EXA SC

4-wire Conductivity Metering System

Model SC400G
Conductivity Converter

IM 12D8N1 - 01E
3rd Edition

Introduction

The SC400G conductivity converter is used to configure the EXA SC conductivity metering system. The use of this converter in combination with a conductivity sensor (the ideal one can be selected from various sensors) allows continuous measurement of fluid conductivity in a wide range of processes. For full achievement of the converter's performance, thoroughly read the instruction manual before use.

Topics and information that need special attention in handling the product are given in the text of this manual along with cautionary notes, such as warnings or cautions, depending on their importance. Strictly observe these items from the standpoint of safety and prevention of equipment damage. For a notation, such as a warning, also indicated on the product, there is an alert mark in the manual.

Example of warning indicated on the product

 **WARNING** Note: For safety concerns, other symbols like  are also included.

1. Specification Check

After the converter is delivered, unpack it carefully and make sure the product is completely free from any damage that may have occurred during transport. Confirm that the SC400G conductivity converter is exactly the same model as you ordered. Confirm the specifications by the model and suffix codes indicated on the nameplate on the instrument and check that there are no items missing among the spare parts (on page 2-5). For a description of the model and suffix codes, refer to Subsection 2.2.2.

MODEL	SC400G	SUPPLY	88-132V AC
SUFFIX	-C-E-1	OUTPUT	4-20/0-20/0-1 mA DC/mA DC/V DC
STYLE		NO.	
YOKOGAWA ◆	Made in the Netherlands		

Example of Name Plate

2. Before Measurement

If the SC400G conductivity converter is operated in the condition as delivered, it operates with the parameters (default data) set upon shipment. Check whether or not the default data meet the operating conditions. Re-set the parameters for the desired operation, if necessary.

To check the defaults, make use of the record of operation parameter settings. If the operation parameters are re-set, it is recommended that the changed data be recorded in this record or the like. After the use of contact outputs S1, S2, & S3 are determined, attach the accompanying seal near the lamp on the operating panel (so the use of contact outputs are clearly identified).

IM 12D8N1-01E (FD No. 10134-K87)
3rd Edition: Mar. 1997 (YG)

3. Information Covered in This Manual

This manual covers all of the information for handling the SC400G conductivity converter, including instructions on installation, setting of operation parameters, inspection and maintenance. For a better understanding of the product, necessary information is also included.

For information on handling the SC8SG conductivity sensors used in combination with the SC400G, refer to their separate instruction manuals.

Note that the instruction manuals listed in the following table are for equipment associated with the EXA SC series conductivity metering system.

Manuals for Equipment Associated with the EXA sc Conductivity Metering System

Model	Title of Manual	Publication No.
SC400G	Conductivity Converter	IM 12D8N1-01E
SC8SG	Conductivity Sensor	IM 12D8G2-01E

[Notations Specific to This Instruction Manual]

Whenever the contents displayed on the operation keys and the display section and the product are concretely described in this manual, they are presented as follows in principle.

1. **Operation key**
   Displayed in brackets [ ] . (Example: YES → [YES] key)

2. **Contents of the display section**
   Displayed in quotation brackets 『 』. [Example: status display HOLD 『HOLD』]
   [Example: operation key indicator YES → 『YES』]
   [Example: message display → 『*CALIB』]
   [Example: data display → 『2.05』 (lit), 『2.05』 (flashing)]

3. **Notations on products**
   Displayed in angle brackets <and>. [Example: contact output indicator lamp → <●S3> (on status), <○S3> (off status)
   [Example: Measurement mode → <MEASURE> mode]

4. **Expression of flashing figures**
   Appears in a light gray shade. (Flashing) 205 (lit) 205

Table of Contents

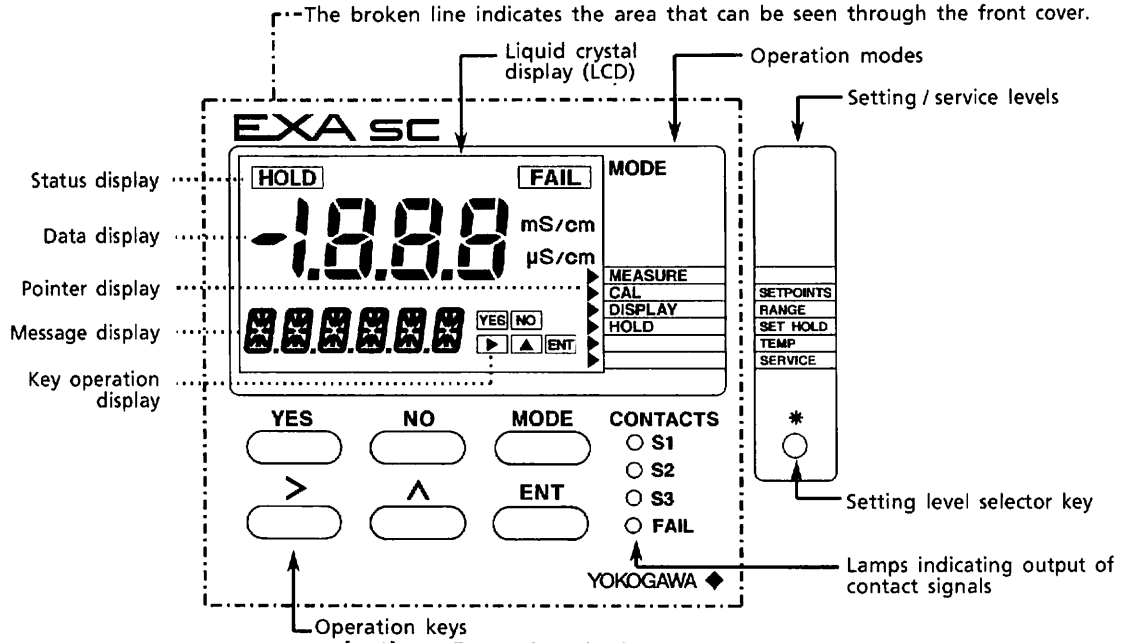
The description of the SC400G conductivity converter, found in this instruction manual, is applicable to the products with software (ROM) of version Rel 2.6 or later.
The software version of your product can be confirmed in the indication selection mode of the message display at the operation level (refer to page 5-9 also).

1. Procedures for Key Operation

This chapter shows the basic patterns of key operation for the SC400G Conductivity Converter and how to operate keys and check operation parameters already set, before installation. For concrete operation procedures, see Chapter 5.

1.1 Display Section and Keys on Operation Panel

Figure 1.1 shows the operation panel of the SC400G conductivity converter. There are a display section and keys on the panel. The six keys that can be seen through the window of the front cover can be operated from the outside.



[YES] : Press when the flashing display is relevant to "Yes."
[NO] : Press if the flashing display is relevant to "No."
[MODE] : Press when the mode is changed from the measurement mode to the operation level.
Press when returning to the measurement mode from another mode.
[>] : Press when keying in a digit for data setting.
[^] : Press when keying in a digit for data setting.
[ENT] : Press when entering a keyed-in data item.

Figure 1.1 Operation Panel

Once the uses of contact outputs S1, S2, & S3 are determined, select one of the accompanying labels and affix it to the blank area on the LCD display.

1.2 Operating the Conductivity Converter

1.2.1 Connection of the Conductivity Sensor and Supply of Power

The SC400G conductivity converter operates on an AC power supply at the specified voltage. Before supplying power, connect the conductivity sensor. In this case, the membrane protection cap (for storage) is allowed to be attached to the sensor.

CAUTION

Guard against electrical shock !

The conductivity converter has no power switch. In order to avoid electrical shock or damage to the instrument, turn on the power after properly connecting each cable conductor to the predetermined external wiring terminals.

Carry out wiring by removing the front cover and the terminal cover as shown in Figure 1.2.

