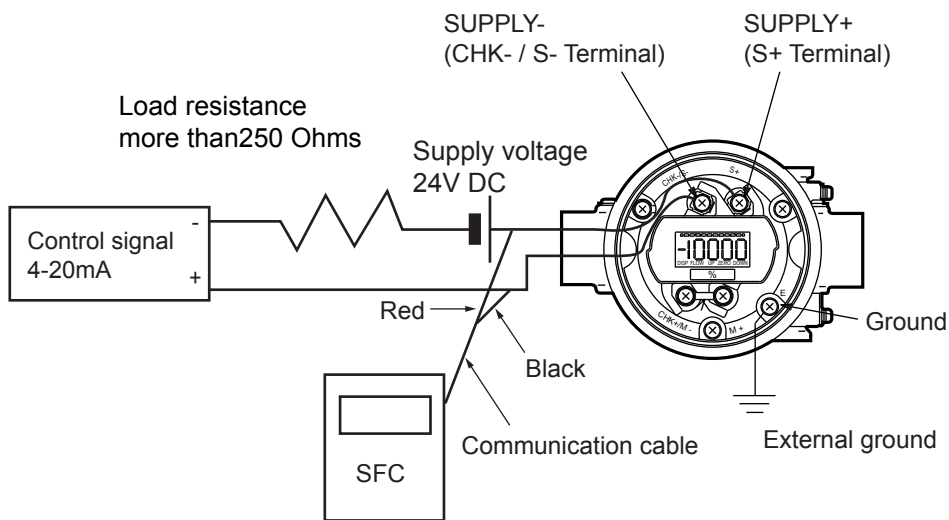
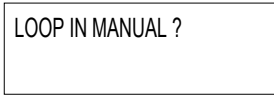


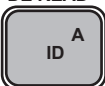

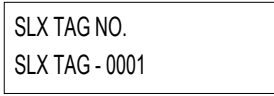

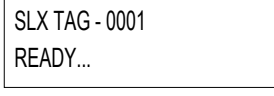


Figure 2-6 Connection with SFC

Communication start

WARNING

- While the process is in auto-control mode, do not start communication between the SFC and this instrument. This may temporarily change the output drastically, producing a dangerous operation condition.
- Before starting communication with this instrument, be sure to change the control loop of the process to manual control.




| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | | Turn on power to the SFC. |  |
| 2 |  | Check to see if the control loop is in manual operation. If “yes”, press the [ENTER] key. |  |
| 3 |  | Press [ID]. Communication with this instrument starts. |  |
| 4 | | TAG No. appears. |  |
| 5 |  | Pressing CLR makes communication ready to start. |  |

Checking set data

Print out the set data and check it.

In the case of the SFC without a printing function, check the set data from the display (See “2-6 : Operation using SFC” on page 2-19).

For the procedure for changing the setting, See “ Displaying and changing set data for measurement” on page 2-37

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | | Check that the system is on standby waiting for operation. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 READY... </div> |
| 2 |  | Press [SHIFT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SHIFT- </div> |
| 3 |  | Press [9]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> TAG NO. WORKING... </div> |
| 4 | | Printing starts. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> PRINTING... </div> |
| 5 |  | When printing is completed, the system is again on standby waiting for operation. To stop printing, press [CLR]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 READY... </div> |

Items to be checked

- TAG No.
- Output mode
- Damping time constant
- Span, LRV, URV, range
- Specific gravity (specific gravity to be set by basic data setting)
- Torque tube temperature coefficient (TQ tube temperature coefficient to be set in basic data setting)
- Display format (%(0.0), real memory (4.5 digits))
- Engineering unit (real scale) upper limit (real memory (4.5 digits))
- Engineering unit (real scale) lower limit (real memory (4.5 digits))
- Burnout direction (B/O-NON, B/O-UP, B/O-DOWN)
- Self-diagnostic result

Printing example

| | Meaning |
|---------------------------|----------------------------------------------------------------------------------------------------------|
| '01-01-01 08:30 | Date/time |
| Tag No. SLX-0001 | Tag No. |
| Type : SLX | Sensor type (printed as SLX) |
| ANA/DE : ANALOG XMTR | Output mode (analog, DE) |
| SER1# : 9909141101 | Serial number |
| SW VER : 3.0 | S/W version |
| DAMP : 10.0 s | Damping time constant |
| SPAN : 301 mm | Span |
| LRV : 0 mm | LRV |
| URV : 300 mm | URV |
| RANGE : 300 mm | Range |
| GRAVITY : 1.000 | Specific gravity (specific gravity to be set in basic data setting) |
| COEF TQ : 0.954 | Torque tube temperature coefficient (COEF TQ set in basic data setting) |
| DIGITAL METER | |
| TYPE : ENG. UNIT (4.5DIG) | Display format (%(0.0), real memory (4.5 digits)) |
| EUHI : 150 | Engineering unit (real scale) upper limit |
| EULO : -150 | Engineering unit (real scale) lower limit |
| F/SAFE DOWNSCALE | Burnout direction (B/O-NON, B/O-UP, B/O-DOWN) |
| INPUT : 150mm | Input value |
| OUTPUT : 50.0% | Output value |
| TQTT : T=200°C | Torque tube temperature |
| PTST : T=25.0°C | Angle sensor temperature |
| OFFSET : 0.1234 | Offset angle (OFFSET to be set in basic data setting) |
| COEF MT : 1.000 | Material coefficient (COEF MT to be set in basic data setting) |
| SENS IN : 3.060 | Input angle |
| SENS LO : 3.460 | Calibration lower limit angle |
| SENS SP : -0.800 | Calibration span angle |
| STATUS CHECK= OK | Self-diagnostic result (In the event of an error, status messages generated are printed sequentially) |

Zero span adjustment


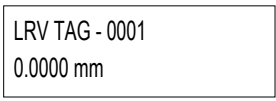

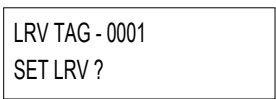

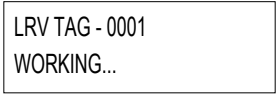
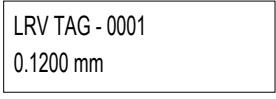
- ~Note**
- Turn on the power to the instrument and wait for at least 10 minutes before carrying out a zero span adjustment.
 - Be sure to carry out a span adjustment after the zero adjustment is completed.

When liquid level in chamber (liquid tank) can be changed up to upper limit

Method using SFC

Zero adjustment

Carry out a zero adjustment with the liquid level in the chamber (liquid tank) set to 0% (in the case of the level gauge, the float must be completely immersed in the liquid of the upper layer).





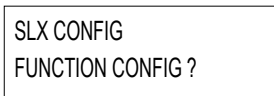

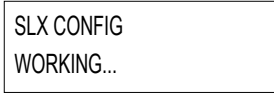

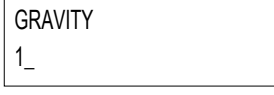
| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [LRV]. The current LRV value is shown. |  |
| 2 |  | Press [SET]. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The current input becomes the zero point. Setting completed. |  |





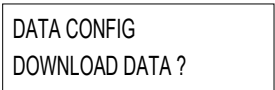

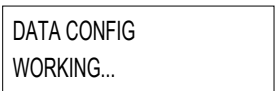

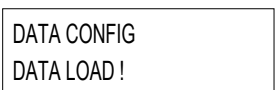
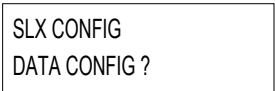
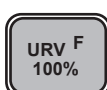
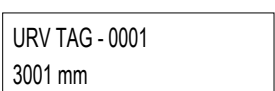

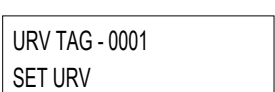

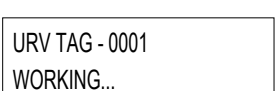
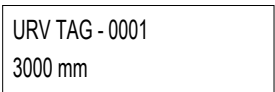

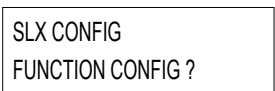
Span adjustment



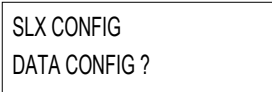

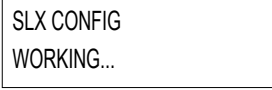






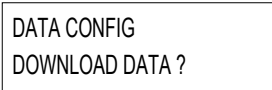
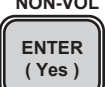


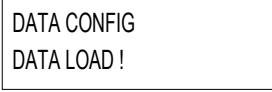
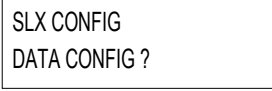
- The following procedure is based on water level adjustment.
- 1. Set specific gravity to 1 (water).
- 2. Set water 100%.
- 3. Carry out a span adjustment.
- 4. Change the specific gravity to the specific gravity of the fluid to be measured.

- ~Note**
- *When the fluid to be measured can be set to liquid level 100%, the specific gravity need not be changed before and after the adjustment.*
 - *When the specific gravity of the fluid to be measured is lighter than water, it is possible to carry out span adjustment without changing specific gravity (conventional water level adjustment) by inputting the liquid level for which specific gravity is converted beforehand (giving 100% equivalent buoyancy generated).*
 - *In the case of the level gauge, carry out span adjustment with the float completed immersed in the liquid of the lower layer without changing specific gravity.*

Set the liquid level in the chamber to water 100%.

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  OR  | press [NEXT] or [PREV] to display the basic data setting screen. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The current specific gravity set value is displayed. |  |
| 5 | | Enter value of 1 as specific gravity of water. |  |

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 |  | Press [ENTER]. |  |
| 7 |  or  | Press [NEXT] or [[PREV]] to display the download selection screen. |  |
| 8 |  | Press [ENTER]. |  |
| 9 |  | Change of specific gravity has been completed. press [CLR] once to return to the original condition. |   |
| 10 |  | Press URV. The current URV value is displayed. |  |
| 11 |  | Press SET. |  |
| 12 |  | Press [ENTER]. |  |
| 13 | | The current input becomes the span point. |  |
| 14 |  | Press [CONF]. |  |

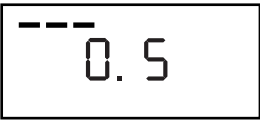

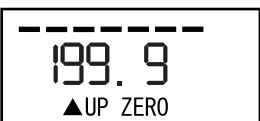

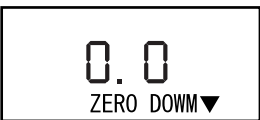
| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 |  or  | press [NEXT] or [[PREV]] to display the basic data setting screen. |  |
| 16 |  | Press [ENTER]. |  |
| 17 | | The current specific gravity set value (water) is displayed. |  |
| 18 | | Enter the specific gravity of the fluid to be measured. Example: Enter value of 0.9 |  |
| 19 |  | Press [ENTER]. |  |
| 20 |  or  | Press NEXT or [PREV] to display the download selection screen. |  |
| 21 |  | Press [ENTER]. |  |
| 22 |  | Setting completed press [CLR] once to return to the original condition. |   |

Method using external adjustment switch (with indicator)

For detailed explanations of the external adjustment switch, See “2-7 : Operation of external adjustment switch (with indicator)” on page 2-74

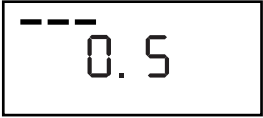

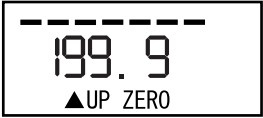
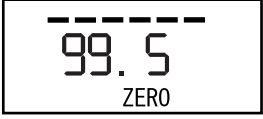

Zero adjustment

Carry out zero adjustment by giving 0% equivalent input.

| Step | Procedure | LCD screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch clockwise (+) for approximately 3 sec. |  |
| 2 | When “▲UP ZERO” appears, turn OFF the switch. This enters “Damping adjustment mode”. |  |
| 3 | Turn the switch counterclockwise (-) and display “199.9” below “0”. |  |
| 4 | “ZERO” appears after approximately 10 sec. and “Zero span adjustment mode” is entered. The current output value is displayed in digital. When zero adjustment is not performed, the normal condition is restored after approximately 30 sec. |  |
| 5 | Hold the switch counterclockwise for approximately 3 sec. When “ZERODOWN▼” is displayed, turn OFF the switch. The current input becomes the zero point. After approximately 2 sec., the normal condition is restored. |  |

Span adjustment

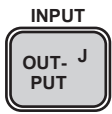
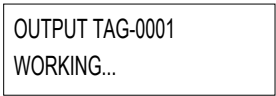



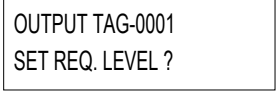

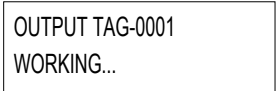

Perform span adjustment by giving 100% equivalent input.

| Step | Procedure | LCD screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch clockwise (+) for approximately 3 sec. |  |
| 2 | When “▲UP ZERO” appears, turn OFF the switch. This enters “Damping adjustment mode”. |  |
| 3 | Turn the switch counterclockwise (-) and display “199.9” below “0”. |  |
| 4 | “ZERO” appears after approximately 10 sec. and “Zero span adjustment mode” is entered. The current output value is displayed in digital. When zero adjustment is not performed, the normal condition is restored after approximately 30 sec. |  |
| 5 | Hold the switch clockwise (+) for approximately 3 sec. When “▲UP ZERO” is displayed, turn OFF the switch. The current input becomes the zero point. After approximately 2 sec., the normal condition is restored. |  |


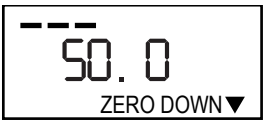


When adjusting zero point to output value according to real level

- The zero point is adjusted so that the current input value becomes the desired output value (the span does not change).
- Example of use: Adjust the output to the readout of the liquid level of the glass gauge.

Method using SFC

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. |  |
| 2 | | The current output value is displayed. |  |
| 3 | | Enter the desired output using numeric keys. Example: Enter value of 55 |  |
| 4 |  | Press SET. |  |
| 5 |  | Press [ENTER]. |  |
| 6 | | The zero point is changed so that the current real input level becomes the desired output value. Setting completed |  |

Method using external adjustment switch

| Step | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 | Hold the switch counterclockwise (-) for approximately 3 sec. |  |
| 2 | When “ZERO DOWN▼“appears, turn OFF the switch. This enters “Zero adjustment mode to adjust to real level”. |  |
| 3-1 | Hold the switch counterclockwise (-). The readout reduces continuously. When the desired readout appears, turn OFF the switch. The normal condition is restored after approximately 10 sec. |  |
| 3-2 | Hold the switch clockwise (+). The readout increases continuously. When the desired readout appears, turn OFF the switch. The normal condition is restored after approximately 10 sec. |  |

2-4 : Operation start

Before operation start

Before starting operation, carry out the following final check.

- Check to see if the transmitter part cover is closed correctly.
- Tighten the lock on the front of the cover (fixing screw with hexagonal hole M3) with a hexagonal wrench.
- Make sure no coupling section of the pressure container is left unfastened and there is no looseness.

Start operation

Open the valve of the process coupling piping section and introduce the liquid to be measured into the chamber (liquid tank).

- ~Note
- *At this time, adjust the open level of the valve so that no drastic pressure/liquid level changes (including flashing) occur.*
 - *Make sure there is no liquid or gas leakage from the coupling of the pressure container such as the chamber and bonnet.*

When steady operation is reached

When the pressure, temperature, etc. reach a steady operation state, use the following procedure to check the output values.

- If the output value (display value) is not stable, perform a damping adjustment by SFC (see “Damping time constant” on page 2-52) or external adjustment switch (see “Damping adjustment” on page 2-76).
- When the glass gauge is provided together, compare the output values of this instrument with the readouts of the glass gauge liquid level and check to see if any output shift has occurred.

If an output shift has occurred, See “3-3 : When output shift is large” on page 3-8 to adjust it appropriately.

2-5 : Operation stop

Turn the power off.

When the instrument is not used for a long period of time (operation stopped) after the installation, it is recommended to remove the float.

2-6 : Operation using SFC

The SFC is used to check measured data and to change the set data of this instrument.

This chapter explains how to use the SFC to communicate with this instrument and gives the basics to be able to operate from the SFC.

For details of the SFC, see the SFC Instruction Manual (CM2-SFC100-2001).

The SFC that can be used with the SLX is SFC160/260 Ver.8.0 or newer.



WARNING

Always the SFC is a non-hazardous location, otherwise an explosion can result from an electrical discharge.

Principles of key operation


The following points should be noted when using the SFC keys.

- Slowly and firmly press the keys. If the screen does not respond, it means that the key input has not been accepted. Slowly press the key once again.
- If a key is pressed and the screen of the data display window does not change, the key may be invalid at that stage or the key may not be used in this instrument. Press necessary keys.
- If you have pressed the wrong key and want to redo the procedure from the beginning with the original factory settings, see Chapter 4 :Repair.

Interaction with screen


You can operate the SFC interactively.

Carry out interaction according to the following principles.

- To answer “Yes” to a question on the screen, press  .



Answering “Yes” to a question on the screen using a dedicated function advances a step to the next layer.

Answering “Yes” to “Do you quit?” returns the screen to the first layer.

- To answer “No” to a question on the screen, press  .

Answering “No” to a question on the screen using a dedicated function moves a step back to the layer at the previous level.

Answering “No” to “Do you quit?” returns the screen to the first screen of that function.

- To select a different function in the same layer, press  or  .