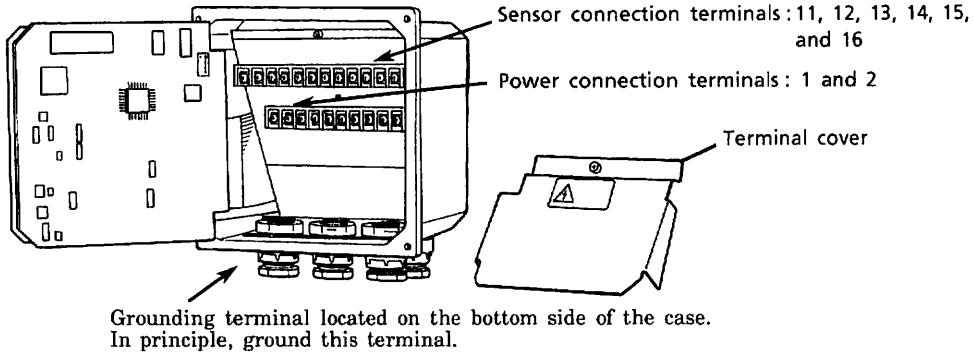


Figure 1.2 External Wiring Connection Terminals

- When the power is supplied to the converter, the converter starts up in the measurement mode; the data display indicates the conductivity value (unit: µS/cm) and the message display, the temperature at the measurement [initial status].
- If the converter detects a failure, 『*FAIL*』 is displayed and the <FAIL> indicator lamp lights up, and the data display indicates an error. If a failure occurs, refer to Section 8.2.

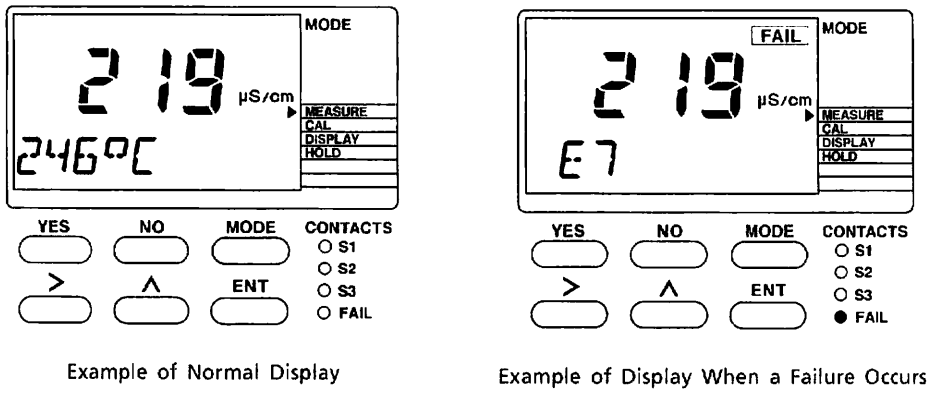


Figure 1.3 Example of Measurement Mode Display

1.3 Basic Key Operation

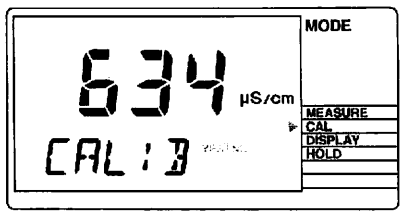
1.3.1 Mode Selection at Operation Level (For details, see Section 5.3.)

To check that key operation from the outside can be done normally, attach the front cover. When the mode is to be selected, note the following three points:

- For an operation other than in the measurement mode, the mode returns to the measurement mode by pressing the [MODE] key.
- The <HOLD> mode is skipped. [Default setting]
- If no key is operated for ten minutes or more, the mode automatically changes to the measurement mode. [Default setting]

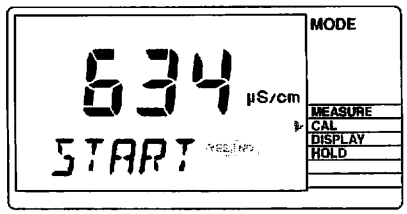
1. Press the [MODE] key once. The display shown in Figure 1.4 (1) appears.

(1)



The pointer to <CAL> and 『YES』 and 『NO』 in the key operation section are flashing.
This indication is asking, "Do you want to do a calibration?" Answer it by pressing the [YES] or [NO] key.

(2)



This is the display when the [YES] key is pressed in answer to the indication in (1).
The message display changes over to 『START』, indicating that calibration mode has been set.

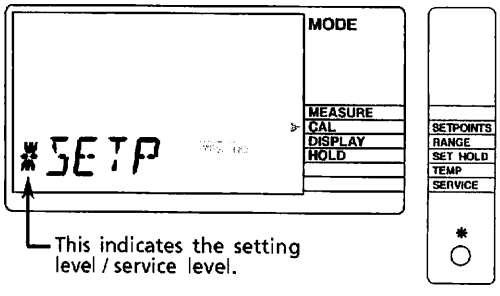
Figure 1.4 Example of Indication at Operation Level

2. Press the [NO] key for the display in Figure 1.4 (1). Every time the [NO] key is pressed, the display changes, and after completing one round, the display returns to that of Figure 1.4 (1).

1.3.2 Operation to Switch Setting Level (For details, see Section 5.3.)

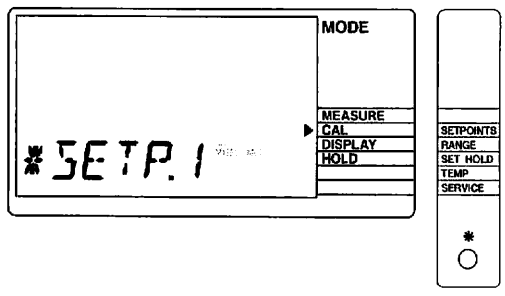
Select the setting level by removing the front cover. In the measurement mode, Press the [*] key (setting level selection).

(1)



When the [*] key is pressed, a display appears meaning "Do you want to change to the alarm point setting mode?" Answer it by pressing the [YES] or [NO] key.

(2)



In the status in Figure 1.5 (1), when the [YES] key is pressed, the mode changes to the alarm point setting mode and a display appears meaning "Do you want to set the contents of contact output S1?"

Figure 1.5 Example of Display at Setting Level

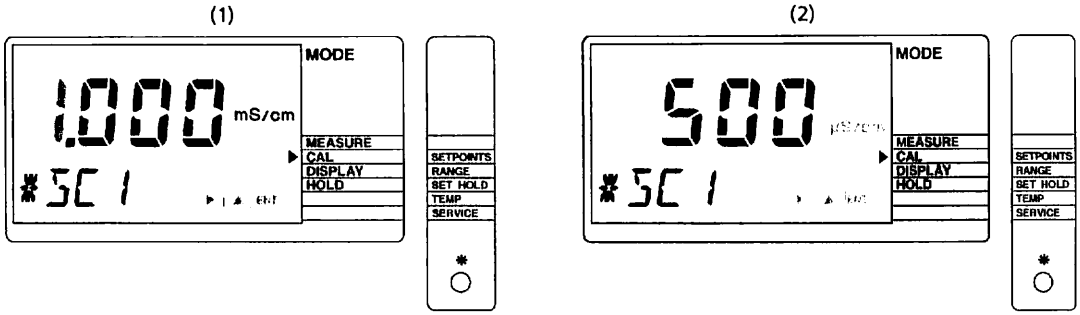
1.3.3 Operation to Enter Data (Numerical Values)

CAUTION

Entered data are not canceled even if the power is turned off. If temporary data are entered, enter the normal fixed data again.

When the [YES] key is pressed for the display in Figure 1.5 (2), the display changes to that in Figure 1.6 (1). In this display, changing the data value from 1 mS that has been entered to 500 µS is given as an example.

(1) Press the [>] key to make "1" flash.
(2) Continue to press the [∧] key until the flashing "1" goes out.
(3) Press the [>] key to have "0" begin flashing and enter "5" with the [∧] key.
(4) Hold down the [>] key until the displayed decimal point and unit begin flashing. Then hold down the [∧] key until the display of 500 µS/cm appears.
(5) Press the [ENT] key. The value of 500 µS/cm is entered and the display returns to that in Figure 1.5 (1).



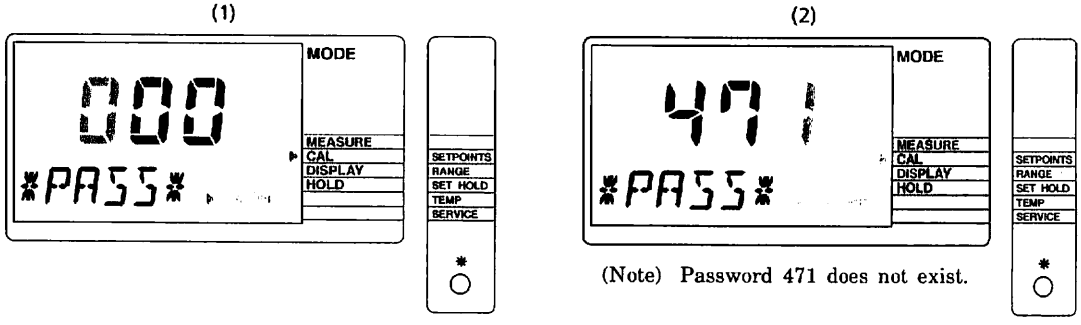
When the [YES] key is pressed in the display in Figure 1.5(2), the display changes to one like this.

When the [ENT] key is pressed, the displayed value is entered.

Figure 1.6 Example of Display at Setting Level

1.3.4 Operation to Enter Password

In order to prevent the setting data from being changed inadvertently, passwords can be provided for each level of operation, setting and service (i.e., for nine types). After passwords have been set, the display shown in Figure 1.7 (1) (password entry request) appears whenever entry to the corresponding level is attempted. As these passwords are not set upon shipment from the factory, the password entry request is not displayed.



The display appears when the [MODE] key or the [*] key is pressed, or when the [YES] key is pressed in response to the "*SERV" message.

(Note) Password 471 does not exist.

Enter the set password and then press the [ENT] key. If it is different from the setting, the display changes back to the one here on the left.

Figure 1.7 Example of Password Entry Request Display and Entry Display

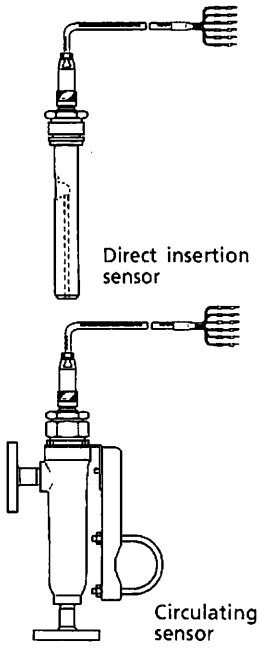
2. Overview

This chapter gives an overview of the EXA SC series conductivity metering system and the specifications for the SC400G conductivity converter.

2.1 EXA SC Series Conductivity Metering System

The basic configuring devices of the conductivity metering system are a conductivity sensor and conductivity converter.

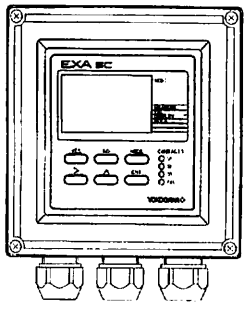
2.1.1 SC8SG Conductivity Sensor



Receiving an applied rectangular wave AC voltage of a specific frequency and voltage from the SC400G conductivity converter, the SC8SG conductivity sensor hands over a current signal proportional to the conductivity of measurement fluid and a temperature signal for compensation purposes to the conductivity converter. The SC8SG conductivity sensor comes in 2 versions: one possessing a 0.01 cm^{-1} cell constant, and the other possessing a 10 cm^{-1} cell constant. They are used respectively depending on the measurement range. The conductivity sensor of a 10 cm^{-1} cell constant again comes in 2 versions, a 2-electrode sensor and a 4-electrode sensor, and they too are used respectively depending on whether or not the measurement fluid contains soiled components which would cause a polarization event.

The construction of the SC8SG also is of 2 types: one which is directly connected to the insertion socket of process piping, etc. (direct insertion sensor), and one which is separately connected to the sampling piping (circulating sensor).

2.1.2 SC400G Conductivity Converter



The SC400G conductivity converter computes the conductivity of a measurement solution (reference temperature conversion value) based on the conductivity (current) signal and temperature (resistance value) signal received from the conductivity sensor. The calculated conductivity value is displayed in digital form and is also output as an analog signal of 0 to 20 mA DC, 4 to 20 mA DC, or 0 to 1 V DC. Furthermore, the SC400G is equipped with a variety of operation parameter setting functions and self-diagnosis functions, which are needed for measurement / control of conductivity (or density).

2.2 Specifications for SC400G Conductivity Converter

The SC400G conductivity converter accurately measures conductivity because it has multiple temperature compensation methods any of which can be selected depending on the temperature coefficient of the measurement fluid. It outputs an analog signal corresponding to the conductivity value and several contact signals, such as upper and lower limit alarms. The analog signal can also be made to be a non-linear output, so that it corresponds to (approximates) the density.

This converter meets a wide variety of applications since it is provided with many operation parameter setting functions. It also has several self-diagnostic functions which simplify maintenance work.

2.2.1 Standard Specifications

[Construction and Operating Conditions]

Water-proof construction:
JIS C0920 deck water-tight (conforming to IP65 or NEMA TYPE 4)

Materials : Case : aluminum alloy casting
Cover : poly-carbonate resin

Coating : Epoxy resin group coating, baked

Coating color : Cover : deep sea-moss green (Equivalent to Munsell 0.6GY 3.1 / 2.0)
Case : frosty white (Equivalent to Munsell 2.5Y 8.4 / 1.2)

Mounting : pipe (O.D. of 60.5 mm), wall, or panel mounting

Weight : Converter body : about 2.5 kg (without hood)
Mounting bracket : about 0.7 kg (option code: /U), or
about 0.4 kg (option code: /PM)

Operating environment:
Ambient temperature : −10 to 55°C
Humidity : 10 to 90 % RH

Storage environment: Temperature: −30 to 70°C

Cable inlet ports : (6 places)
Cable gland : DIN PG16 or equivalent, made of plastic (applicable cable OD: 7 to 12 mm)

Power supply : 88 to 132 V AC, 50 / 60 Hz (suffix code: -1)
176 to 264 V AC, 50 / 60 Hz (suffix code: -2)

Power consumption: maximum of 8.5 VA

[Functions]

Measurable range: Conductivity : 0.05 µS/cm to 2000 mS/cm
Temperature : −10 to 250°C
Note : −10 to 200°C, in cases involving other than the Pt 1000 Ω temperature element

Measuring range : can be arbitrarily set (but must satisfy the setting conditions)
Conductivity : minimum range: 0 to 0.5 µS/cm to maximum range: 0 to 2000 mS/cm
Note : Span: 0.5 µS/cm. Keep it at less than 60 % of the maximum value, when the minimum value of the range is other than 0.

Temperature : more than a minimum span of 50°C

Output signal : (Current output and voltage output; each one point)
4 to 20 mA DC / 0 to 20 mA DC, isolated transmission output, maximum load of 600 Ω
0 to 1 V DC, isolated transmission output, minimum load of 1 kΩ
(The temperature signal can be output from either the current or voltage output terminal.)

Features of output signal:
Linear output or non-linear output (20-step data setting after every 5 %), selectable
Note: Linear output only in the case of temperature

Contact output : (four points - S1, S2, S3, and FAIL)
Application : S1 (high or low alarm)
S2 (high or low alarm)
S3 (high / low alarm)
FAIL (failure detection)
Output modes of higher / lower limit alarm contact signals:
Selectable from status output, proportional duty pulse output, and proportional frequency output
Type of contact : relay contact output (dry contact)
Contact rating : 250 V AC, 2 A, maximum of 100 VA
220 V DC, 2 A, maximum of 50 W
Contact status:

Contact	Contact Status at Power Off	Contact Status at Power On	
		Relay Deenergized	Relay Energized
S1	Open	Open	Closed
S2	Open	Open	Closed
S3	Open	Open	Closed
FAIL	Closed	Open	Closed

Note : When a relay is energized, the corresponding LED on the operation panel lights up.