Correction of input

To redo input, use the following procedure.

When a wrong alphabetic character has been entered

First, press [ALPHA] to cancel the alphabetic mode, press [←] to move the cursor back by one space, press [ALPHA] again and reenter the alphabetic character.

When a wrong numeric value is entered

Press [←] to move the cursor back by one space and reenter the numeric value.

SFC keyboard

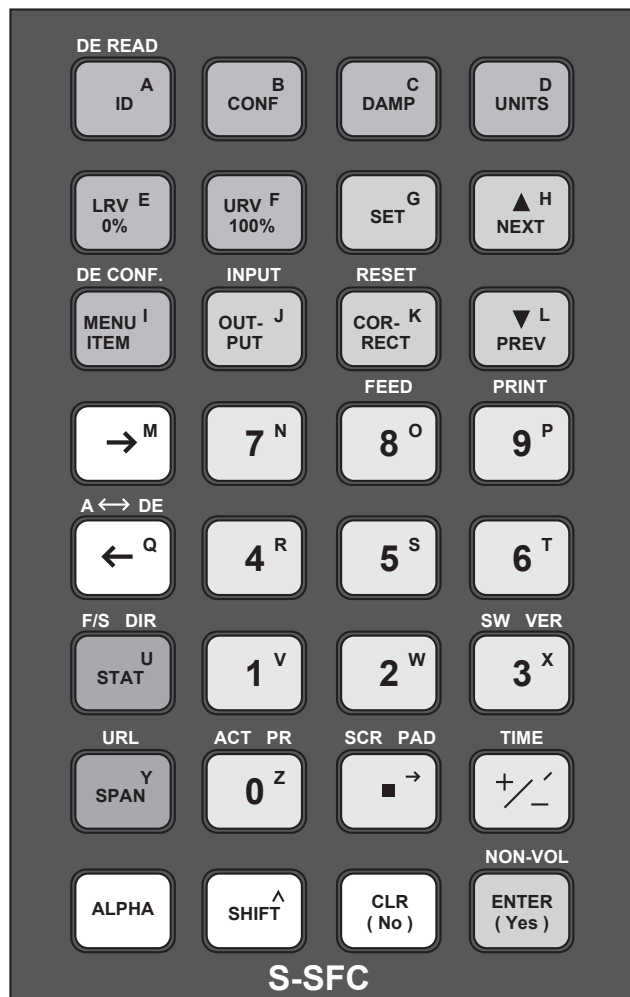





Figure 2-7 SFC keyboard

Basic operation of key input


To input or stop input of alphabetic characters, proceed as follow.

| Step | Procedure | Button |
|------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 | Press [ALPHA]. - A blinking cursor appears in the data display window. |  |
| 2 | Press the key of an letter you want to enter. - The letter entered appears. - Letters are marked on the top right corner of each key. | |
| 3 | To exit, press [ALPHA] again. |  |

To input a numeral or symbol or use a different function, use the following procedure.

| Step | Procedure | Button |
|------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | While a cursor is blinking in the data display window, press [ALPHA]. - “_” cursor appears. |  |
| 2 | Press the desired key. | |

To use a function displayed just above the key, use the following procedure.

| Step | Procedure | Button |
|------|----------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Press [SHIFT]. “SHIFT-” appears in the data display window. |  |
| 2 | Press the desired key. | |

SFC key functions

The SFC keys are color-coded according to main functions.

The SFC functions include functions common to other devices and functions only applicable to this instrument (dedicated functions).

The common functions can be operated by using LRV, URV, alphabetic character key, numeric key, etc. (Also includes functions used by pressing [SHIFT].)

The dedicated functions are organized in a hierarchic structure and are accessed by pressing [CONF].

The 32 keys on the keyboard are color-coded into five types according to their functions to make it easier for you to find the necessary keys.

The color codes are as follows.

CAUTION

There are also keys that will not be used for measurements using this instrument.






| Key color coding | Main functions |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green | <ul style="list-style-type: none"> - Starts communication with this instrument. - Enables functions dedicated to this instrument to be used. - Sets or changes measuring conditions. - Displays data set in this instrument. - Selects a menu. |
| Orange | <ul style="list-style-type: none"> - Displays measured data. - Selects a screen. - Saves data. |
| Yellow | <ul style="list-style-type: none"> - Enters a numeric value. - Prints data. - Allows a memo to be made. |
| Dark green | <ul style="list-style-type: none"> - Diagnostics. - Checks span of setting range. |
| White | <ul style="list-style-type: none"> - Moves the cursor in the data display window. - Changes the function of another color key. - Cancels the currently set content. |
| All | <ul style="list-style-type: none"> - Enters alphabetic character. (Used after pressing [ALPHA]) |



Green key functions

The functions of a green key when pressed with or without pressing [SHIFT] are described here.

Their main functions are to:

- Start communication with this instrument.
- Enable functions dedicated to this instrument to be displayed/changed.
- Display or change measuring conditions.
- Display data set in this instrument.
- Select a parameter (item).

| Display on key | Description | |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|  | <p>ID: Starts communication with this instrument.</p> <p>TAG NO. of this instrument appears.</p> <p>TAG NO. can be changed in this screen.</p> | <p>Used when converted output is DE.</p> <p>The function is the same as ID.</p> |
|  | <p>Dedicated function: For use of functions dedicated to this instrument.</p> <p>These dedicated functions are organized in a hierarchic structure. See “Dedicated functions” on page 2-32</p> | <p>No function</p> |
|  | <p>Damping: Shows current damping time constant. The damping time constant can be changed in this screen.</p> | <p>No function</p> |
|  | <p>No function</p> | <p>No function</p> |
|  | <p>LRV0%: Displays the lower range value of the current setting range. The lower range value can be changed in this screen.</p> | <p>No function</p> |

| Display on key | Description | |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|  | <p>URV100%: Displays the upper range value of the current setting range. The upper range value can be changed in this screen.</p> | No function |
|  | <p>Menu: This key by itself does not have a function. Used to select one data item from among a series of grouped functions. Used to display or select a variable.</p> | <p>DE CONF: Output in digital communication.</p> |

Orange key functions


The functions of an orange key when pressed with or without [SHIFT] are described here.

Their main functions are to:

- Display measured data.
- Select a screen.
- Type in data.

Alphabetic characters are entered by pressing the desired letter after pressing [ALPHA].

| Display on key | Description | |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
| | Setting: Automatically set in combination with other functions. | No function |
| | ▲: - Displays the next function in the same layer. - Pressing this key after [DAMP] sends a damping time constant next. | No function |
| | ▼: - Displays the previous function in the same layer. - Pressing this key after [DAMP] sends a damping time constant previous. | No function |
| | Output: Displays the output (%) of this instrument. Can be used as a constant current source in combination with a numeric key. (Maintenance function) | Input value: Displays the liquid level (mm) input to this instrument. |
| | Calibration: Used to calibrate the setting range. | Returns all set data to the original factory settings. |

| Display on key | Description | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|  A rectangular key with rounded corners. At the top, it says "NON-VOL". Below that, it says "ENTER" in a larger font, and "(Yes)" in a smaller font below "ENTER". | ENTER: Used to send data to this instrument. Used to answer "Yes" to a question on the screen. | Non-volatile data: Writes set data to a non-volatile memory of this instrument and data is retained even if power to this instrument is turned off. |





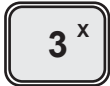
Yellow key functions






The functions of a yellow key when pressed with or without [SHIFT] are described here.

Their main functions are to:

- Print data
- Enter numeric value
- Allow a memo to be made.

This key becomes valid when a cursor appears on the screen.

| Display on key | Description | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
| PRINT  | 9: Enters numeric “9” | Data printing: Prints out a list of internal data of this instrument. This is called “maintenance print” (valid only for SFC with a printer) |
| FEED  | 8: Enters numeric “8”. | Paper feed: Pressing this key once advances the print paper by one line and sets a printer feed mode. Every time of 8 is pressed, it advances the sheet by one line. To cancel this function, press [CLR]. |
|  to  | 7 to 4: Enters numeric “7” to “4”. | No function |
| SW VER  | 3: Enters numeric “3” | Version: If the SFC is connected to this instrument, displays both software versions. If the SFC is not connected, only displays the SFC software version. |

| Display on key | Description | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|   | 2,1: Enters numeric “2”, “1”. | No function |
|  | +/-: Enters [+/-]. /: After pressing [ALPHA] once, enter “/”. | Time: Displays the current date and time (valid only for SFC with a printer). |
|  | ∴: Enters a decimal point. →: After pressing [ALPHA] once, enter a space. | Memo: Used to write a memo. |
|  | 0: Enter numeric “0” | Action print: Every time this function is used, response from this instrument is printed. This is called “action print”. To close this function, press [CLR] (valid only for SFC with a printer). |



Dark green key functions

The functions of a dark green key when pressed with or without [SHIFT] are described here.

Their main functions are to:

- Perform self-diagnosis of the SFC and this instrument.
- Display the span of the setting range.

Alphabetic characters are entered by pressing the desired letter after pressing the [ALPHA] key.

| Display on key | Description | |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|  | Diagnosis: Displays results of self-diagnosis of the SFC and this instrument. | “F/S processing B/O down” appears, but is unrelated to this setting. |
|  | Span: Displays the span of the current setting range. | URL: Displays the maximum value (float length) of the liquid level that can be measured by this instrument. |






White key functions

The functions of the white key are described here.

Their main functions are to:

- Move the cursor.
- Change the function of another key.
- Cancel the currently set content.

This key becomes valid when a cursor appears on the screen.

| Display on key | Description | |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| | When the key alone is pressed | When key is pressed after [SHIFT] |
|  | →: Advances the cursor by one space. | No function |
|  | ←: Moves the cursor back by one space. | Output mode change: Changes output mode from Analog to DE or DE to Analog. |
|  | The cursor can be changed by pressing this key. ↔■ | No function |
|  | Shift: If the cursor is other than ■, (_ or cursor is not displayed), this key is used to enter the function displayed above each key. | No function |
|  | Clear (No): Cancels the display in the data display window and sets the SFC in a state of waiting for input. Used to answer “No” to a question on the screen. | No function |




Dedicated functions

The following are the main dedicated functions of the SFC.

- Settings of basic functions
- Settings of basic data
- Display of serial number.
- Display of torque tube temperature
- Display of angle sensor temperature
- Display of input angle

The dedicated functions are organized in a hierarchic structure. Press the dedicated function key, and then conduct operations according to the instructions that appear displayed on the screen.




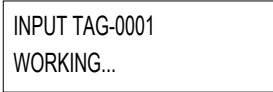
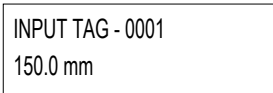
Operation when starting measurement

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1 | | Turn on the power to the SFC. | LOOP IN MANUAL ? |
| 2 |  | Make sure that the control loop has been set to “manual operation”. If it is not set to manual operation, press [ENTER]. | PRESS ID |
| 3 |  | Press [ID]. Communication with this instrument commences. | TAG NO. WORKING... |
| 4 | | TAG No. appears. Confirm whether the instrument is the one that is to be measured. | SLX TAG NO. SLX TAG - 0001 |
| 5 |  | Pressing [CLR] makes communication ready to start. | SLX TAG - 0001 READY... |

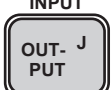
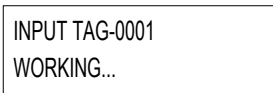
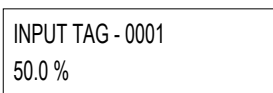
For the connection of the SFC, See “2-4 : Operation start” on page 2-18
Start all the following operations in this state (“READY...” state).

Display measured data


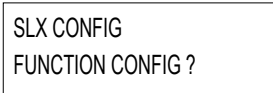
Liquid level input (mm)



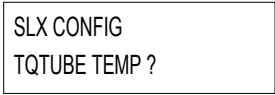

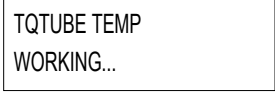


| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 |  | Press [SHIFT]. |  |
| 2 |  | Press [OUTPUT]. |  |
| 3 | | Displays the current liquid level. Updated approximately every 6 seconds. |  |

Output being transmitted (%)





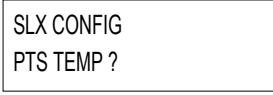





| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. |  |
| 2 | | Displays the current output. Updated approximately every 6 seconds. |  |

Torque tube temperature (°C)

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |





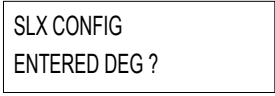

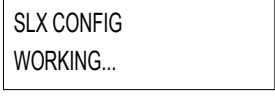


| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 2 |  or  | press [NEXT] or [PREV] to go to the torque tube temperature reading screen. |  |
| 3 | NON-VOL  | Press [ENTER]. |  |
| 4 |  | Displays the current torque tube temperature. Updated approximately every 6 seconds. Pressing [CLR] twice sets the mode back to the “Please perform next operation” state. |  |

Angle sensor temperature (°C)

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  or  | Press [NEXT] or [PREV] to go to the angle sensor temperature reading screen. |  |
| 3 |  | Press [ENTER]. Communication commences |  |
| 4 |   | Displays the current angle sensor temperature. Updated every approximately 6 seconds. Pressing [CLR] twice sets the mode back to the “Please perform next operation” state. |  |

Input angle

This is for service/maintenance purposes and is not required for normal usage.


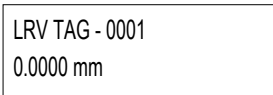
| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press the [CONF]. |  |
| 2 |  or  | Press [NEXT] or [PREV] to go to the sensor angle reading screen. |  |
| 3 | NON-VOL  | Press [ENTER]. |  |
| 4 |  | Displays the current sensor angle. Updated every approximately 6 seconds. Pressing [CLR] twice sets the mode back to the “Please perform next operation” state. |  |

Displaying and changing set data for measurement

Lower range value (LRV)

LRV: Liquid level (mm) outputting 0%

Display of lower range value


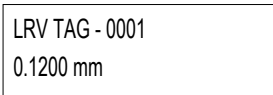
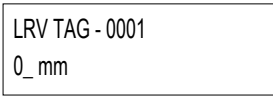

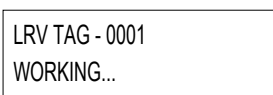
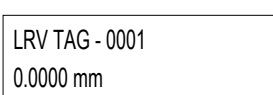
| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 |  | Press [LRV]. The current lower range value will appear. |  |

Changing lower range value

The allowable setting range is $\pm 2/3$ of the upper range value. If a value beyond the allowable setting range is entered, “ENTRY > SENS RNG” will appear on the lower row for 2 sec. and the former value will remain current.

Numeric input

Enter numeric values for the lower range value of the liquid level in millimeters.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [LRV]. The current lower value will appear. |  |
| 2 | | Enter the desired liquid level the using numeric keys. Example: Enter value of 0. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The lower range value is set to 0 mm. Setting completed. |  |


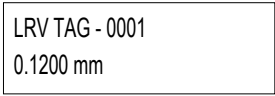

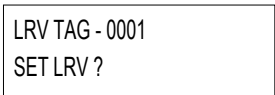

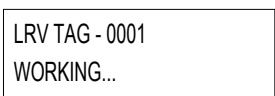
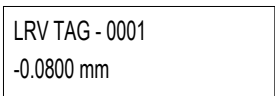
During an elevation, it is possible to set the lower range value using this method.

For example, when 10% of a range is desired: 0 to 300 mm is set as a lower limit value, $300 \text{ mm} \times 10\% = 30 \text{ mm}$, and so the lower range value is set to 30 mm.

However, since the upper range value at this time becomes 330 mm (the span remains unchanged at 300 mm), it is necessary to reset the upper range value to 300 mm (the span is therefore changed to 270 mm).


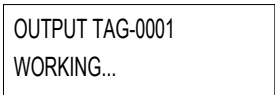
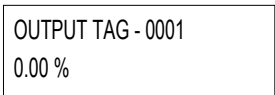

Actual level input


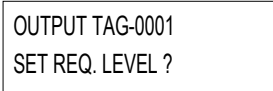



This input should be done while the liquid level is 0% equivalent.

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [LRV]. The current lower range value will appear. |  |
| 2 |  | Press [SET]. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The actual input level becomes the zero point. Setting completed. |  |

Zero adjustment that adjusts to the actual level (pinpoint adjustment)

Normal zero adjustment is performed by entering 0% while the liquid level is 0% equivalent.


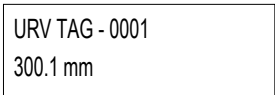
| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. |  |
| 2 | | The current output value will appear. |  |
| 3 | | Enter the desired output using numeric keys. Example: Enter value of 55 |  |

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 4 |  | Press [SET]. |  |
| 5 | | Press [ENTER]. |  |
| 6 |  | A zero adjustment is performed so that the actually input level becomes the level entered using numeric keys. Setting completed |  |

Upper range value (URV)

URV: Liquid level (mm) for outputting 100%

Display of upper range value


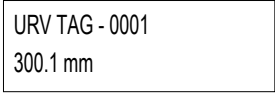
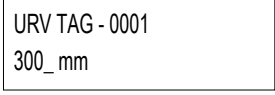

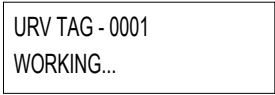
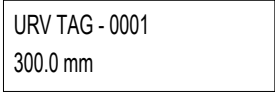
| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 |  | Press [URV]. The current upper range value will appear. |  |

Changing upper range value

Suppose the allowable setting range is a maximum of 1.7 times the range and the span exceeds 0.4 times the range. If a value beyond the allowable setting range is entered “ENTRY > SENS RNG” will appear on the lower row for 2 sec. and the former value will remain current.


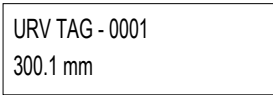



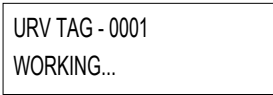
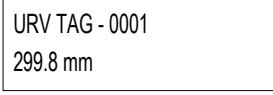
Numeric input

Enter the liquid level (mm) to be set as the upper range value using numeric keys.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [URV]. The current upper range value will appear. |  |
| 2 | | Enter the desired liquid level using numeric keys. Example: Enter value of 300. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The upper range value is set to 300 mm. Setting completed. |  |

Actual level input


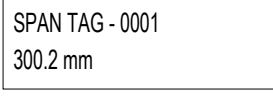
Enter the actual level while the liquid level is 100% equivalent.

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 |  | Press [URV]. The current upper range value will appear. |  |
| 2 |  | Press [SET]. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The actual input level becomes the upper range value. Setting completed. |  |

Span

This is a value of URV-LRV.

The span is for reference only and cannot be changed.


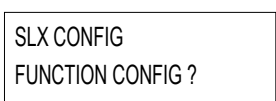


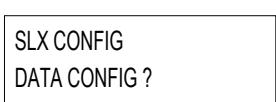

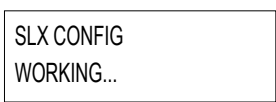
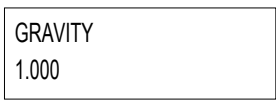
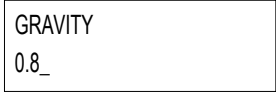




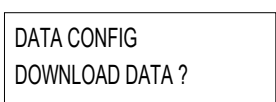
| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [SPAN]. |  |


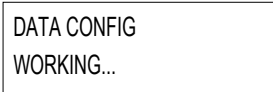
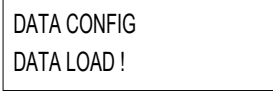
Specific gravity

Even if the specific gravity is changed, the span does not change, and only the calibration span angle (SENS SP) changes.

For measuring the interface, input the specific gravity of upper layer liquid and lower layer liquid.


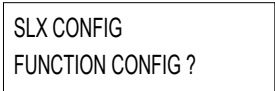


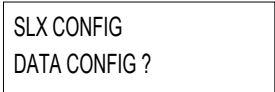

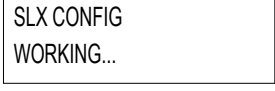
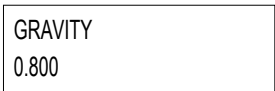






Display and change of specific gravity



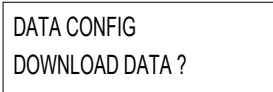

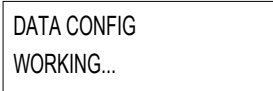

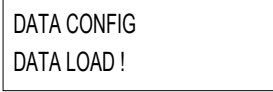
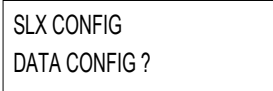
| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  or  | Press [NEXT] or [PREV] to go to the basic data setting screen. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The current specific gravity set value will appear. |  |
| 5 | | Enter the desired specific gravity using numeric keys. Example: Enter value of 0.8 |  |
| 6 |  | Press [ENTER]. |  |
| 7 |  or  | press [NEXT] or [PREV] to go to the download selection screen. |  |

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------|
| 8 |  | Press [ENTER]. |  |
| 9 | | Setting completed. |  |

Torque tube temperature coefficient

When the output shift from the process due to temperature is large, this change to the coefficient can reduce the shift. For the method of determining the coefficient, See “3-3 : When output shift is large” on page 3-8

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  or  | Press [NEXT] or [PREV] to go to the basic data setting screen. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The current specific gravity set value is displayed. Example: Enter value of 0.8 |  |
| 5 |  or  | Press [NEXT] or [PREV] to go to the temperature compensation coefficient setting screen. Example: 1 |  |
| 6 | | Enter the desired torque tube temperature coefficient using numeric keys. Example: Enter value of 1.2 |  |
| 7 |  | Press [ENTER]. |  |







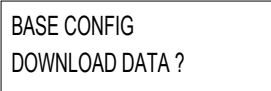

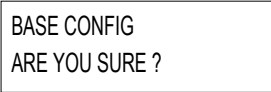

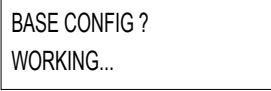


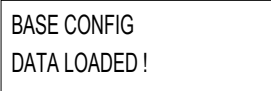
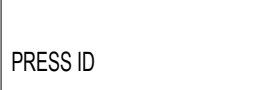
| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 |  or  | Press [NEXT] or [PREV] to go to the download selection screen. |  |
| 9 | NON-VOL  | Press [ENTER]. |  |
| 10 |  | Setting completed. Pressing [CLR] once set the mode back to the “Please perform next operation” state. |   |

Range

This refers to the length of the float. It is normally not required to change the range
 Pressing [SHIFT] + [SPAN] shows the range as an URL.


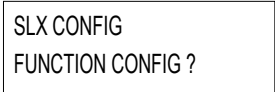


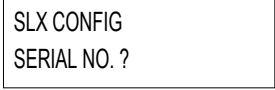

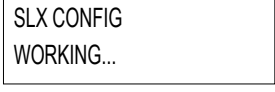
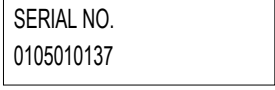


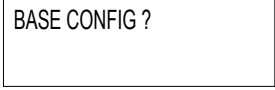
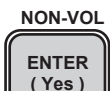
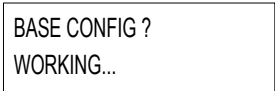











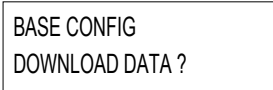

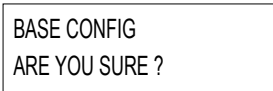

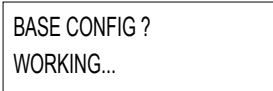
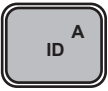


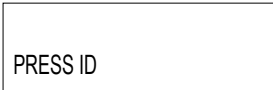
| Step | Button | Procedure | SFC screen |
|------|-------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | | Press [CONF]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX CONFIG FUNCTION CONFIG ? </div> |
| 2 | or | Press [NEXT] or [PREV] to go to the SERIAL No. screen. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX CONFIG SERIAL NO. ? </div> |
| 3 | NON-VOL | Press [ENTER]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX CONFIG WORKING... </div> |
| 4 | | The serial number will appear. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SERIAL NO. 0105010137 </div> |
| 5 | or | Press [NEXT] or [PREV] to go to the standard setting screen. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> BASE CONFIG ? </div> |
| 6 | NON-VOL | Press [ENTER]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> BASE CONFIG ? WORKING... </div> |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | | The current range will appear. |  |
| 8 | | Enter the desired range using numeric keys. Example: Enter value of 500 |  |
| 9 |  | Press [ENTER]. |  |
| 10 |  or  | Press [NEXT] or [PREV] to go to the download selection screen. |  |
| 11 |  | Press [ENTER]. A confirmation screen will appear. press [CLR] to return. |  |
| 12 |  | Press [ENTER]. |  |
| 13 |   | Setting completed. Pressing [ID] and [CLR] sets the mode back to the “Please perform next operation” state. |   |

Offset angle





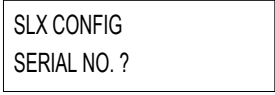

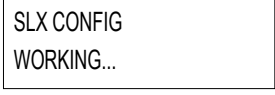
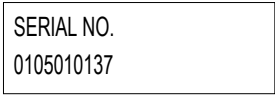




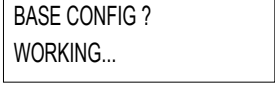

This is normally not required to be changed. (However, be sure to set the offset angle when replacing the transmitter part.)



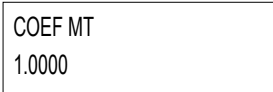
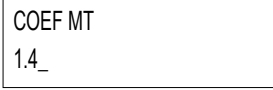




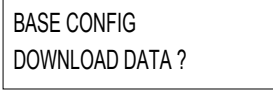

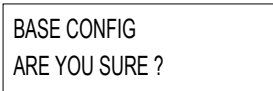

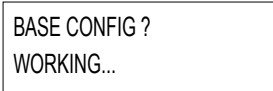



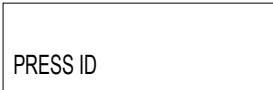
| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  OR  | Press [NEXT] or [PREV] to go to the SERIAL No. screen. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The serial number will appear. |  |
| 5 |  OR  | press [NEXT] or [PREV] to go to the standard setting screen. |  |
| 6 |  | Press [ENTER]. |  |
| 7 | | The current range will appear. |  |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 |  or  | Press [NEXT] or [PREV] to go to the offset angle screen. The current offset angle will appear. |  |
| 9 | | Enter the desired offset angle using numeric keys. Example: Enter value of 0.547 |  |
| 10 | NON-VOL  | Press [ENTER]. |  |
| 11 |  or  | Press [NEXT] or [PREV] to go to the download selection screen. |  |
| 12 | NON-VOL  | Press [ENTER]. A confirmation screen will appear. press [CLR] to return. |  |
| 13 | NON-VOL  | Press [ENTER]. |  |
| 14 | DE READ   | Setting completed. Pressing [ID] and [CLR] sets the mode back to the “Please perform next operation” state. |   |


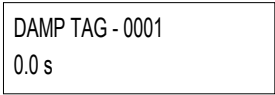


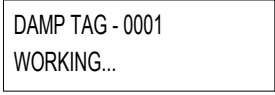
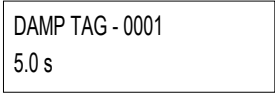
Material coefficient

This is normally not required to be changed.

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  OR  | Press [NEXT] or [PREV] to go to the SERIAL No. screen. |  |
| 3 |  | Press [ENTER]. |  |
| 4 | | The serial number will appear. |  |
| 5 |  OR  | Press [NEXT] or [PREV] to go to the standard setting screen. |  |
| 6 |  | Press [ENTER]. |  |
| 7 | | The current range will appear. |  |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 |  or  | Press [NEXT] or [PREV] to go to the material coefficient screen. The current material coefficient will appear. |  |
| 9 | | Enter the desired material coefficient using numeric keys. Example: Enter value of 1.4 |  |
| 10 | NON-VOL  | Press [ENTER]. |  |
| 11 |  or  | Press [NEXT] or [PREV] to go to the download selection screen. |  |
| 12 | NON-VOL  | Press [ENTER]. A confirmation screen will appear. press [CLR] to return. |  |
| 13 | NON-VOL  | Press [ENTER]. |  |
| 14 | DE READ   | Setting completed. Pressing [ID] and [CLR] sets the mode back to the “Please perform next operation” state. |   |

Damping time constant

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 |  | Press [DAMP]. The current damping time constant value will appear. |  |
| 2 |  or  | Press [NEXT] or [PREV] to select the desired damping time constant. |  |
| 3 | | The damping time constant is changed. Setting completed. |  |

Allowable damping time constants (sec.): 0, 0.5, 1, 2, 3, 4, 5, 10, 50, 100

Factory setting: 2.0 s

Printing

The set data of this instrument or response results from this instrument can be printed and saved using the SFC with a printer.

There are two types of printing functions, which are “Maintenance printout” and “Action printout”, and these are used for different purposes by key operations.


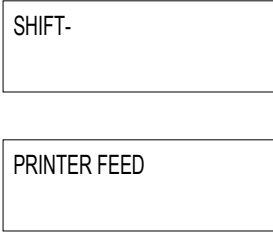

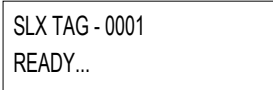
This is a thermal printer which prints 24 characters per line.

When the power of the SFC is turned on, the print head makes a to-and-fro movement once and stops, and then the printer is on stand-by.

At this time, the recording paper advances approximately 5 mm.

How to feed recording paper

Use the following procedure to feed recording paper.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [SHIFT] then 8 in that order. - The recording paper advances 1 line and paper feed mode is set. - Recording paper advances 1 line every time 8 is pressed. |  |
| 2 |  | To cancel the paper feed mode, press [CLR]. |  |

Maintenance printout


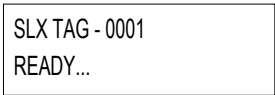



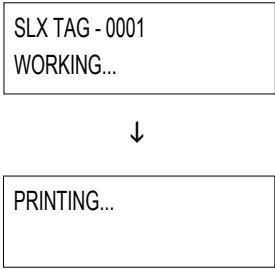

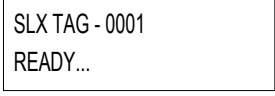
This is a function to print out the internal data (tag No., damping time constant, output range, input value, output value, etc....)of this instrument.

Can be used to record such things as the setting condition and fault condition of this instrument.

Procedure

Maintenance printout is performed using the following procedure.

This operation can also be performed during measurement.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CLR] until the screen to the right appears. |  |
| 2 |  | Press [SHIFT]. |  |
| 3 |  | Press [9]. - Printing starts. |  |
| 4 |  | To stop printing, press [CLR]. |  |

Examples of maintenance printout

| Printing example | Meaning |
|---------------------------|----------------------------------------------------------------------------------------------------------|
| '01-01-01 08:30 | Date/time |
| Tag No. SLX-0001 | Tag No. |
| Type : SLX | Sensor type (printed as SLX) |
| ANA/DE : ANALOG XMTR | Output mode (analog, DE) |
| SER1# : 9909141101 | Serial number |
| SW VER : 3.0 | S/W version |
| DAMP : 10.0 s | Damping time constant |
| SPAN : 301 mm | Span |
| LRV : 0 mm | LRV |
| URV : 300 mm | URV |
| RANGE : 300 mm | Range |
| GRAVITY : 1.000 | Specific gravity (specific gravity to be set in basic data setting) |
| COEF TQ : 0.954 | Torque tube temperature coefficient (COEF TQ set in basic data setting) |
| DIGITAL METER | |
| TYPE : ENG. UNIT (4.5DIG) | Display format (%(0.0), real memory (4.5 digits)) |
| EUHI : 150 | Engineering unit (real scale) upper limit |
| EULO : -150 | Engineering unit (real scale) lower limit |
| F/SAFE DOWNSCALE | Burnout direction (B/O-NON, B/O-UP, B/O-DOWN) |
| INPUT : 150mm | Input value |
| OUTPUT : 50.0% | Output value |
| TQTT : T=200°C | Torque tube temperature |
| PTST : T=25.0°C | Angle sensor temperature |
| OFFSET : 0.1234 | Offset angle (OFFSET to be set in basic data setting) |
| COEF MT : 1.000 | Material coefficient (COEF MT to be set in basic data setting) |
| SENS IN : 3.060 | Input angle |
| SENS LO : 3.460 | Calibration lower limit angle |
| SENS SP : -0.800 | Calibration span angle |
| STATUS CHECK= OK | Self-diagnostic result (In the event of an error, status messages generated are printed sequentially) |


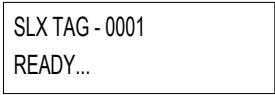


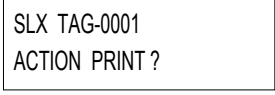

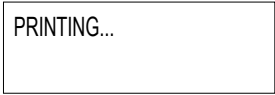




Action printout


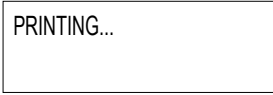
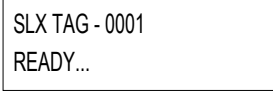
This is a function to print out this instruments response to every key operation of the SFC.

Procedure

Use the following procedure to print data.

This operation can also be conducted during measurement.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | press [CLR] until the screen to the right appears. |  |
| 2 |  | Press [SHIFT] and 0 in that order. |   |
| 3 |  | Press [ENTER]. The following content will be printed. *Action print* start TAG. NO. TAG-0001 (tag No.) '98.12.10 13:10 (date) |   |
| 4 | | After this, response results from this instrument are printed for every key operation. | |
| 5 |  | To cancel this printing function, press [SHIFT] and 0 in that order. |   |

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 |  | Press [CLR]. * Action print* end is printed and printing is finished. |   |

Example of action printout

A printout example which corresponds to key operations is shown below.