Contact input : used for the conductivity measurement range switching command (becomes 10 times the setting range).
Type of contact: dry contact
On input resistance: 10 Ω or less
Off input resistance: 100 kΩ or more

Display on operation panel:
digital liquid crystal display

Display details : conductivity value (appears in the data display)
Range: 0 to 1999 mS/cm
Measuring temperature (appears in the message display)
Output current (appears in the message display)
Output voltage (appears in the message display)
Weight % density value (appears in the message display) when display function is EXECUTE
Cell constant (appears in the message display)
Ref. temp. (appears in the message display)
Software version (appears in the message display)
Error code (when generated, appears in the data display)

Calibration function:
standard solution calibration
Compensation function:
temperature compensation
Self-diagnosis functions:
Error check of polarization of electrodes (in case of 2-electrode conductivity sensor)
Error check of temp. coefficient
Error in calibration value
Electrode short
Electrode wire snapped
Error in temp. measurement
EEPROM failure
Error in temp. compensation range
Error in setting of minimum value of measurement range
Error in setting of non-linear output value
Error in input data
Alarm output time over
Operation parameter setting function:
(See Section 5.2.)

[Basic Performance]
Repeatability : 0.5 % of measured span or less [in 0 to 1 µS/cm and 0 to 2 S/cm measurement ranges]
Accuracy : ±1 % of measured span or less [in 0 to 1 µS/cm and 0 to 2 S/cm measurement ranges]
±(0.02 µS/cm +0.02 mA) or less [in 0 to 1 µS/cm measurement range]
Accuracy of temperature compensation:
±0.5 % [−10 to 200°C range]

2.2.2 Model and Codes

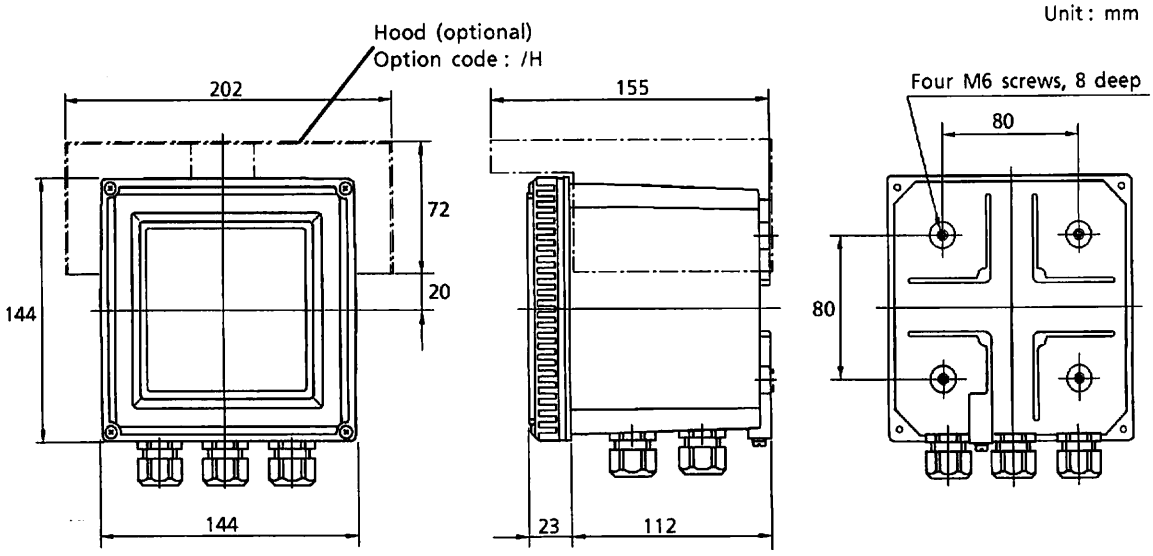
Model	Suffix Code	Option Code	Specifications
SC400G	.....	.....	Conductivity converter
—	-C	.....	Always -C
Written language	-J	.....	Japanese
	-E	.....	English
Power supply	-1	.....	88 to 132 V AC, 50/60 Hz
	-2	.....	176 to 264 V AC, 50/60 Hz
Optional specifications	Mounting bracket	/U	For pipe/wall mounting
		/PM	For panel mounting
	Hood	/H	Shading hood
	Tag plate	/SCT	Stainless steel tag plate
	Adapter for conduit connection	/AFTG	Conduit connection screw: G1/2 female

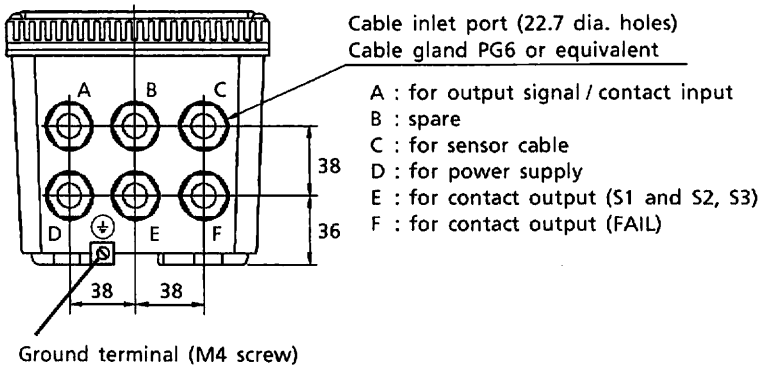
Accessories

Item	Part Number	Description
Labels for units and contact signals	K9313PC	For display on the operation panel
Spare fuse (1)	K9313PS	For a 100 V AC power system
	K9313PT	For a 200 V AC power system
Pipe/wall mounting bracket	K9171SS	Attached when option code "/U" is specified.
Panel mounting bracket	K9171ST	Attached when option code "/PM" is specified.
Shading hood	K9313PJ	Attached when option code "/H" is specified.
Tag plate	Y9412NP	Attached when option code "/SCT" is specified.
Adapter for conduit connection	K9171SU	Attached when option code "/AFTG" is specified.

2.2.3 External Dimensions

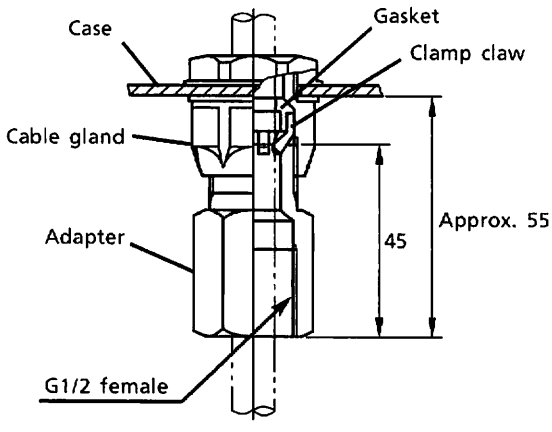
Unit : mm





Weight : Approx. 2.5 kg

Adapter for conduit work (option code : /AFTG)



Note : This adapter is for use with 5 cable inlet ports; it does not include the port for the sensor cable.