Key operation

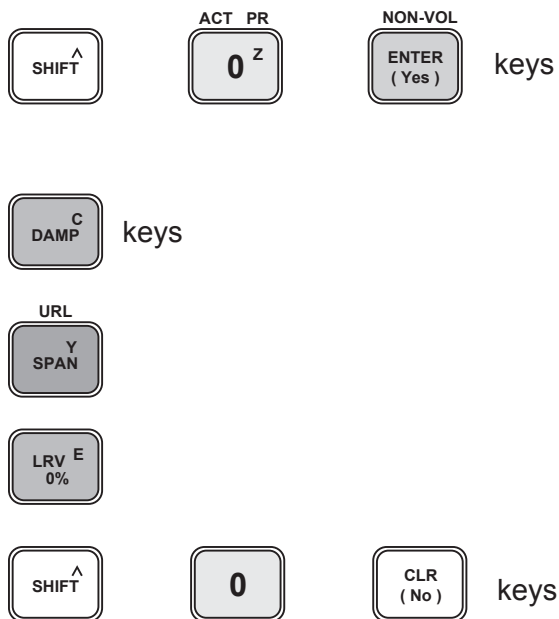


Diagram illustrating key operations:

- SHIFT [^]
- ACT PR 0 ^Z
- NON-VOL ENTER (Yes)
- keys
- DAMP ^C keys
- URL Y SPAN
- LRV ^E 0%
- SHIFT [^]
- 0
- CLR (No)
- keys

Printing example of corresponding action printout

```

* ACTIONPRINT * START
TAG. No. TAG-0001
'01. 07. 10 16:11

DAMP TAG-0001
0.0 s

SPAN TAG-0001
300.0 mm

LRV TAG-0001
0.000 mm

* ACTION PRINT * END
    
```

Action Printout Example

Display and change of setting of this instrument**Changeable and non-changeable data**

✓ : Changeable -: Not changeable





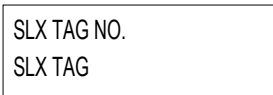

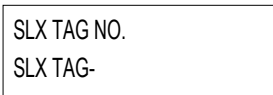
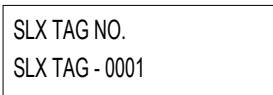

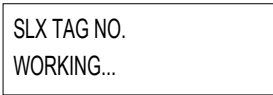
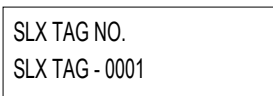
| Item | Display | Change |
|------------------------------------------------|----------------|---------------|
| Tag No. | ✓ | ✓ |
| Serial number | ✓ | - |
| Software version | ✓ | - |
| Indicator display format | ✓ | ✓ |
| Engineering unit value (real scale) URV/LRV | ✓ | ✓ |
| Burnout direction | ✓ | ✓ |

Tag No.





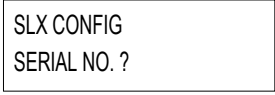



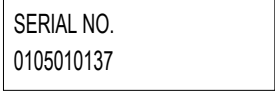
Once communication with this instrument has started, set the tag No. using the following procedure.

The tag No. is given on the identification plate of this instrument.

Here, a case where the tag. No is to be changed to “TAG-0001” is given.

| Step | Button | Procedure | SFC screen |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |   DE READ   | Press [ALPHA], [6], [ID] and [SET] in that order. |  |
| 2 | TIME  | Press [ALPHA] and [+/-] in that order. |  |
| 3 | | Press enter value of 0001 in that order. |  |
| 4 | NON-VOL  | Press [ENTER]. - A tag No. “TAG-0001” is set. |  ↓  |

Serial number

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  or  | press [NEXT] or [PREV] to go to the SERIAL No. screen. |  |
| 3 | NON-VOL  | Press [ENTER]. |  |
| 4 |  | The serial number will appear. Pressing [CLR] twice sets the mode back to the “Please perform next operation” state. |  |




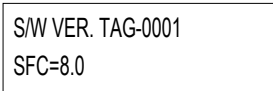
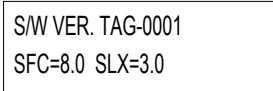

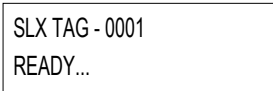
Software version

The software versions of the SFC and this instrument can be displayed using the SFC.

Use the following procedure to display the software versions.




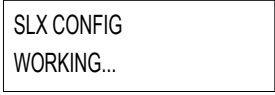
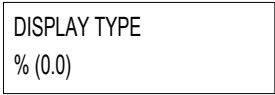

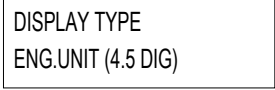


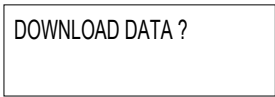

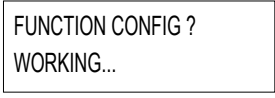

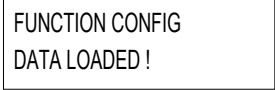
SFC: 8.0

This instrument: 3.0

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Press [SHIFT]. |  |
| 2 |  | Press [3]. |   |
| 3 |  | After confirming the software versions, press [CLR]. |  |




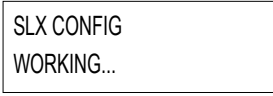
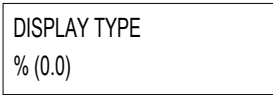

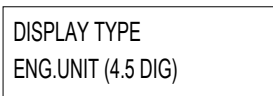

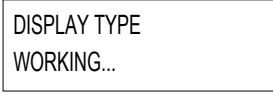



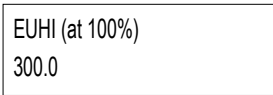
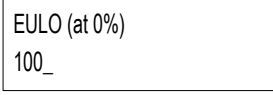

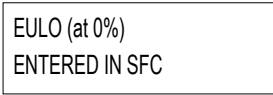
Indicator display format



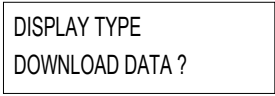

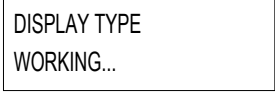

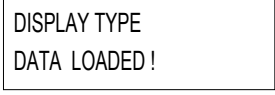
Only two types; PV value and engineering unit value (real scale) are available.

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  | Press [ENTER]. |  |
| 3 | | The current display format appears. Example: PV value. |  |
| 4 |  | Press [MENU] and select a display format. Example: engineering unit value (real scale). |  |
| 5 |  or  | press [NEXT] or [PREV] to go to the download selection screen. |  |
| 6 |  | Press [ENTER]. |  |
| 7 |  | Setting completed. It takes approximately 6 sec. until the entry comes up in the display. Pressing [CLR] once sets the mode back to the “Please perform next operation” state. |  |

Engineering unit value

Upper range value/lower range value

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  | Press [ENTER]. |  |
| 3 | | The current display format appears. Example: PV value |  |
| 4 |  | Press [MENU] and select a display format. |  |
| 5 |  | Press [ENTER]. |  |
| 6-1 | | The current engineering unit value (real scale) will appear. |  |
| 6-2 |  or  | To set an upper range value, press [NEXT] or [PREV] to go to the engineering unit upper range value setting screen and set the upper range value. |  |
| 7 | | Enter the desired engineering unit upper range value using numerical keys. Example: Enter value of 100 |  |
| 8 |  | Press [ENTER]. |  |

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 9 |  or  | press [NEXT] or [PREV] to go to the download selection screen. |  |
| 10 | NON-VOL  | Press [ENTER]. |  |
| 11 |  | Setting completed. It takes approximately 6 sec. until the entry comes up in the display. Pressing [CLR] twice sets the mode back to the “Please perform next operation” state. |  |

Burnout direction

Burnout takes place when an SFC diagnostic result shows a serious fault or equivalent.

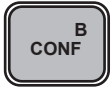
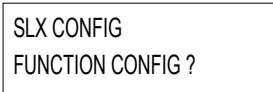

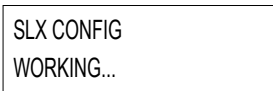
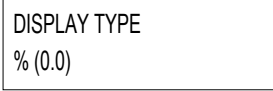


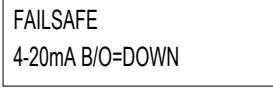

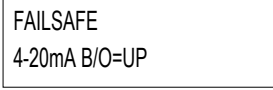
A selection can be made from the following three types. Burnout direction LRV is set at the time of shipment.



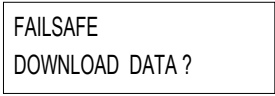

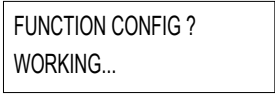

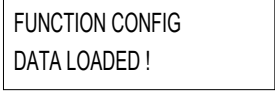
- No burnout direction (B/O-NON): Outputs the current output as is.
- Burnout direction URV (B/O-UP): Forcibly scales out the output beyond the URV (independent of input value).
- Burnout direction LRV (B/O-DOWN): Forcibly scales out the output below the LRV (independent of input value).

Upon recovery from the fault condition, a normal value is output automatically.

With the SLX, it is not possible to confirm the burnout direction using [SHIFT]+[STAT]. “DOWN SCALE” appears, but this display content has no effect.

To set or confirm the burnout direction, see the following. Data is printed with the set data is regards to the burnout direction.

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |
| 2 |  | Press [ENTER]. |  |
| 3 | | The current display format will appear. Example: PV value display |  |
| 4 |  or  | press [NEXT] or [PREV] to go to the burnout setting screen. Example: Burnout DOWN |  |
| 5 |  | Press [MENU] to select the desired burnout setting. Example: Burnout UP |  |

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 6 |  or  | press [NEXT] or [PREV] to go to the download selection screen. |  |
| 7 | NON-VOL  | Press [ENTER]. |  |
| 8 |  | Setting completed. It takes approximately 6 sec. until the entry is comes up in the display. Pressing [CLR] once sets the mode back to the “Please perform next operation” state. |  |

DE output format

When digital (DE) output is used, the output signal mode and information quantity mode, etc. should be set. Here, these will be explained focusing on their operations.

Using the digital (DE) output as the output format of the SLX allows bi-directional communication between the SLX and the host system. At this time, three types of setting are available (necessary) according to operations carried out by means of communication.

Output signal mode setting

Select the type of data to be output from three of the following:

- Single range
- Dual range
- Single range & secondary variable (Single range W/SV) (this mode cannot be set)

Information quantity setting

Select the number of bytes of data to be output from among the following two:

- DE-6 bytes (DE-6 BYTE)
- DE-4 bytes (DE-4 BYTE) (this mode cannot be set)

Fail-safe mode setting

Select the type of fail-safe.



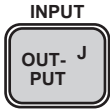
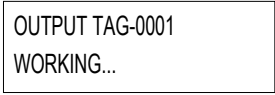

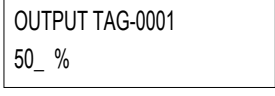

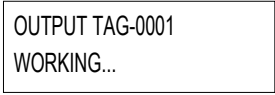
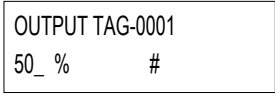
CAUTION

Since the fail-safe mode is set by the host system, this selection has no effect.

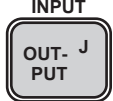
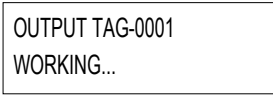


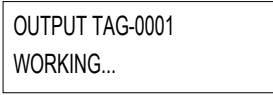

Constant current source mode

Constant current source mode setting

Example: When output is fixed to 50% (12 mA)

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. |  |
| 2 | | The current output data will appear. Example: 65.2% |  |
| 3 | | Enter 50% using numeric keys. |  |
| 4 |  | Press [ENTER]. |  |
| 5 | | The 50% constant current source mode is set. A “#” will appear. 12 mA is output and the indicator display starts to blink. |  |

Cancellation of constant current source mode

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. |  |
| 2 | | The current output data will appear. Example: 50.0% |  |
| 3 |  | Immediately, press [CLR]. |  |
| 4 | | The system has recovered from the constant current source mode. The “#” disappears. |  |

Memo recording


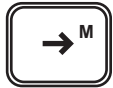

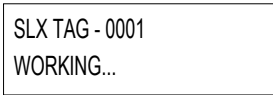

The function of recording a memo in the SFC is called a “scratch pad”.









There are scratch pad 1 and scratch pad 2.




Writing to scratch pad 1

Use the following procedure write data to scratch pad 1.

Here, “01-7 ZERO CHECK” (means “a zero adjustment check was conducted in July 2001”) is entered.





| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |   | Press [SHIFT] and [→] in that order. - SCR-PADSSCR-PADS is set by default. |   ↓  |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| 2 | <p>ACT PR</p>   <p>TIME</p>   | <p>Press [0], [1], [+/-] and [7] in that order.</p> |  |
| 3 |   | <p>Press [ALPHA] and [→] in that order.</p> |  |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 |  | <p>Press [0], [URV], [4], [8], [→], [DAMP], [NEXT], [LRV], [DAMP] and [CORRECT] in that order.</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>MEMO 1 01-7 ZERO CHECK</p> </div> |
| 5 |  | <p>Press [ENTER]. - The writing to scratch pad 1 has been completed.</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>MEMO WORKING...</p> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>MEMO 1 01-7 ZERO CHECK</p> </div> </div> |
| 6 |  | <p>- To exit scratch pad 1, press [CLR].</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>SLX TAG - 0001 READY...</p> </div> |

Writing to scratch pad 2

Use the following procedure to write data to scratch pad 2.

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |   | Press [SHIFT] and [→] in that order. The content of scratch pad 1 is displayed. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SHIFT-</div> <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 WORKING...</div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">MEMO 1 01-7 ZERO CHECK (or xxxxxxxx)</div> |
| 2 |  | Press [NEXT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">MEMO 1 SCR-PADSSCR-PADS</div> |
| 3 | | The writing method is the same as that of scratch pad 1. | |
| 4 |  | - To exit scratch pad 2, press [CLR]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 READY...</div> |

Charging SFC

If “.” appears blinking in the center of the upper row on the SFC screen, this means that the voltage of the built-in battery is dropping. Immediately charge the battery.

Leaving the battery unattended will shorten the life of the battery.

The time required for charging is as follows:

- Non-explosion-proof type SFC: Approximately 6 hours
- Intrinsically explosion-proof type SFC: Approximately 10 hours

WARNING

Charging should be performed in a non-hazardous area.

Procedure

Use the following procedure to change the battery.

Use the provided battery charger only.

| Step | Procedure |
|-------------|-------------------------------------------------------------------------------------------------|
| 1 | Turn OFF the power to the SFC. |
| 2 | Disconnect the communication cable on the transmitter side. |
| 3 | Pull out the SFC plug of the communication cable. |
| 4 | Connect the plug of the battery charger cable to the SFC. |
| 5 | Connect the plug of the battery charger main unit to an 100 VAC receptacle. Charging starts. |
| 6 | After a predetermined charging time has passed, remove the battery charger to finish charging. |

2-7 : Operation of external adjustment switch (with indicator)

Data can be read by the SFC even while the external adjustment switch is in operation. What is read is data immediately before the adjustment mode was entered.

~Note :

- *If an SFC communication has been started while operating the external adjustment switch, adjustment will be stopped as long as the communication continues.*
- *In the case of the DE output mode, the external adjustment switch cannot be used.*
- *The change is reflected in the output after the normal condition is recovered from the adjustment mode.*
- *Do not use a magnetic driver because this may prevent accurate adjustment.*
- *In the case of an engineering unit (real scale) display format, it may take a few seconds after each adjustment mode is entered until a correct value is displayed.*
- *Start operation after correct value appears.*

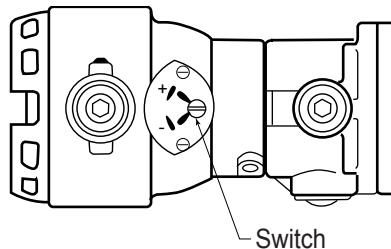


Figure 2-8 Switch position

Basic operation method

While pushing in the switch toward the back using a flat-head screwdriver, turn the switch clockwise (+) or counterclockwise (-).

Function



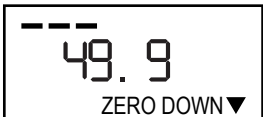

- Zero adjustment to adjust to real level (pinpoint adjustment)
- Damping adjustment
- Zero span adjustment

The operation sequence of the entire external adjustment switch is given on “Operation sequence” on page 2-79.

Operation procedure





Zero adjustment to adjust to real level (pinpoint adjustment)

- Example of use: To adjust output to reading of liquid level of glass gauge
- Adjustment range: -1.25% (output 3.8 mA) to +105% (20.8 mA)
- Even in the case of engineering unit value (real scale), the digital display in “pinpoint adjustment” is a PV value display.

| Step | Procedure | LCD screen |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch counterclockwise (-) for approximately 3 sec. |  |
| 2 | When “ZERO DOWN ▼” appears, on the display turn switch OFF. This means that the “Zero adjustment mode to adjust to real level” has been activated. |  |
| 3-1 | As the switch is held counterclockwise (-) the readout decreases by increments of 0.1%. When the desired readout appears, turn the switch OFF. The normal condition is restored after approximately 10 sec. |  |
| 3-2 | As the switch is held clockwise (+), the readout increases by increments of 0.1%. When the desired readout appears, turn the switch OFF. The normal condition is restored after approximately 10 sec. |  |

Damping adjustment

- Satisfiable damping time constant (sec.):
- The cyclic direction does not change (from 0 to 100, not from 100 to 0)
- Caution: “199.9” is not a damping time constant.



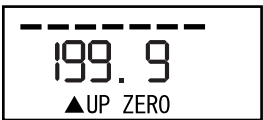


| Step | Procedure | LCD screen |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch clockwise (+) for approximately 3 sec. |  |
| 2 | When “▲UP ZERO” appears on the display, turn the switch OFF. This means that the “Damping adjustment mode” has been activated. |  |
| 3-1 | Every time the switch is turned counterclockwise (-) one turn, the damping time constant decreases by an increment of 1. The normal condition is restored after approximately 10 sec. |  |
| 3-2 | Every time the switch is turned clockwise (+) one turn, the damping time constant increases by an increment of 1. The normal condition is restored after approximately 10 sec. |  |

Zero span adjustment

- Zero adjustment can also be performed from “pinpoint adjustment”.
- The set value immediately before the “zero span adjustment mode” was entered is used as the damping time constant during zero span adjustment.
- In the case of an engineering unit value (real scale) display, the digital display in “zero span adjustment” is engineering unit value (real scale) display.