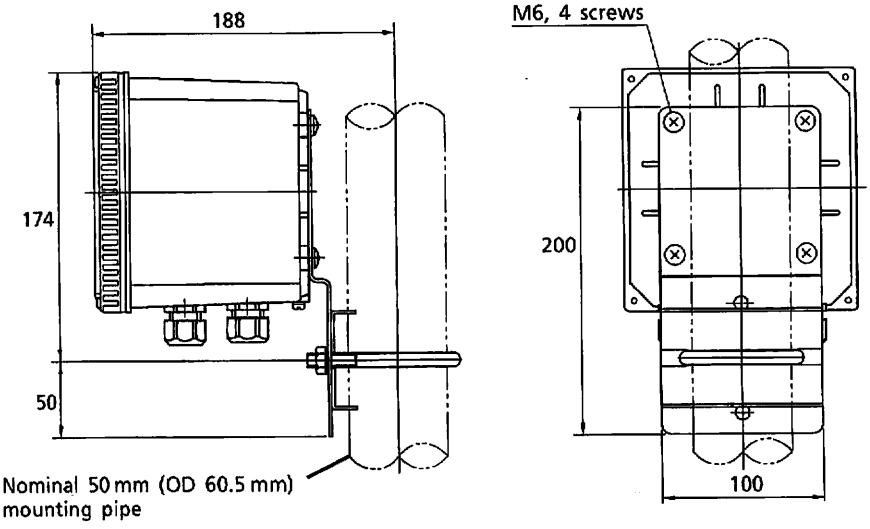
Figure 2.1 SC400G Conductivity Converter

Pipe Mounting Bracket / Wall Mounting Bracket (option code : /U)

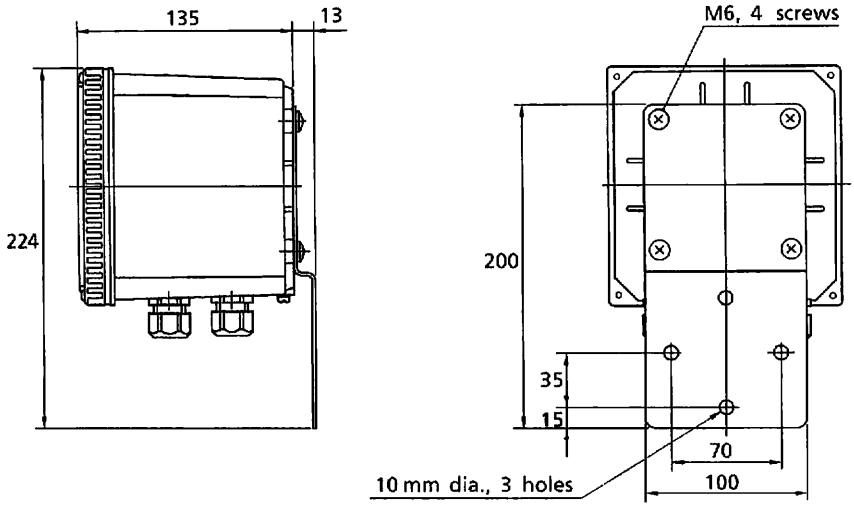
Unit : mm

Weight : Approx. 0.7 kg

• Example of bracket used for pipe mounting



• Example of bracket used for wall mounting



Panel Mounting Bracket (option code : /PM)

Weight : Approx. 0.4 kg

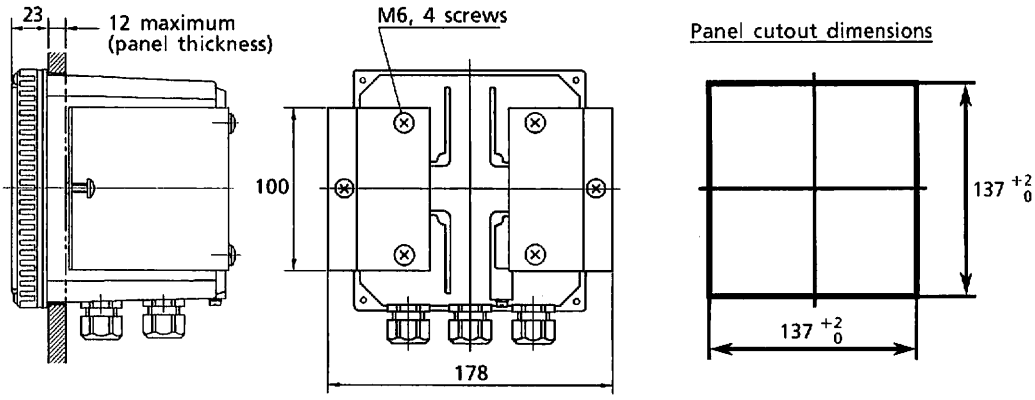


Figure 2.2 Mounting Bracket of SC400G Conductivity Converter

3. Installation and Wiring

Install the SC400G conductivity converter where the operator can see the display and carry out key operations. This chapter describes the selection of a location and the procedures for mounting and wiring.

3.1 Installation

3.1.1 Selection of Location

Install the SC400G conductivity converter where the following conditions are met.

- **It should be near the installation site of the conductivity sensor.**
  Consider the length of the cable that will be used to connect it to the sensor.
- **There should be no corrosive gases present.**
  Corrosive gases are not desirable because they may damage the electrical components in the converter.
- **There should be little mechanical vibration.**
  Vibrations may loosen the connections of external wiring.
- **The temperature should be around normal room temperature and any fluctuations should be small.**
  It is necessary for the temperature not to deviate outside the range of −10 to 55°C.
- **The humidity should be in the range of 25 to 85 % RH where the converter can operate normally.**
  The converter can be used at 10 to 90 % RH. However, avoid using it in very high or very low humidity.
- **The converter should not be exposed to direct sunlight.**
  Direct sunlight may raise the temperature in the converter abnormally. If direct sunlight cannot be avoided, use a hood for shading (optional).

3.1.2 Preparation for Installation

[Incorporation of Separate Attachments]

Optional parts specified with the option codes (hood, mounting bracket, adapter for conduit connection, etc.) are delivered as separate attachments. To avoid losing these parts, it is recommended that you attach them before installation. (For incorporation, see Subsections 2.2.3 and 3.1.3.)

[Installation Provisions]

Make provisions to fix the SC400G conductivity converter so that it is installed in a position for easy operation.

(1) Pipe mounting

The SC400G should be fixed to a stanchion (pipe) with a U-bolt. Provide a rigid vertical pipe with an O.D. of 60.5 mm (a horizontal pipe is also acceptable).

(2) Wall mounting

Fix the SC400G with three M8 bolts (not supplied). Carry out drilling on the mounting surface as shown in Figure 3.1.

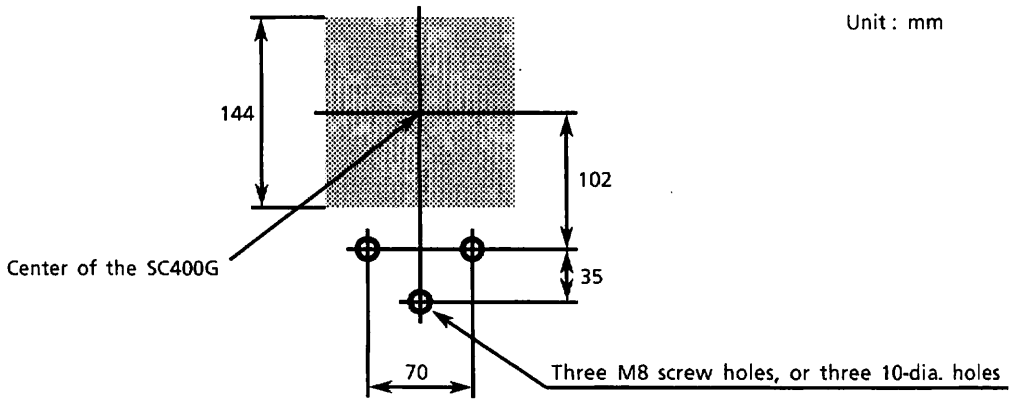


Figure 3.1 Drilling for Wall Mounting

(3) Panel mounting

Make a panel cutout as shown in Figure 3.2 in the mounting position.