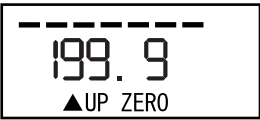
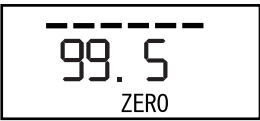

Zero adjustment

Carry out zero adjustment by giving 0% equivalent input.

| Step | Procedure | LCD screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch clockwise (+) for approximately 3 sec. |  |
| 2 | When "▲UP ZERO" appears on the display, turn the switch OFF. This means that the "Damping adjustment mode" has been activated. |  |
| 3 | Turn the switch counterclockwise (-) and "199.9" below "0" will appear. |  |
| 4 | "ZERO" appears after approximately 10 sec. and "Zero span adjustment mode" is activated. The current output value is displayed. If zero adjustment is not performed, the normal condition will be restored after approximately 30 sec. |  |
| 5 | Hold the switch counterclockwise for approximately 3 sec. When "ZERO DOWN▼" appears, turn the switch OFF. The current input becomes the zero point. After approximately 2 sec., the normal condition will be restored. |  |

Span adjustment

Perform span adjustment by giving 100% equivalent input.

| Step | Procedure | LCD screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | Hold the switch clockwise (+) for approximately 3 sec. |  |
| 2 | When “▲UP ZERO” appears, turn the switch OFF. This means that the “Damping adjustment mode” has been acticated. |  |
| 3 | Turn the switch counterclockwise (-) “199.9” below “0” will appear. |  |
| 4 | “ZERO” appears after approximately 10 sec. and “Zero span adjustment mode” is activated. The current output value is displayed. If zero adjustment is not performed, the normal condition will be restored after approximately 30 sec. |  |
| 5 | Hold the switch clockwise (+) for approximately 3 sec. When “▲UP ZERO” appears, turn the switch OFF. The current input becomes the zero point. After approximately 2 sec., normal condition will be restored. |  |

Operation sequence

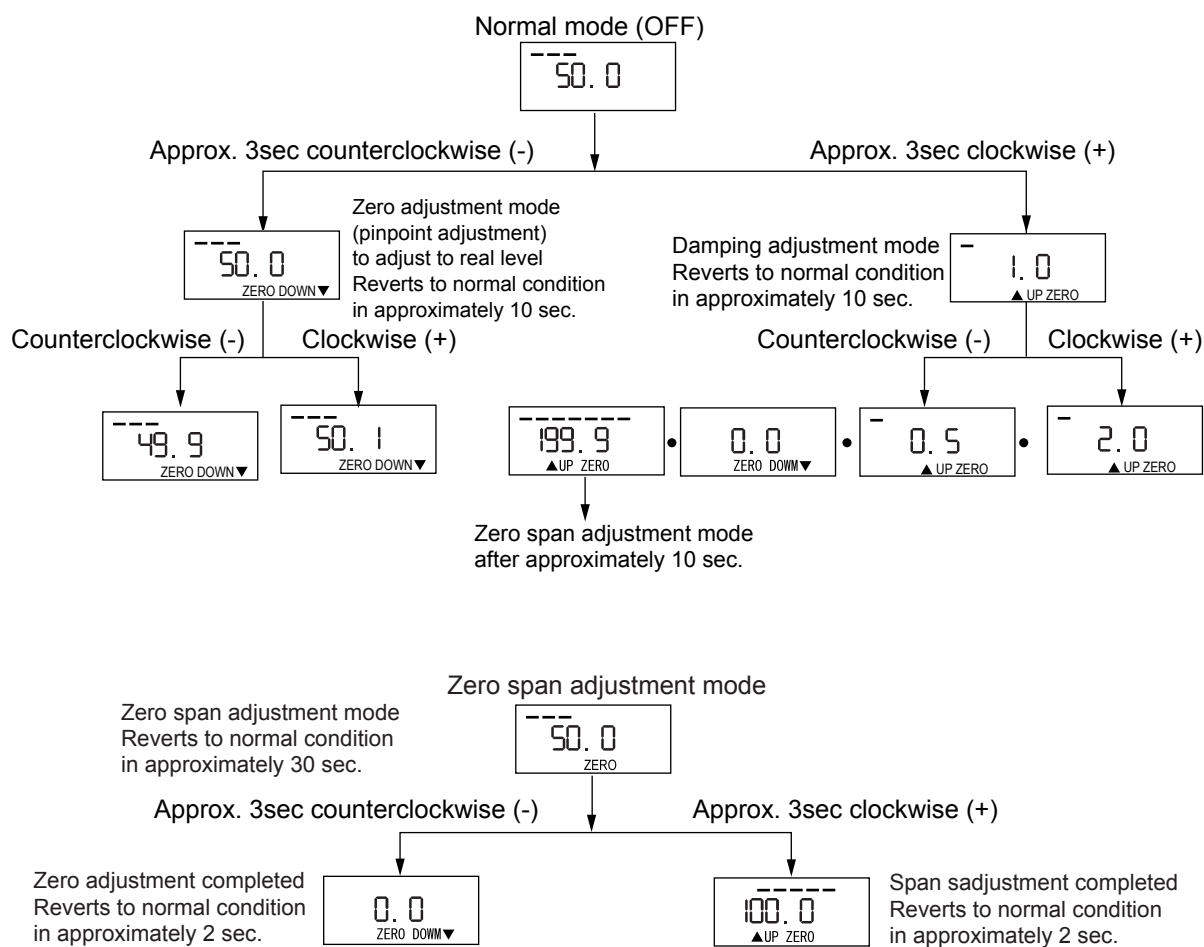


Table 2-2:

| Adjust mode | Indicator display |
|----------------------|-------------------|
| Normal status | (none) |
| Pinpoint adjustment | ZERO DOWN ▼ |
| Damping adjustment | ▲UP ZERO |
| Zero-span adjustment | ZERO |

Chapter 3 : Maintenance

WARNING

-
- Do not use the instrument beyond the rated pressure, connection specification and rated temperature specified for the instrument. This may result in serious accident due to damage.
 - Wiring in an explosion-proof area should be performed according to the work procedure specified in the explosion-proof guideline.
-

CAUTION

-
- After installation, do not use this instrument as a foothold, etc. This may damage the instrument or may result in physical injury
 - Avoid hitting the glass part of the display with tools. This may damage the glass and result in physical injury.
 - Perform installation correctly. Insufficient installation or no installation may result in output errors or violate applicable regulations.
 - This product is heavy. Pay attention to the scaffolding and wear safety shoes.
-

3-1 : Daily maintenance items (to be carried out during operation with instrument installed on the process)

Visual inspection

Check for the following items.

- Fracture, corrosion, or damage of components
- Leakage from flange section.
- Noize when the chamber (liquid tank) touches the float due to vibration
- Error display on indicator
- Check whether reading is stable or not

Zero adjustment

If there is any difference evident from the level gauge, conduct “Operation of external adjustment switch (with indicator)” on page 2-74.

3-2 : Items of periodic maintenance check

Verification of functions

- With the device installed on process equipment, run a functional check with water filled in chamber (or, use water in lieu of process fluid) by varying water level. Or, remove the main body and run a functional check by calibrating weight.
- If specified accuracy is not achieved, perform following maintenance checks.

~Note *The guaranteed accuracy of SLX is by means of weight calibration.*

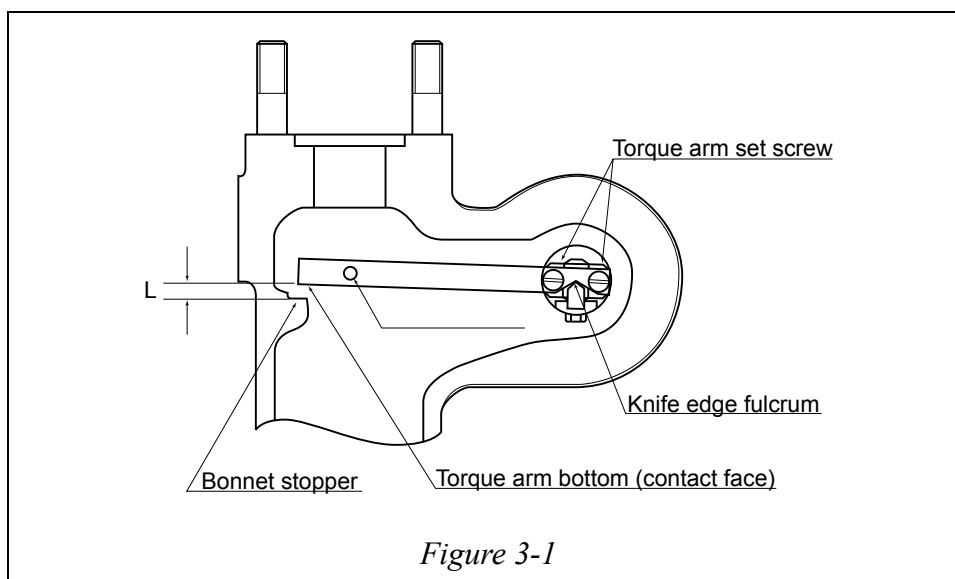
Disassembly and cleaning of wetted parts

If rated accuracy is not achieved by a test as described in 1) above, or if the measured fluid is of high viscosity, adhesive or extremely corrosive, disassemble/clean as follows:

For description/nomenclature of parts, refer to “Names of components and parts” on page 1-1, “Principles of operation” on page 2-1 and drawings at the end of this manual.

Primary disassembly/cleaning (when inside of torque tube housing is not cleaned)

- If there is no deposit inside of the torque tube housing or on the knife-edge pivot, primary disassembly/cleaning is recommended.
- Disassemble SLX into two or three parts and clean in the following order:
 - External tube type: Body, float and chamber
 - Internal tube type: Body and float

Body (torque arm, bonnet, torque tube housing assembly):

- Remove deposit from bonnet stopper, if any,
- Remove deposit from torque arm pin or lower face on torque arm pin (contact face), if any,

~Note *If accumulation of deposit makes the distance between bonnet stopper and lower surface of torque arm (contact surface) too short, they may contact before liquid level becomes zero, resulting in unsatisfactory accuracy (linearity).*

Float

- Remove deposit from the surface of float, if any.

~Note *If weight or dimension of float changes, measured accuracy (zero, span) will be affected.*

- If float is corroded, its replacement is recommended.

Chamber

- Remove sedimentation from the bottom of chamber, if any,
- Steam clean or chemically cleanse inside of chamber if there is any deposit on the side of chamber.

~Note *If accumulation of deposit makes distance between chamber and float too short, they may contact during operation, resulting in reduced accuracy (zero, span or linearity)*

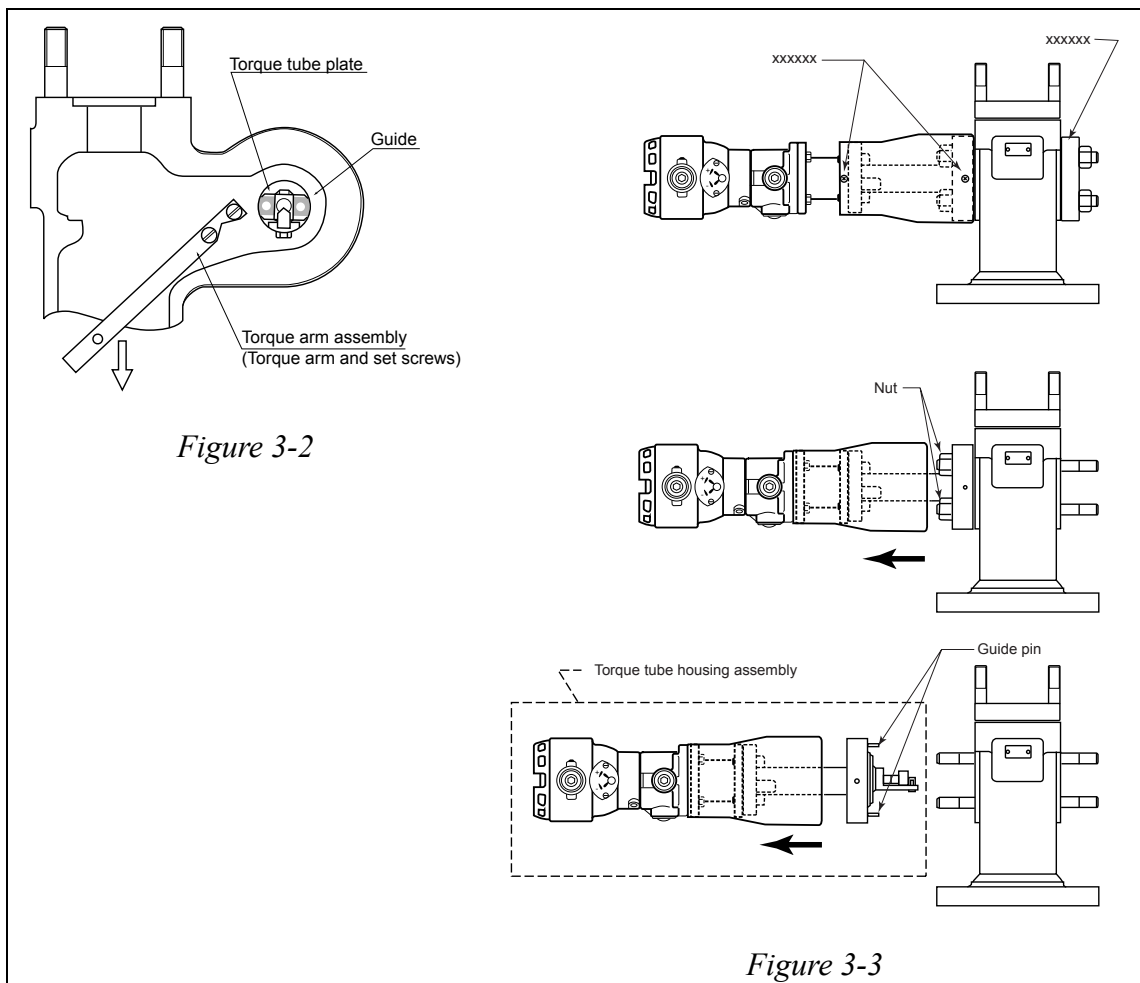
Secondary disassembly/cleaning (cleaning inside of torque tube housing)

- If any deposit is found inside of torque tube housing or knife-edge pivot, secondary disassembly/cleaning is recommended.
- Continue disassembly after completing initial assembly as follows. Note that the secondary disassembly involves removal of small parts, hence exercise care in loss or dropping of these parts.

Disassembly of main body (torque arm, bonnet and torque tube housing assembly)

- Remove blind flange on the side of bonnet.
- Loosen torque arm mounting screws alternately and remove torque arm. Extract torque arm from bonnet flange.
- Remove cover mounting screws (4 pcs.) and slide the cover to the instrument side to expose mounting nut.

Remove mounting nut and slowly extract torque tube housing assembly horizontally from bonnet.



Torque arm

- Remove deposit on contacts of knife-edge, bonnet stopper or pin if any.

Bonnet

- Remove deposit from bonnet stopper, if any.

Torque tube housing assembly

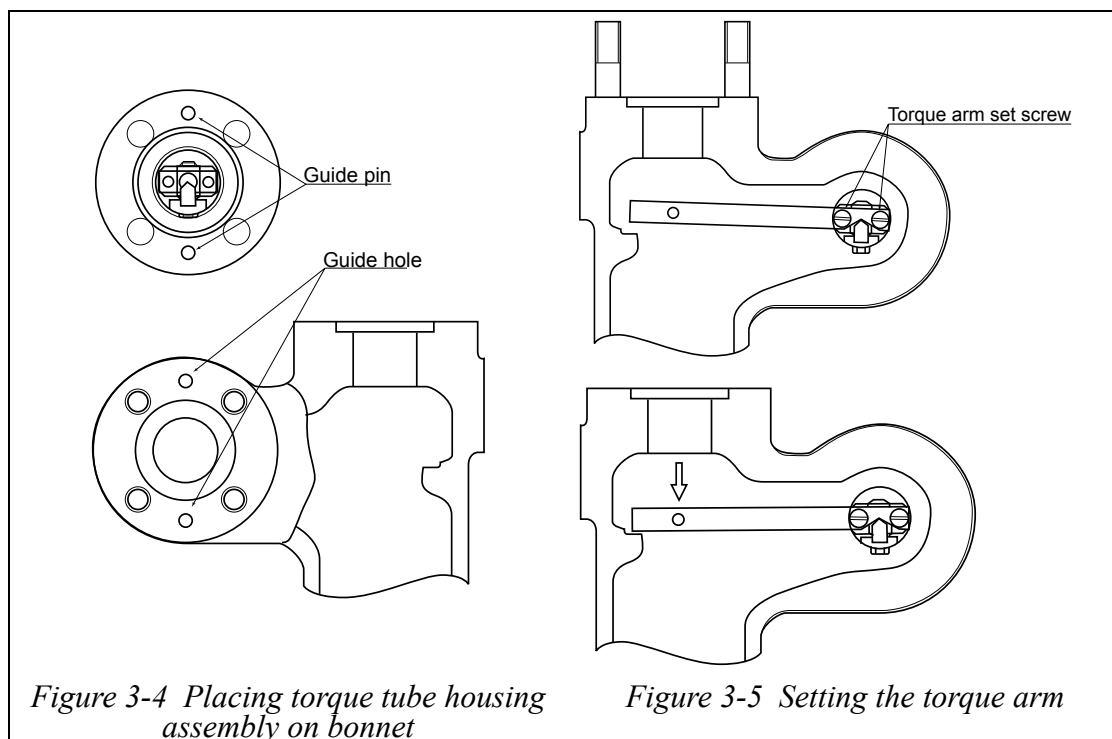
- Remove deposit from knife-edge or torque plate, if any,
- To clean inside of torque tube housing, inject steam or pour in appropriate detergent through a gap between torque tube housing and torque tube.