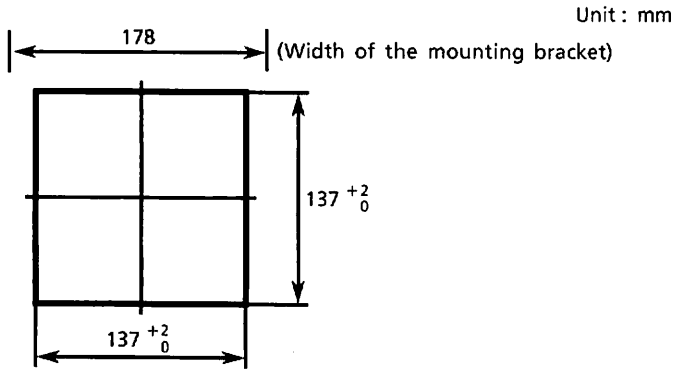
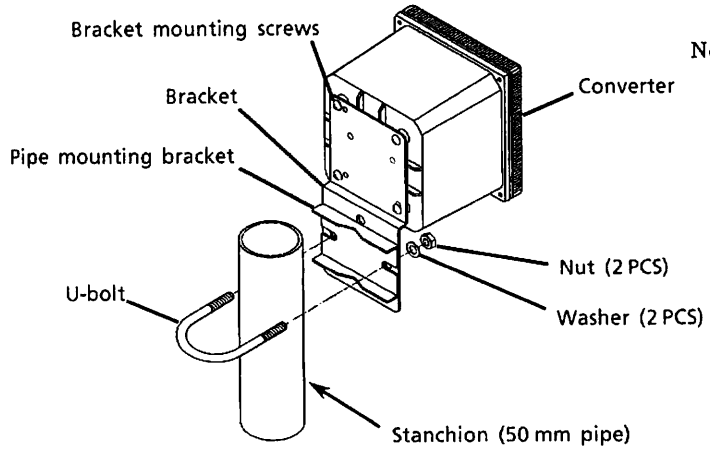


Figure 3.2 Cutout for Panel Mounting

3.1.3 Converter Mounting

(1) Pipe mounting

Figure 3.3 illustrates the mounting bracket and procedure.

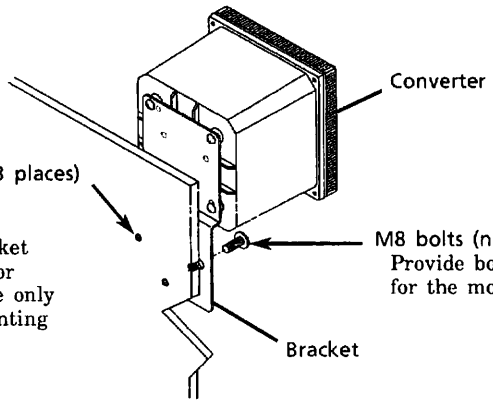


Note : If a hood (see Figure 2.1) is to be attached, fix it making use of the two upper bracket mounting screws.

Figure 3.3 Pipe Mounting Procedure

(2) Wall mounting

Figure 3.4 illustrates the wall mounting procedure.

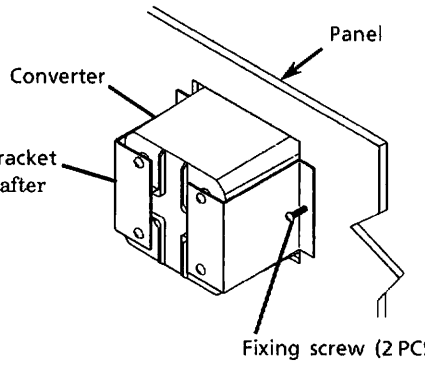


Note : Comes with a bracket the same as that for pipe mounting. Use only the bracket if mounting on a wall.

Figure 3.4 Wall Mounting Procedure

(3) Panel mounting

Figure 3.5 illustrates the panel mounting procedure.



Mount the SC400G after inserting it into the panel cut opening.

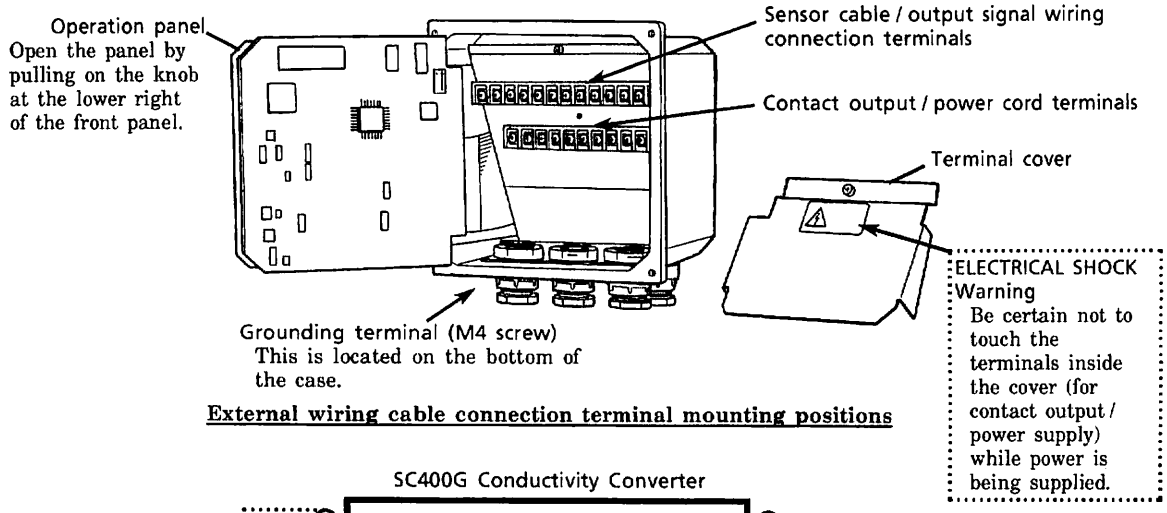
Figure 3.5 Panel Mounting Procedure

3.2 Wiring

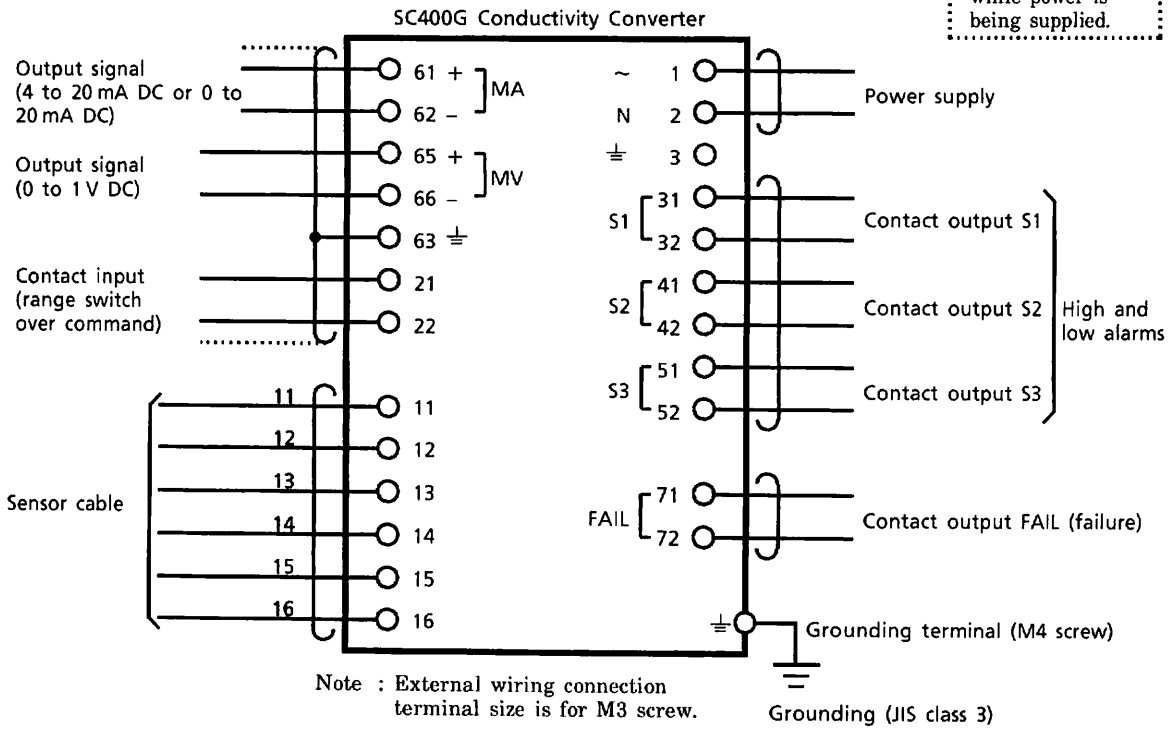
3.2.1 Kinds of Wiring for Converter

Implement the following kinds of wiring with the SC400G conductivity converter. However, omit the wiring for unrequired functions.

(1) Sensor cable (or extension cable) connection (see Subsection 3.2.3)
(2) Wiring for output signal and for remote cleaning start command (contact input) (see Subsection 3.2.4)
(3) Wiring for high and low alarms (S1, S2, and S3 contact outputs) (see Subsection 3.2.5)
(4) Wiring for (or alarm) / failure (FAIL contact output) (see Subsection 3.2.6)
(5) Wiring for power supply (see Subsection 3.2.7)
(6) Ground wiring (see Subsection 3.2.8)



External wiring cable connection terminal mounting positions



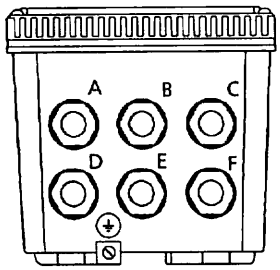
Note : External wiring connection terminal size is for M3 screw.

Figure 3.6 External Wiring Cable Connection Terminals and Diagram

3.2.2 Cable Inlet Port

There are six cable inlet ports in the SC400G conductivity converter. These ports are provided with cable glands conforming to a cable with an O.D. of 7 to 12 mm.

Introduce each cable through the port as specified in Figure 3.7. If there is a cable inlet port which is not used, seal the opening so that no dust can get in.



A : For output signal / remote cleaning start command
B : Extra
C : For sensor cable
D : For power supply
E : For (S1, S2, and S3) contact output
F : For (FAIL) contact output

Figure 3.7 Specified Application of Cable Inlet Ports

If a cable is protected with a conduit, use an adapter (5 sets are supplied when the option code "AFTG" is specified). Remove the cable glands from the A, (B), D, E, and F ports and attach the adapters and adapter cable glands provided as accessories in place of the above cable glands as shown in Figure 3.8. No conduit work is done with sensor cable inlet port C. Use the cable gland that was attached on delivery without removing it.

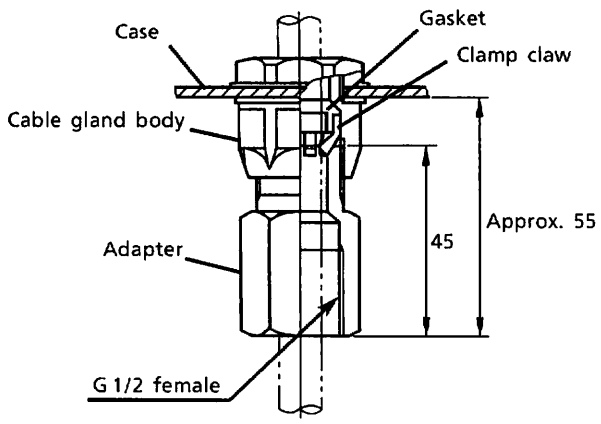


Figure 3.8 Conduit Connecting Adapter

3.2.3 Sensor Cable Connection

Ordinarily, the sensor cable (detector configuring component) is connected directly to the converter. The sensor cable already has a finished end treatment.

[Connection Procedure]

(1) Connect each conductor of the sensor cable to predetermined terminals 11, 12, 13, 14, 15, and 16. When the cable is introduced into the converter, remove the cable gland body and assembled parts located at cable inlet port C and pass the cable through these parts in the proper order in advance.

(2) Fix the cable.
Adjust the cable length required for the converter and fix the cable by mounting the parts through which the cable passes to the cable gland body.

3.2.4 Wiring for Output Signal and Remote Range Select Command

This is wiring for transmitting the converter's output signal to a receiving instrument, such as a recorder, and for sending a contact input signal for range conversion to the converter.

There are two standard output signals (0 to 20 mA DC or 4 to 20 mA DC, and 0 to 1 V DC) corresponding to the conductivity range and temperature range. Two output signals can be used for both the conductivity and temperature signal or for conductivity only. Either signal can also be used as the conductivity signal. The wiring for the contact input signal is done only when executing the range select command (when on, a range 10 times that of the set conductivity range is selected). The on / off contact input can be identified with input resistances (on : 10 Ω or less ; off : 100 kΩ or more). Use a dry contact.

[Cable to Be Used]

Use a shielded cable with a finished OD of 7 to 12 mm. Select 2, 4, or 6 conductors depending on the number of signals.

Separate cables may be used for wiring for the output and contact input signals. In that case, the wiring for the contact input signal is taken in through cable inlet port B.

[Connection Procedure]

(1) End-treat the cable.
Strip off about 40 mm of the insulation covering the end of the cable. Cut the exposed shield at its root near the remaining covering and solder a grounding leadwire (about the same length as the cable conductors) to the shield. Protect the soldered point by, e.g., wrapping with insulation tape. Next, attach crimping terminal lugs conforming to an M3 screw to the end of the leadwire and each conductor.

(2) Connect each cable conductor to the specified terminals.
Terminals 61 (+) and 62 (−) : conductors for 4 to 20 mA DC / 0 to 20 mA DC output signal
Terminals 65 (+) and 66 (−) : conductors for 0 to 1 V DC output signal
Terminal 63 : ground leadwire
Terminals 21 and 22 : conductors for contact input signal

CAUTION

Ground the cable shield only on the converter side.

When the cable is introduced into the converter, remove the cable gland body and assembled parts located at cable inlet port A and pass the cable through these parts in the proper order in advance.

(3) Fix the cable.
Adjust the cable length required for the converter and fix the cable by mounting the parts through which the cable passes to the cable gland body.

3.2.5 Connection of the Conductivity Sensor and Supply of Power

This is the wiring to output high and low alarms for the conductivity (or temperature) as contact signals S1 S2, and S3. The rating for this contact output relay contact (normally open) is as shown in Table 3.1. Use equipment which satisfies the conditions shown in Table 3.1.

Note : Contacts S1, S2, and S3 for contact output must be "open" when deenergized.

Table 3.1 Rating of Relay Contact for Contact Output

	DC	AC
Maximum permissible voltage for contact	220 V	250 V
Maximum permissible current for contact	2 A	2 A
Maximum permissible power for contact	50 W	100 VA

[Cable to Be Used]

Use a cable with a finished O.D. of 7 to 12 mm. Select 2, 4, or 6 conductors depending on the number of signals.

[Connecting Procedure]

(1) End-treat the cable.
Strip off about 40 mm of the insulation covering the end of the cable and attach crimping terminal lugs conforming to an M3 screw to the end of each conductor.

(2) Connect each cable conductor to the specified terminals.
Terminals 31 and 32 : conductors for contact output S1
Terminals 41 and 42 : conductors for contact output S2
Terminals 51 and 52 : conductors for contact output S3
When the cable is introduced into the converter, remove the cable gland body and assembled parts located at cable inlet port E and pass the cable through these parts in the proper order in advance.

(3) Fix the cable.
Adjust the cable length required in the converter and fix the cable by mounting the parts through which the cable passes to the cable gland body.

3.2.6 Wiring for FAIL Contact Output

From the contact output, FAIL, a failure signal is output if the converter detects a failure. The wiring is done if these contact signals are used.
The relay contact (NO) rating for these contact outputs is also as shown in Table 3.1, the same as contact S1, S2 or S3. Use equipment which satisfies the conditions shown in Table 3.1.

Note : The contact of contact output FAIL must be "closed" at power off.

[Cable to be Used]

Use a 2-core cable with a finished O.D. of 7 to 12 mm.

[Connecting Procedure]

(1) End-treat the cable.
Strip off about 40 mm of the insulation from the end of the cable and attach crimping terminal lugs conforming to an M3 screw to the end of each conductor.

(2) Connect each cable conductor to the specified terminals.
Terminals 71 and 72: conductors for contact output FAIL
When the cable is introduced into the converter, remove the cable gland body and assembled parts located at cable inlet port F and pass the cable through these parts in the proper order in advance.

(3) Fix the cable.
Adjust the cable length required for the converter and fix the cable by mounting the parts through which the cable passes to the cable gland body.