WARNING

Steam, detergent or deposit, which has been injected into inside of torque tube housing will flow out through the gap between torque tube housing and torque tube because the interior of the torque tube housing is sealed. In addition to extreme caution to be exercised during cleaning work, do not point inlet/outlet of steam or detergent to any person.

Reassembly, reinstallation

- Install and assemble in the reverse order of disassembly. Refer to Figure 3-4 and Figure 3-5.



Installation of torque tube housing assembly and bonnet

Insert guide pin of torque tube housing assembly into the hole of bonnet's guide hole while installing.

Installation of torque tube plate and torque arm

- Set torque arm in the torque tube plate's slot and tighten torque arm mounting screw alternately. Temporarily tighten screws slightly short of fastening of the arm.
- While pressing bottom of torque arm against bonnet stopper so that the torque arm does not shift, tighten torque arm mounting screws at the specified torque.
- Tightening torque for flange bolt and screw is as follows:

Table 3-1: Tightening torques for flange bolts and screw

| Bonnet flange | Refer to P-14 | |
|-----------------------------------------|---------------|---------------|
| Torque tube housing flange Blind flange | M14 | 127+20 (N.m) |
| Torque arm mounting screw | M6 | 3.7+0.3 (N.m) |
| Cover mounting screw | M4 | 1.5+0.3 (N.m) |

CAUTION

Right hand or left hand orientation of instrument head cannot be reversed on SLX. The orientation has been set at the time of factory shipment. Under no circumstance, torque tube housing should be mounted on the opposite side of side flange of bonnet when assembling.

Handling of torque tube

- SLX has been designed to facilitate replacement of torque tube by disassembling its main body, taking into consideration of possible corrosion,
- However, replacement of torque tube requires specific dedicated tools. Also, pressure-withstanding test of metallic contact surface of torque tube housing (pressure sealing surface) is required.
- For replacement or removal of torque tube, please consult with our sales office or service station closest to your plant.

Inspection of instrument

- Open the front cover of instrument and verify that no water has seeped inside. If necessary, tighten screws or replace O-ring for prevention of water intrusion.
- Do not disassemble two plugs on sensor assembly or mounting screws of sensor housing and its extension. If necessary, please consult with our sales office or service station closest to your plant.

Zero and span adjustment

- Calibrate in installed position on process equipment, with water filled,
Refer to “Zero span adjustment” on page 2-10
- Or calibrate with weight.
Refer to “3-4 :Zero span calibration with weight” on page 3-12

3-3 : When output shift is large

Even if the process reaches a stable state of operation (expected temperature, pressure and specific gravity of the liquid, etc.), this instrument may experience a considerable output shift, and this may be attributed to influences of temperature in the process.

This instrument measures temperature near the torque tube by using a thermocouple and compensates the torsional spring constant for temperature (see “2-1 :Principles of operation” on page 2-1). However, depending on the application, there may be measurement errors between temperatures measured using the actual torque tube temperature and the thermocouple, which thus may prevent full temperature compensation. This applies to, for example, an application which allows a process fluid such as heated steam or upper layer liquid during measurement of the interface to enter the torque tube housing.

In order to cope with various environments and applications having the potential for producing such measuring errors of compensation temperatures, “torque tube temperature coefficients” (parameters to compensate for measuring errors), which are satiable by means of SFC communication, are provided.

If an appropriate “torque tube temperature coefficient” is set when the first stable operation is reached, it is possible to conduct the measurement appropriate for the application without the need for resetting from the next operation onward.

~Note *Check to see if the specific gravity of the actual liquid to be measured matches the set specific gravity of this instrument. If they do not match, set a correct value by means of SFC communication.*

Adjustment

1. If the output shift is large even if the specific gravity of the actual liquid to be measured matches the set specific gravity of this instrument, select either one of the following to adjust the output:

- ① Zero adjustment that adjusts to the level (pinpoint adjustment)
- ② Change of torque tube temperature coefficient

Since a selection of the adjustment method requires the current set data, use the SFC to print out the data (or read the necessary data).

2. substitute values of the necessary set data into the following equation and make a calculation.

$$\Delta PV < \frac{\pm 0.5 \times |SENSLO - OFFSET| / |SENS SP|}{55} \times (Tp - Tz) \dots\dots\dots(1)$$

- ΔPV : Amount of output shift (%)
- Tp : Current process temperature (°C)
- Tz : Process temperature (°C) during zero adjustment
- $SENS LO$: Sensor zero angle (*)
- $OFFSET$: Offset angle (*)
- $SENS SP$: Sensor span angle (*)

(*) Read from the SFC printout result.

~Note *Read ΔPV after making sure the output of this instrument has been stabilized.*

3. If ΔPV satisfies expression (1), this means that the torque tube temperature compensation functions effectively, and therefore it is recommended to select zero adjustment (pinpoint adjustment) that adjusts to the level in ①.
4. If ΔPV does not satisfy expression (1), it is recommended to select the change to the torque tube temperature coefficient in ②. In this case, calculate the torque tube temperature coefficient to be changed from expression (2) and set the coefficient using the SFC.

$$TQ = TQ_0 - \frac{-\Delta PV}{0.4 \times MT / (SENS SP) \times (SENS IN - OFFSET) \times (TQTT - PTST)} \quad \text{..(2)}$$

TQ : Torque tube temperature coefficient to be changed

TQ_0 : Current torque tube temperature coefficient (*)

MT : Material coefficient (*)

$SENS IN$: Input angle (*)

$TQTT$: Torque tube temperature (°C) (*)


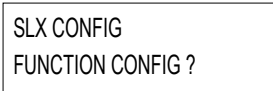
$PTST$: Angle sensor temperature (°C) (*)



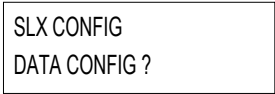

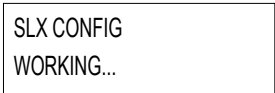
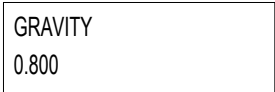








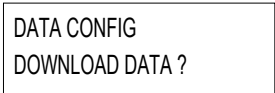

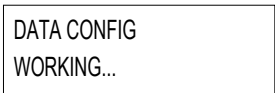
(*) Read from the SFC printout result.


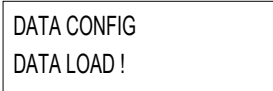
5. After confirming that the output of the instrument has been stabilized, read ΔPV and if ΔPV satisfies expression (1), conduct a zero adjustment that adjusts the level in ① (pinpoint adjustment). If ΔPV does not satisfy expression (1), change the torque tube temperature coefficient until the output of the instrument matches the reading of the glass gauge.

At this time, estimate the torque tube temperature coefficient to be changed from the correlation between past torque tube temperature coefficients and ΔPV .

The following is the method of setting a torque tube temperature coefficient using the SFC.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------|
| 1 |  | Press [CONF]. |  |

| Step | Button | Procedure | SFC screen |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2 |  or  | Press [NEXT] or [PREV] to go to the basic data setting screen. |  |
| 3 | NON-VOL  | Press [ENTER]. |  |
| 4 | | The current specific gravity set value will appear. Example: 0.8 |  |
| 5 |  or  | Press [NEXT] or [PREV] to go to the coefficient setting screen. Example: 0 |  |
| 6 | | Enter the desired torque tube temperature coefficient using numeric keys. Example: Enter value of 1.3 |  |
| 7 | NON-VOL  | Press [ENTER]. |  |
| 8 |  or  | Press [NEXT] or [PREV] to go to the download selection screen. |  |
| 9 | NON-VOL  | Press [ENTER]. |  |

| Step | Button | Procedure | SFC screen |
|------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 10 |  | Setting completed. Pressing [CLR] once sets the mode back the original state. |  |

~Note *According to in-house test results, in the case of heated steam at 160°C and 0.6 MPa, and if the torque tube temperature coefficient is assumed to be*

$$COEF TQ = 1.3$$

then, the amount of output shift is $\pm 1.5\%$ per a variation of 55°C.

Furthermore, in a case the instrument is used as an interface gauge and a heated oil at 150°C and 0.1 MPa flows into the torque tube housing, and if the torque tube temperature coefficient is assumed to be

$$COEF TQ = 1.7$$

then, the amount of output shift is $\pm 1.5\%$ per a variation of 55°C.

(In both cases, the conditions were that the ambient temperature was 20°C with the setting of a range of 300 mm and specific gravity of 1.)

3-4 : Zero span calibration with weight

It is recommended to carry out this calibration during periodic maintenance.

Difference between adjustment and calibration

Adjustment (key sequence [SET], [ENTER]):

This adjustment associates the current input (mm) with output 0%/100%. The calibration data provided at the time of shipment will not be rewritten.

Zero adjustment may not result in “0 mm” on the SFC display (however, the output becomes 0%).

Example: Though a liquid level 0% equivalent state has been set, the input remains “-30 mm” and output remains “-10%”, and so a zero adjustment is necessary.

The input does not change and the LRV is changed to the current input to be output “0%”.

| | SFC display (input) | LRV | URV | SENS_LO | SENS_SP | Input angle | Output |
|----------------------------------|---------------------|-------|-------|---------|----------|-------------|--------|
| Liquid level 0% equivalent state | -30mm | 0mm | 300mm | 1.6DEG | -0.85DEG | 1.685DEG | -10% |
| State after LRV adjustment | -30mm | -30mm | 270mm | 1.6DEG | -0.85DEG | 1.685DEG | 0% |

Calibration (key sequence [CORRECT], [ENTER]):

This adjustment associates the current LRV/URV (mm) set value with the input angle. The calibration data provided at the time of shipment will be rewritten.

Calibration requires a SFC. Calibration is not possible using the external adjustment switch. The external adjustment switch is only for adjustments.

Example 1: Though a liquid level 0% equivalent state has been set, the input remains “-30 mm” and output remains “-10%”, and so a zero calibration is necessary.

The LRV does not change and the calibration LRV angle (SENS_LO) is rewritten to the current input angle and the input becomes “0 mm” and the output becomes “0%”.

| | SFC display (input) | LRV | URV | SENS_LO | SENS_SP | Input angle | Output |
|----------------------------------|---------------------|-----|-------|----------|----------|-------------|--------|
| Liquid level 0% equivalent state | -30mm | 0mm | 300mm | 1.6DEG | -0.85DEG | 1.685DEG | -10% |
| State after LRV adjustment | 0mm | 0mm | 300mm | 1.685DEG | -0.85DEG | 1.685DEG | 0% |

Procedure for calibration with weight

1. Remove the main unit from the process and place it on a frame in a place with minimal ambient disturbance such as the control room.
2. Prepare the following calibration weights according to the calculation expression below.
 - Level gauge: weight 1 (mass F_1), weight 2 (mass F_2) Liquid gauge expression
 - Interface gauge: weight 3 (mass F_3), weight 4 (mass F_4) Interface gauge expression

~Note

- *Weights 1 and 3 include pans for weights, etc.*
- *According to the level gauge, "weight 1 + weight 2" is 0% calibrated load and "weight 1" is 100% calibrated load.*
- *According to the interface gauge, "weight 3 + weight 4" is 0% calibrated load and "weight 3" is 100% calibrated load.*
- *For 0% calibrated load and 100% calibrated load, see Figure A.*
- *When carrying out an elevation, also carry out calibration with weights using the following procedure.*

Then, make an elevation setting with reference to "Displaying and changing set data for measurement" on page 2-37.

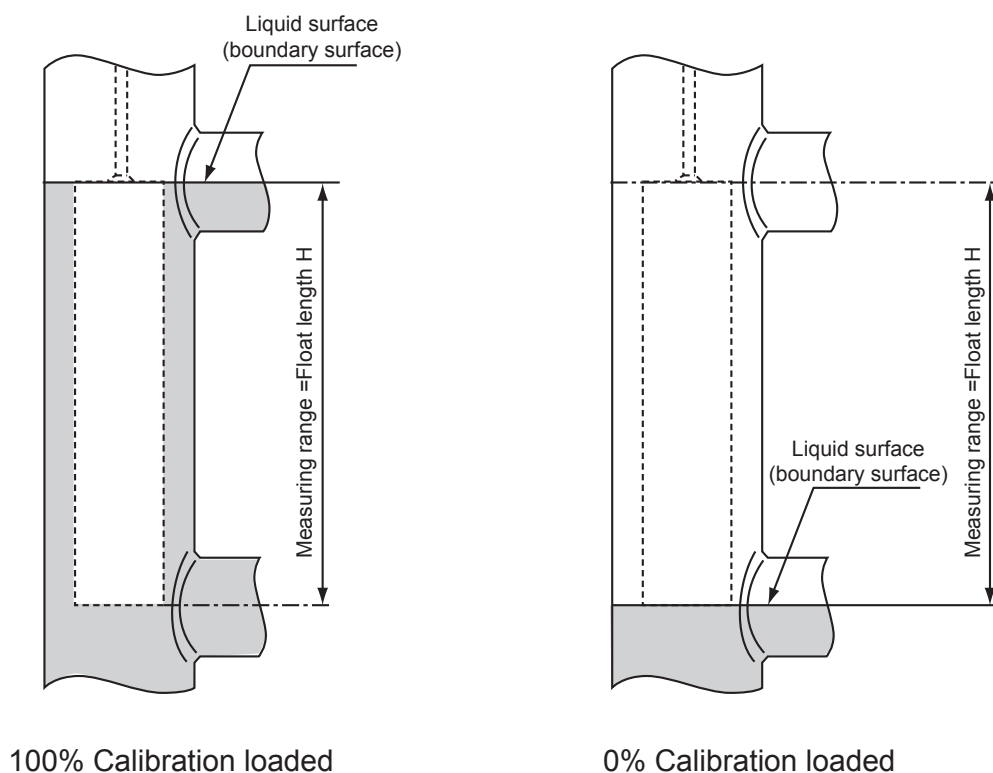


Figure 3-6 Points of calibration loaded

Liquid gauge expression

$$F_1(g) = Fb - F_2$$

Fb: Mass of float (FLOAT LOAD is given on identification plate or is the measured value of float mass)

$$F_2(g) = \frac{\pi/4 \times D^2 \times H \times \rho \times 10^{-3}}{1 + \alpha \times \pi \times D^2 \times \rho}$$

D: Float diameter (mm)

H: Float length (mm)

ρ : Specific gravity (g/cm³)

α : Constant, $\alpha = 5.76 \times 10^{-7}$

Interface gauge expression

$$F_3(g) = Fb - (\pi/4) \times D^2 \times H \times \rho_1 \times 10^{-3} - F_4$$

Fb: Mass of float (FLOAT LOAD described on identification plate or measured value of float mass)


$$F_4(g) = \frac{\pi/4 \times D^2 \times H \times (\rho_2 - \rho_1) \times 10^{-3}}{1 + \alpha \times \pi \times D^2 \times (\rho_2 - \rho_1)}$$


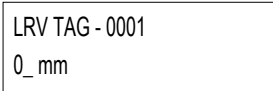

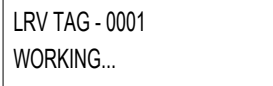
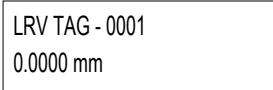

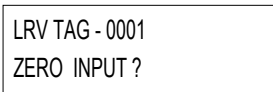

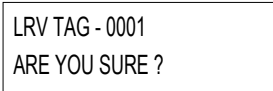


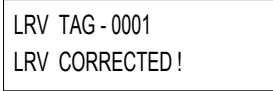
ρ_1 : Specific gravity of upper layer liquid (g/cm³)

ρ_2 : Specific gravity of lower layer liquid (g/cm³), $\rho_2 > \rho_1$

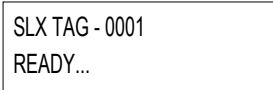

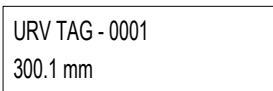
Other parameters are same to (a) liquid gauge.




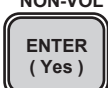
3. Turn the power to the instrument ON and connect the SFC.
(See “2-3 : Items to be checked before operation” on page 2-5.)
4. Make sure the value of specific gravity conforms with the specific gravity of the fluid to be measured and carry out the setting.
(See “ Displaying and changing set data for measurement” on page 2-37.)
5. Calibrate the LRV.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | | Apply 0% calibrated load to the torque arm. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 READY... </div> |
| 2 |  | Press [LRV]. The current LRV will appear. Example: 0.12 mm | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> LRV TAG - 0001 0.1200 mm </div> |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 3 |  | Enter zero [0] as the LRV using numeric keys. Example: [0] |  |
| 4 |  | Press [ENTER]. |  |
| 5 | | The LRV is set to 0 mm. |  |
| 6 |  | Press [CORRECT]. |  |
| 7 |  | Press [ENTER]. A confirmation screen will appear. |  |
| 8 |  | After checking that the weight is not swaying, press [ENTER] again. |  |
| 9 | | Setting of LRV completed |  |

⑥ Calibrate URV.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1 | | Apply 0% calibrated load to the torque arm. |  |
| 2 |  | Press [URV]. The current URV will appear. Example: 300.1 mm |  |

| Step | Button | Procedure | SFC screen |
|------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | | Enter the desired liquid level as the URV using numeric keys. Example: Enter value of 300 | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 300_mm </div> |
| 4 | NON-VOL  | Press [ENTER]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 WORKING... </div> |
| 5 | | The URV is set to 300 mm. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 300.0 mm </div> |
| 6 | RESET  | Press [CORRECT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 CORRECT LRV ? </div> |
| 7 | NON-VOL  | Press [ENTER]. A confirmation screen will appear. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 ARE YOU SURE !? </div> |
| 8 | NON-VOL  | After checking that the weight is not swaying, press [ENTER] again. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 WORKING... </div> |
| 9 | | Setting of URV completed. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> URV TAG - 0001 URV CORRECTED </div> |

 **CAUTION**

Be sure to calibrate the URV after calibrating the LRV first.

3-5 : Calibrating output signal

Normally, preparation is not required.

Calibration of the output signal (adjustment of D/A conversion section) is not required under normal operating conditions.

Therefore, do not carry out this calibration under normal circumstances.

If calibration is unavoidable, the following instruments are required.

Instruments used

- Precision ammeter with a precision of 0.03%FS or higher
- Precision resistor: $250\Omega \pm 0.005\%$
- SFC

Setup

While referring to the figure below, connect the SFC and the ammeter. To confirm that they are connected correctly and the instrument is communicating with the SFC, check connections with reference to “2-3 :Items to be checked before operation” on page 2-5

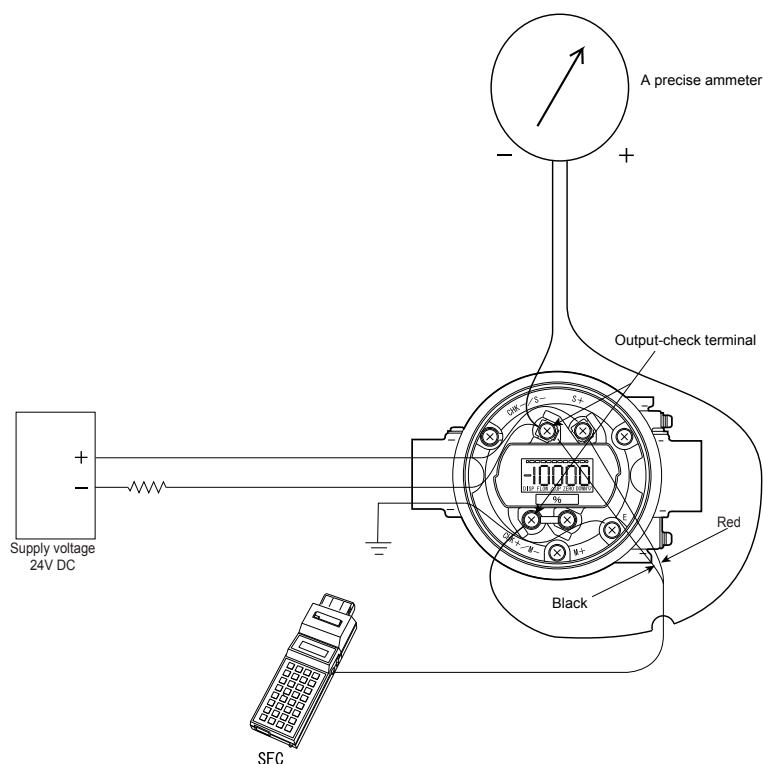
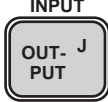









Figure 3-7 Setup for output signal calibration

Calibrating output signal 0%

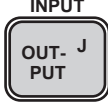





Use the following procedure to set the output to 0% and to calibrate so that the reading of the ammeter becomes 4 mA.


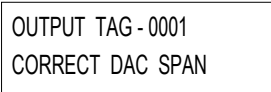

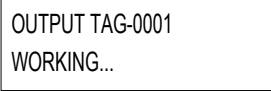
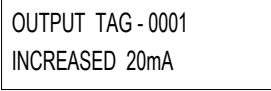
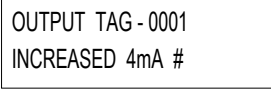

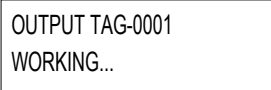
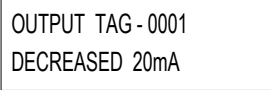
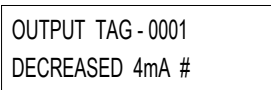

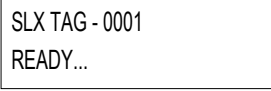
| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0.00 % </div> |
| 2 |  | Enter value of 0. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0 </div> |
| 3 |  | Press [ENTER]. - This sets the instrument to a 4 mA (0%) constant current source mode. - Once the constant current source mode is activated, a “#” appears on the screen. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0.00 % # </div> |
| 4 | | Make sure the ammeter indicates 4 mA. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0.00 % # </div> |
| 5 |  | Press [OUTPUT]. The current output is 0%. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0.00 % # </div> |
| 6 |  | Press [CORRECT]. - Carry out step 7 if the reading is lower than 4 mA, and carry out step 8 if the reading is higher than 4 mA. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 CORRECT DAC ZERO </div> |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 |  | Press [NEXT]. Check the reading of the ammeter, while pressing this key. | <div data-bbox="1173 315 1445 405" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <div data-bbox="1173 439 1445 528" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> OUTPUT TAG - 0001 INCREASED 4mA # </div> <div data-bbox="1173 562 1445 651" style="border: 1px solid black; padding: 5px;"> OUTPUT TAG - 0001 CORRECT DAC ZERO # </div> |
| 8 |  | Press [PREV]. Check the reading of the ammeter, while pressing this key. | <div data-bbox="1173 721 1445 810" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <div data-bbox="1295 835 1315 862" style="text-align: center;"> ↓ </div> <div data-bbox="1173 889 1445 978" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> OUTPUT TAG - 0001 DECREASED 4mA </div> <div data-bbox="1173 1012 1445 1102" style="border: 1px solid black; padding: 5px;"> OUTPUT TAG - 0001 CORRECT DAC ZERO </div> |
| 9 |  | When calibration is completed, press [CLR]. | <div data-bbox="1173 1178 1445 1267" style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 READY... </div> |
| 10 | | - Save the calibrated values according to 4 and exit the constant current source mode. | |

Calibrating output signal 100%





Use the following procedure to set the output to 100% and calibrate so that the reading of the ammeter becomes 20 mA.

| Step | Button | Procedure | SFC screen |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Press [OUTPUT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 0.00 % </div> |
| 2 |    | Press numeric keys [1] [0] [0] in that order. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 100 </div> |
| 3 |  | Press [ENTER]. - This sets the instrument to a 20 mA constant current source mode. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 100.00 % # </div> |
| 4 | | Make sure the ammeter indicates 20 mA. | <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 100.00 % # </div> |
| 5 |  | Press [OUTPUT]. The current output is 100%. | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> OUTPUT TAG-0001 WORKING... </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> OUTPUT TAG - 0001 100.00 % # </div> |

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 |  | Press [CORRECT]. - Carry out step 7 if the reading is lower than 20 mA, and carry out step 8 if the reading is higher than 20 mA. |  |
| 7 |  | Press [NEXT]. - Check the reading of the ammeter, while pressing this key. |    |
| 8 |  | Press [PREV]. - Check the reading of the ammeter, while pressing this key. |  <p style="text-align: center;">↓</p>   |
| 9 |  | When calibration is completed, press [CLR]. |  |
| 10 | | - Save the calibrated values according to 4 and exit the constant current source mode. | |

Saving calibrated values and canceling constant current source mode




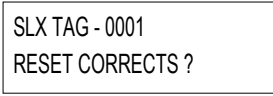

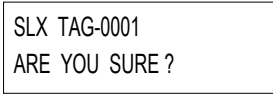
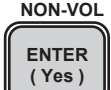
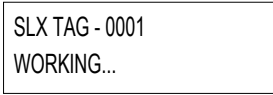

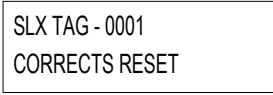


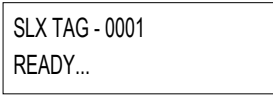
Use the following procedure to forcibly write the calibrated values into the non-volatile memory of this instrument and cancel the constant current source mode.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Press [SHIFT]. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SHIFT- #</div> |
| 2 |  | Press [ENTER]. - Forced data writing is completed. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG NO. WORKING...</div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 DATA NONVOLATILE #</div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 READY...</div> |
| 3 |  | Press [OUTPUT]. The current output is 100%. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 WORKING...</div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">OUTPUT TAG - 0001 100 % #</div> |
| 4 |  | Press [CLR]. - The “#” disappears, indicating that the constant current source mode has been cancelled. | <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 WORKING...</div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">SLX TAG - 0001 READY...</div> |

3-6 : Returning all set data to factory settings

This procedure can return not only calibrated data but also all other set data (damping time constant, etc.) to factory settings.

Before restoring the factory settings, it is recommended to record or print out the currently set data.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | Press [SHIFT]. |  |
| 2 |  | Press [CORRECT]. |  |
| 3 |  | Press [ENTER]. A confirmation screen will appear. |  |
| 4 |  | Press [ENTER] again. |  |
| 5 |  | All set data returns to factory settings. Press [ID]. |   |
| 6 |  | The current settings (factory settings) are loaded to the SFC. Press [CLR] to exit. |  |

3-7 : Insulation resistance test and withstand voltage test

CAUTION

Do not carry out any insulation resistance test and withstand voltage test in principle. Such tests may damage built-in varistors for surge voltage absorption. When these tests are unavoidable, carefully carry out these tests according to the specified procedure.

Test procedure

- (1) Remove the external wiring from the instrument.
- (2) Short between + and - SUPPLY terminals and between + and - METER terminals. (The product is shipped with these METER terminals shorted.)
- (3) Conduct tests between the shorted SUPPLY terminals and the grounding terminal and between the METER terminals and the grounding terminal.
- (4) The applied voltage and judgment criteria are as follows. To prevent damage of the instrument, do not apply any voltage exceeding the following values.

Judgment criteria

The judgment criteria for these tests are as follows.

| Test | Judgement criteria |
|----------------------------|------------------------------------------------------------------------|
| Insulation resistance test | 20M Ω or more at test voltage of 25V DC (25°C, 60%RH or bellow) |
| Withstand voltage test | 50V AC, 1 minute, leakage current 2mA |

3-8 : Replacement parts and recommended replacement cycle

Replacement parts list

| No | Name | Parts No. | Maximum quantity per unit | Resale unit quantity |
|----|--------------------------------------------------------------|---------------|---------------------------|----------------------|
| 1 | Terminal block with indicator | 80393178-001 | 1 | 1 |
| 2 | Cover O-ring | 80020935-183 | 1 | 10 |
| 3 | Plug (with O-ring) | 80377115-001 | 3 | 1 |
| 4 | Cover (with window, standard finish, O-ring) | 80370008-001 | 1 | 1 |
| | Cover (with window, anti-corrosion finish, O-ring) | 80370008-002 | 1 | 1 |
| | Cover (with window, anti-severe-corrosion finish, O-ring) | 80370008-003 | 1 | 1 |
| | Cover (no window, standard finish, O-ring) | 80277119-001 | 1 | 1 |
| | Cover (no window, anti-corrosion finish, O-ring) | 80277119-002 | 1 | 1 |
| | Cover (no window, anti-severe-corrosion finish, O-ring) | 80277119-003 | 1 | 1 |
| 5 | Pressure-proof packing type cable adapter | 80343903-003 | 2 | 1 |
| 6 | Chamber-bonnet gasket | See page 3-26 | 1 | 1 |
| 7 | Blind flange gasket (main material 1, 2) | 80354690-001 | 1 | 1 |
| | Blind flange gasket (main material 3) | 80354690-002 | 1 | 1 |
| | Blind flange gasket (main material 4) | 80354690-003 | 1 | 1 |

No.1 to 3 are products with limited life and require periodic replacement.

No.3 and 4 are included here because they involve the possibility of misplacement, damage (cracked on glass).

No.5 to 7 require replacement for every re-tightening

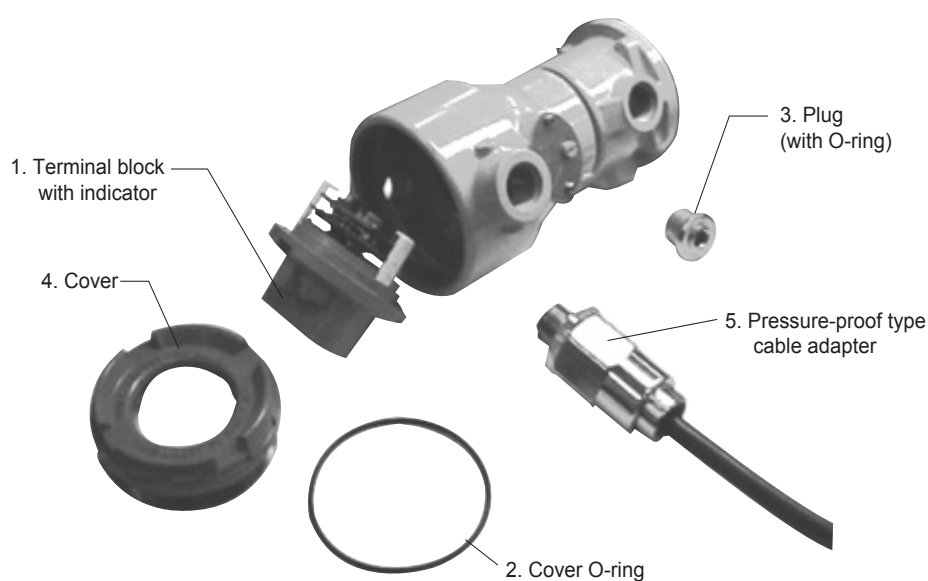


Figure 3-8 Replacement parts

Table for selection of chamber-bonnet gasket parts

Check the product model number and select the correct parts number.

| | Basic model No. | Selection specification | | | | | Qty | Parts No. |
|---------------------------------|-----------------|-------------------------|----------------|---------------|----------------|----------------------|--------------|--------------|
| | | Measurement range | Connect format | Main material | Other material | Pressure rating | | |
| 6. Chamber-bonnet gasket | | | | | | | | |
| Gasket | SLX110 | - | 1, 2, 3, 4 | 1, 2 | U,M,A,E | 1,A,B,G | 1 | 80353472-001 |
| | ↓ | - | ↓ | ↓ | ↓ | 2,3,4,C,D,E,F,H,J,K | 1 | 80353472-002 |
| | ↓ | - | ↓ | 3 | ↓ | G | 1 | 80353472-007 |
| | ↓ | - | ↓ | ↓ | ↓ | 2, 3,4,C,D,E,F,H,J,K | 1 | 80353472-008 |
| | ↓ | - | ↓ | 4 | ↓ | 1,A,B,G | 1 | 80353472-013 |
| | ↓ | - | ↓ | ↓ | ↓ | 2, 3,4,C,D,E,F,H,J,K | 1 | 80353472-014 |
| | ↓ | - | ↓ | 2 | D | 1,A,B,G | 1 | 80353472-101 |
| | ↓ | - | ↓ | ↓ | ↓ | 2, 3,4,C,D,E,F,H,J,K | 1 | 80353472-102 |
| | ↓ | - | ↓ | 3 | ↓ | 1,A,B,G | 1 | 80353472-107 |
| | ↓ | - | ↓ | ↓ | ↓ | 2, 3,4,C,D,E,F,H,J,K | 1 | 80353472-108 |
| | ↓ | - | ↓ | 4 | D, W | 1,A,B,G | 1 | 80353472-113 |
| | ↓ | - | ↓ | ↓ | ↓ | 2, 3,4,C,D,E,F,H,J,K | 1 | 80353472-114 |
| | SLX120 | Except 20 | 1, 2, 3, 4 | 1, 2 | U,M,A,E | 1, A, B, G | 1 | 80353472-005 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-006 |
| | ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | 1 | 80353472-003 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-004 |
| | ↓ | Except 20 | ↓ | 3 | ↓ | 1, A, B, G | 1 | 80353472-011 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-012 |
| | ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | 1 | 80353472-009 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-010 |
| | ↓ | Except 20 | ↓ | 4 | ↓ | 1, A, B, G | 1 | 80353472-017 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-018 |
| | ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | 1 | 80353472-015 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-016 |
| | ↓ | Except 20 | ↓ | 2 | D | 1, A, B, G | 1 | 80353472-105 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-106 |
| | ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | 1 | 80353472-103 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-104 |
| | ↓ | Except 20 | ↓ | 3 | ↓ | 1, A, B, G | 1 | 80353472-111 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-112 |
| | ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | 1 | 80353472-109 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | 1 | 80353472-110 |
| | ↓ | Except 20 | ↓ | 4 | D,W | 1, A, B, G | 1 | 80353472-117 |
| ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | | 80353472-118 | |
| ↓ | 20 | ↓ | ↓ | ↓ | 1, A, B, G | | 80353472-115 | |
| ↓ | ↓ | ↓ | ↓ | ↓ | 2,3,C,D,H | | 80353472-116 | |

“Except 20” means “03, A3, 04, A4, 05, 06, 07, 08, 10, 12, 15”.

Recommended replacement cycle

- Terminal block with indicator (LCD): 5 years
- Cover O-ring, plug (with O-ring)

| Average ambient temperature | Replacement cycle |
|-----------------------------|-------------------|
| 30°C or below | 10 years |
| 30°C to 40°C | 5 years |
| 40°C to 50°C | 2 years |

Replacing terminal block with indicator (LCD)

This section describes the replacement procedure after the cover is removed.

- ① Remove the grounding screws. Also remove the collar at this time.

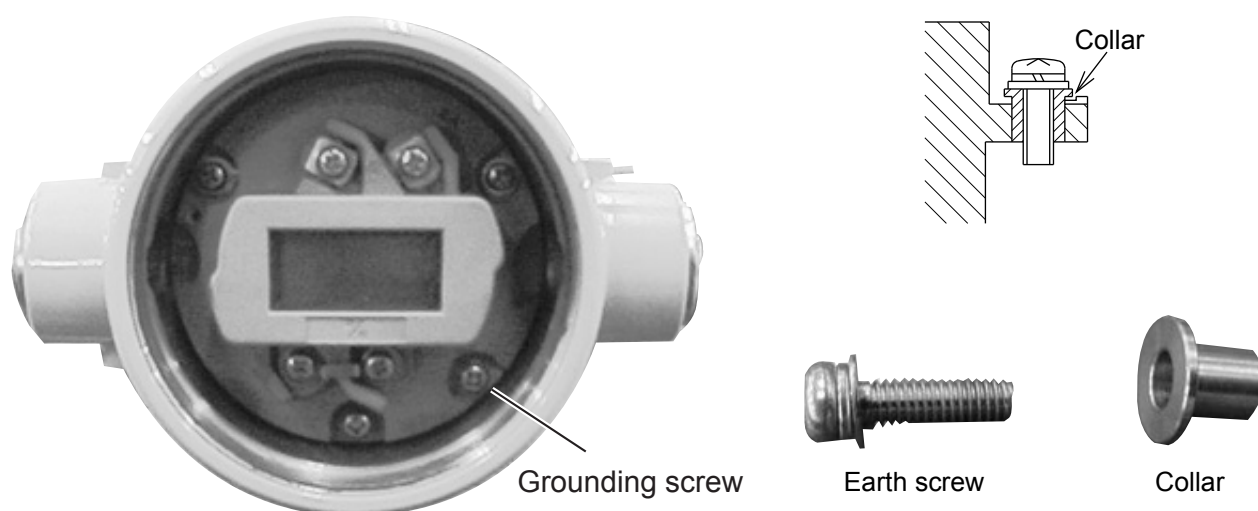
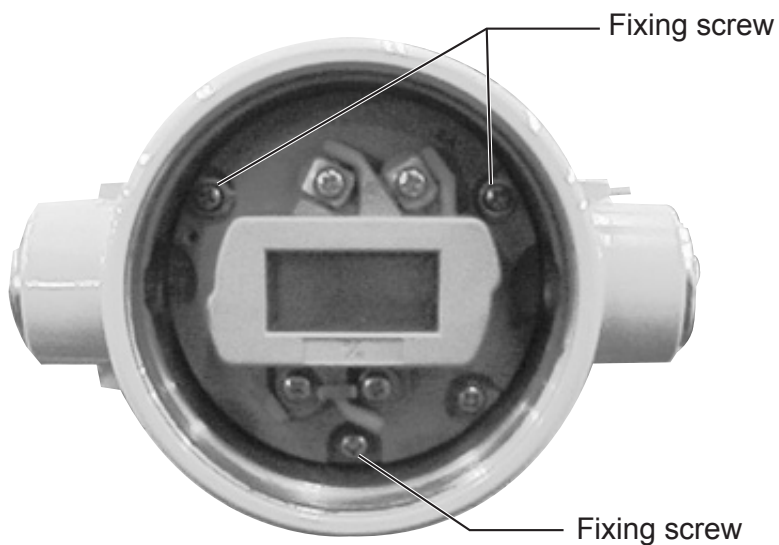
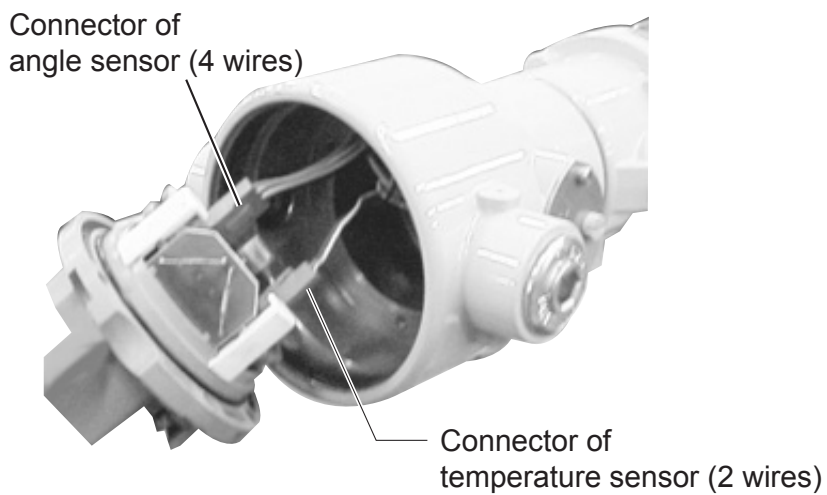


Figure 3-9 An installed terminal block with LCD indicator

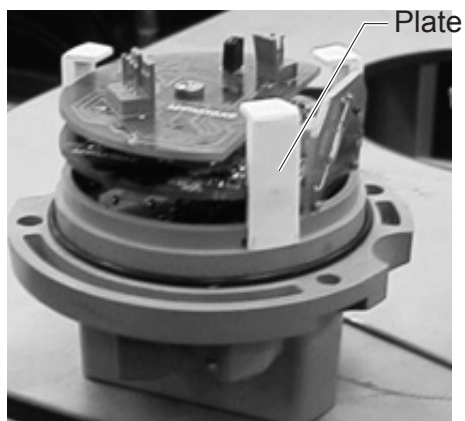
② Remove the three screws that fix the terminal block.



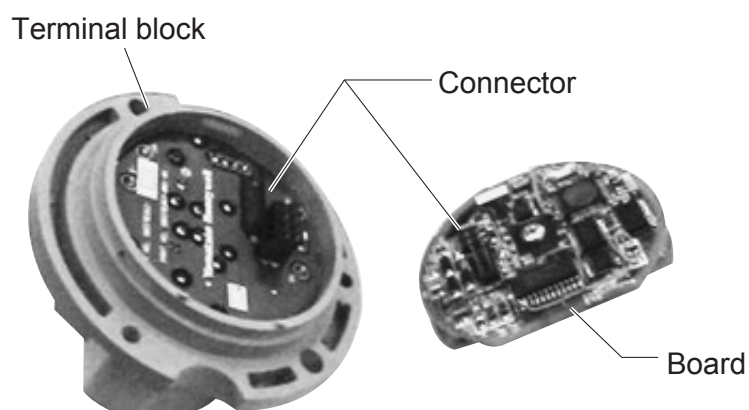
③ Draw the terminal block toward you, remove the two connectors and separate the terminal block from the instrument.



④ Remove the three plates.



- ⑤ Remove the board from the connector of the terminal block and replace the terminal block.



- ⑥ Assemble the terminal block into the instrument in the reverse order.

If the terminal block is assembled into the case, turn the terminal block so that the lead wires are not caught and bind the lead wires together.

Recommended tightening torque of fixing screws, grounding screws: $1.2 \pm 0.1 \text{ N}\cdot\text{m}$

Attach a collar to the grounding screws.

3-9 : Starting instrument after maintenance

*See “Chapter 2 :Operation” on page 2-1

Chapter 4 : Repair

WARNING

-
- Do not use the instrument beyond the rated pressure, connection specification and rated temperature specified for the instrument. This may result in serious accident due to damage.
 - Wiring in an explosion-proof area should be performed according to the work procedure specified in the explosion-proof guideline.
-

CAUTION

-
- After installation, do not use this instrument as a foothold, etc. This may damage the instrument or may result in physical injury
 - Avoid hitting the glass part of the display with tools. This may damage the glass and result in physical injury.
 - Perform installation correctly. Insufficient installation or no installation may result in output errors or violate applicable regulations.
 - This product is heavy. Pay attention to the scaffolding and wear safety shoes.
-

4-1 : Using dedicated apparatus necessary for repair

See “2-6 : Operation using SFC” on page 19.

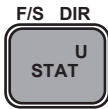
4-2 : Troubleshooting

With the SFC, it is possible to check the operation of this instrument and take appropriate action in the event of an error by means of a self-diagnostic message displayed by the SFC.

Furthermore, If an error occurs in this instrument, process, SFC or communication system, using the SFC also makes it possible to take appropriate action according to this self-diagnostic message.

Operation check

When checking the operation of this instrument, connect the SFC to this instrument and confirm that the instrument is communicating with the SFC using the following procedure.

| Step | Button | Procedure | SFC screen |
|------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 |  | <p>Press [STAT].</p> <p>If a message other than “STATUS CHECK=OK” appears, take appropriate action with reference to the following pages.</p> <p>- When an error message appears, take appropriate action by referring to the messages on the following pages.</p> | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">SLX TAG - 0001 WORKING...</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">SLX TAG-0001 STATUS CHECK = OK</div> <p>(Other messages) ↓</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">SLX TAG - 0001 READY...</div> <p>If there are other messages corresponding to two or more errors, each error message is displayed for 2 sec.</p> |

When error occurs during communication


When an error message appears during communication, take action as follows.

| Message | Action | Button |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG-0001 CRITICAL STAT </div> | <p>- Press [STAT]. Take action according to the message displayed.</p> <p>- In this case, the operations of [ID], [OUTPUT] and [STAT] are active.</p> <p>- After taking action, press [STAT] and make sure “Self-diagnostic result OK” appears.</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> F/S DIR U STAT </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> DE READ A ID </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> INPUT J OUT- PUT </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> F/S DIR U STAT </div> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> F/S DIR U STAT </div> |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> : </div> | <p>The battery is running out of electricity. Charge it according to the procedures in “Charging SFC” on page 2-72</p> | |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> ***** # </div> | <p>- Press [STAT] and take action according to the message displayed.</p> <p>- When the error is repaired, “#” disappears.</p> <p>- After “#” disappears, press [STAT] and make sure “Self-diagnostic result OK” appears.</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> F/S DIR U STAT </div> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> F/S DIR U STAT </div> |

Self-diagnostic message

When an error occurs, pressing [STAT] displays a self-diagnostic message. The meaning of the message and the troubleshooting method are as follows.

When this instrument, process, SFC or communication system is suspected to involve error.

| Message | Meaning | Action | Button |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> TAG NO. NO XMTR RESPONSE </div> | No response from transmitter | - Carry out the communication starting procedure again. - Press [STAT] and see the message. - Check the loop, SFC connection loop, load resistance and supply voltage. |  |

When this instrument is suspected to involve error (serious fault or light fault)

Serious fault:

Refers to a state or fault that causes serious trouble in the operation of the SLX and may damage the SLX itself if left unattended.

The output continues in the set burnout direction. (The output is set to the burnout direction lower range value at the time of shipment.)

| Message | Meaning | Action |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 PTS SENS FAULT # </div> | The connector of the angle sensor is disconnected or there is a problem with the angle sensor. | Check the connector and if the problem persists, contact Azbil Corporation (the transmitter part needs to be replaced). |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 TC SENS FAULT # </div> | The connector of the temperature sensor is disconnected or there is a problem with the angle sensor. | Check the connector and if the problem persists, contact Azbil Corporation (the temperature sensor needs to be replaced). |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 PTS RANGE OVER # </div> | The input angle exceeds the permissible value. | Contact Azbil Corporation. |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;"> SLX TAG - 0001 NVM FAULT # </div> | SLX non-volatile memory error. | Contact Azbil Corporation (the transmitter part needs to be replaced). |

| Message | Meaning | Action |
|-------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 A/D FAULT # </div> | SLX circuit error. | Contact Azbil Corporation (the transmitter part needs to be replaced). |

Light fault:

Refers to a state or fault that does not cause serious problems in the operation of the SLX.

The SLX outputs an indeterminate output value.


- If the problem persists even after taking remedial action, contact Azbil Corporation.


| Message | Meaning | Action |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 TQT OVER TEMP # </div> | The torque tube temperature exceeds the allowable temperature range. | Adjust the torque tube temperature to a range of -200 to 400°C. |
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 PTST OVER TEMP # </div> | The angle sensor temperature exceeds the allowable temperature range. | Adjust the angle sensor temperature to a range of -30 to 80°C (in the case of specification with explosion-proof or with an indicator, adjust the ambient temperature to within the operating condition range.) |
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 EXCESS ZERO COR # </div> | The calibration lower range angle (SENS LO) exceeds the allowable range. | Redo zero calibration (See “3-4 : Zero span calibration with weight” on page 3-12.). |
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 IN OUTPUT MODE # </div> | The constant current output mode is active. | Cancel the constant current output mode (See “2-6 : Operation using SFC” on page 2-19.). |
| <div style="border: 1px solid black; padding: 5px;"> SLX TAG - 0001 EX. SWITCH FAULT # </div> | The connector of the external adjustment switch board has disconnected or there is a problem with it. | Check the connector and if the problem persists, contact Azbil Corporation. |

- When SFC or communication system is suspected to be experiencing error

| Message | Meaning | Action |
|---------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| SLX TAG - 0001 SFC FAULT | SFC defect | - Redo the communication start procedure. - If this message still appears, contact Azbil Corporation. |
| SLX TAG - 0001 FAILED COMM CHK | Introductory remarks of error message | |
| SLX TAG-0001 ILLEGAL RESPONSE 1or2or..1f | Communication defect | Check the connection between the SFC and transmitter, wiring and power supply. |
| SLX TAG - 0001 PRINTER FAIL ! | Printer operation impossible | Contact Azbil Corporation. |
| SLX TAG - 0001 LOW LOOP RES | Insufficient loop resistance | Check the resistance value. |
| SLX TAG - 0001 HI RES / LOW VOLT | - Excessive loop resistance - Insufficient applied voltage | - Check the loop resistance. - Increase the applied voltage. |

- When operational error is suspected

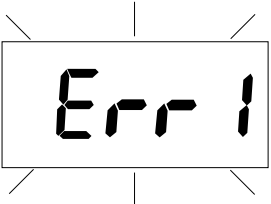
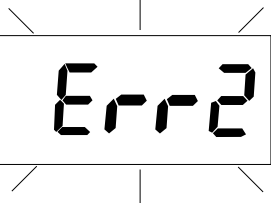
| Message | Meaning | Action |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| NOT SUPORT | The key pressed is not applicable. | Press the correct key. |
| EXCESSIVE OUTPUT | Required output value in constant current source mode > output range (-1.25% to 105%) When inappropriate numeric value is input by dedicated function | Press [CLR] and redo input.  |

| Message | Meaning | Action |
|------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| CORRECT LRV ? | Is the input value appropriate for the value to be set? | Check the input value. If wrong, correct it. |
| ENTRY > SENS RNG | When the set value exceeds the allowable setting range of this instrument | Press [CLR], check the value and set it again.  |
| INVALID REQUEST | This request cannot be executed. | Check the SFC operation procedure. |

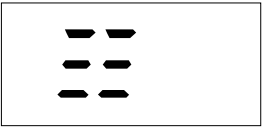
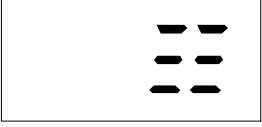
Indicator (option) error messages



When the indicator is attached, if an error occurs in the indicator or transmitter, a message is displayed on the digital display section according to the diagnostic content.

Self-diagnostics upon power-up

| Message | Meaning | Action |
|------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------|
|  <p>(Blinking)</p> | Digital indicator RAM failure | Replace the terminal block with an indicator. |
|  <p>(Blinking)</p> | Digital indicator ROM failure | Replace the terminal block with an indicator. |

Self-diagnostics during normal operation

| Message | Meaning | Action |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------|
|  <p>↕(Displayed alternately)</p>  | Serious fault of this instrument | Contact Azbil Corporation. |

| Message | Meaning | Action |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------|
| <div data-bbox="411 315 675 441"></div> <p data-bbox="422 465 663 499">↕(Displayed alternately)</p> <div data-bbox="411 517 675 642"></div> | Fault of this instrument or indicator | Contact Azbil Corporation. |

4-3 : Removal/installation method

* For the method of removal or reinstallation of the main unit, see “1-6 :Installation method” on page 1-9.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products. You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use

Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down.

You are required to provide your Equipment with safety design such as fool-proof design, *1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.

*2. A design that is safe even if the device fails.

*3. Avoidance of device failure by using highly reliable components, etc.

*4. The use of redundancy.

3. Precautions and restrictions on application

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product.

However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

In addition,

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment

- * Burning appliances
- * Electrothermal equipment
- * Amusement facilities
- * Facilities/applications associated directly with billing

- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations. In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

| | |
|--------------------------|--------------------------------------------------------------------------------------------------|
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