3.2.7 Wiring for Power Supply

Supply AC power of the specified voltage (88 to 132 V or 176 to 264 V) and frequency (50 / 60 Hz) to the SC400G conductivity converter. Use a power source which does not give rise to voltage fluctuations exceeding the usable range.

CAUTION The SC400G conductivity converter has no power switch. Be sure to provide a double-pole switch in the power line in order to prevent electrical shocks or damage to equipment during maintenance.

[Cable to Be Used]

Use a two-conductor cable with a finished O.D. of 7 to 12 mm.

[Connecting Procedure]

(1) End-treat the cable.
Strip off about 40 mm of the insulation covering the end of the cable and attach crimping terminal lugs conforming to an M3 screw to the end of each conductor.

(2) Connect each cable conductor to terminals 1 and 2.
When the cable is introduced into the converter, remove the cable gland body and assembled parts located at cable inlet port D and pass the cable through these parts in the proper order in advance.

(3) Fix the cable.
Adjust the cable length required for the converter and fix the cable by mounting the parts through which the cable passes to the cable gland body.

After connection to the external wiring terminals described in Subsections 3.2.1 to 3.2.7 is completed, mount the terminal cover.

3.2.8 Ground Wiring

The ground terminal is located on the bottom of the case as shown in Figure 3.9. Ground the terminal using a wire having a nominal cross section of 2 mm^2 or more, complying with JIS class 3 grounding (the ground resistance must be 100 Ω or less). The terminal screw size is M4. Attach a crimping terminal lug matching the M4 screw to the end of the wire.

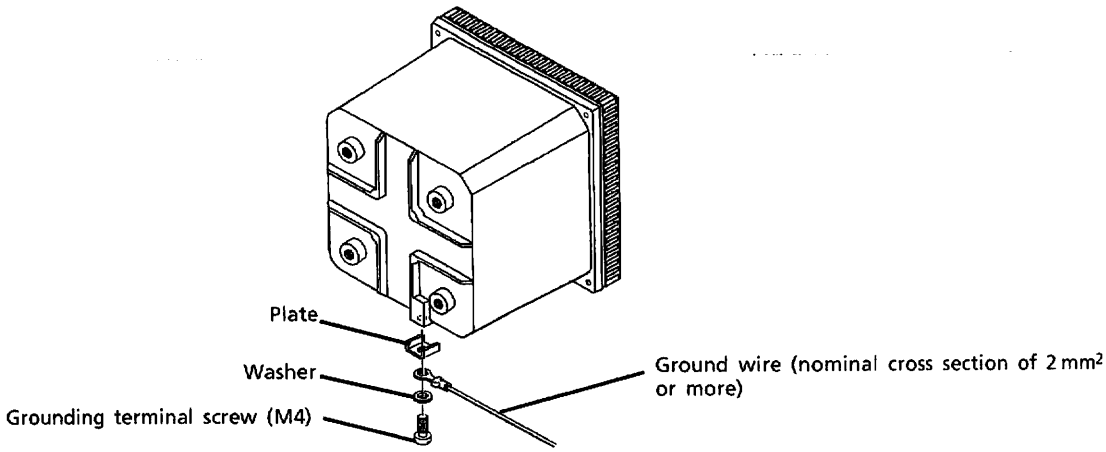


Figure 3.9 Ground Terminal

CAUTION

If grounding cannot be done from the converter case, do it on the power supply side using a power cable conductor. In this case, use a three-conductor cable or a two-conductor shielded cable for the power cord and connect one of three conductors or the shield to terminal 3 (for grounding) in the converter.

4. Operation

This chapter describes the operation of the conductivity metering system, mainly the operating procedures for the SC400G conductivity converter.

4.1 Operating Arrangements

Arrange all equipment composing the conductivity metering system for operation. For details on the conductivity converter, see the instruction manual IM 12D8G2-01E.

4.1.1 Inspection of Installation, Piping and Wiring

[Inspection of Installation]

- Check that the conductivity sensor is firmly mounted in the sensor inlet socket of process piping, etc. (in the case of a direct insertion sensor). And make sure that the measurement fluid outlet of the sensor is downstream in the flow.

  Note : There are restrictions in the flow direction of the measurement fluid, such as against the mounted direction of the conductivity sensor.

  If the sampling piping is made of synthetic resin, confirm that the holder of the sensor is firmly attached to the holding equipment (in the case of a circulating sensor).
- Check that the cable inlet port of the conductivity converter that is not used is sealed, e.g., with a plug.

[Inspection of Wiring]

- Check that all necessary wiring has been done properly. After checking the connections of the conductivity converter, always put the terminal cover back in place.

[Inspection of Piping]

Piping is implemented only if a circulating sensor is used.

- Check that the piping of the sensor holder on both the inlet and outlet sides has been properly connected. And, also confirm that there is no risk of froth forming in the measurement fluid inside the holder.

4.1.2 Supply of Power

First, confirm that connected control equipment is not being operated by a signal from the conductivity converter. Then, turn on the switch on the power line to operate the converter. The supplied power operates the converter in the measurement mode.

[Main Operation in Measurement Mode (with the parameters set upon shipment from the factory)]

- The measured conductivity (μS/cm or mS/cm) is automatically switched over in the data display and the measured temperature (°C) appears in the message display.

- Output signals of 4 to 20 mA DC and 0 to 1 V DC corresponding to the conductivity range (0 to 1 mS/cm) are sent out.
- When the measured conductivity value reaches 1 mS/cm or more (25 °C conversion value), contact output S1 is output (contact "closed"). And, if it falls to 10 µS/cm or less, contact output S2 is output (the contact output S3 function is stopped).
- If the conductivity converter detects a failure, the contact output FAIL is output (contact "closed").

Note : While the power is turned off, the contact for the contact output FAIL is "closed."

4.1.3 Check of Setting Parameters and Change in Defaults

Set up relevant parameters to meet individual operating conditions. Also confirm that important parameters are correctly set even if the parameters set upon shipment from the factory (default) will not be changed.

Note : Set the cell constant and electrode type (2 or 4 electrodes) to match the conductivity sensor being used. The temperature element of the SC8SG conductivity sensor is of Pt 1000 Ω. When measuring the low conductivity, always enter the length (rated) of the sensor cable in service level CODE 18 (default setting: 2 m). A measuring error may occur unless the cable capacitance has been compensated for.

If the defaults have been changed, it is convenient to record the data, e.g., in the operation parameter setting record sheet at the end of this manual.

The types and operation of setting parameters are detailed in Chapter 5. Read them before carrying out setting. For reference, the pages describing the main setting parameters and key operations are shown below.

[Key Operation Procedures]

[Output Signal]

[Contact Output]

[Compensation and Correction]

[Specification of Conductivity Sensor to Be Used]

4.1.4 Calibration

Even when the cell constants of conductivity sensors have identical ratings, they differ slightly with each sensor. Therefore, the shown conductivity value is also not the same. Calibration is necessary in order to accurately measure conductivity. Similarly, even when the conductivity of fluids is the same, they differ according to the temperature; so, generally, measured values are converted into values for the reference temperature. Therefore, accurate temperature measurement also becomes indispensable.

The calibration of a conductivity meter is done taking into account the aspects of compensation of cell constant and accuracy of temperature measurement values. First, calibrate the temperature; however, do it only once at the beginning of use. For the procedure, see Chapter 6. In this section, only an overview of calibration is presented.

[Calibration of temperature reading (1-point calibration)]

Temperature reading is calibrated by entering the exact temperature of the fluid being measured in service level CODE 18. Use a precision thermometer to measure the fluid temperature.

[Calibration of conductivity reading]

Calibration of the conductivity reading is done in the "CAL" mode of the operation level. A standard fluid (a fluid of known conductivity at the reference temperature) is used for the calibration. Usually, a sodium chloride solution with a conductivity of more than 50% of the measurement range is used. At the time of the calibration, check the data that are set in the temperature compensation method setting mode of the setting level (see page 5-14), and change them if necessary.

4.1.5 Operation Check

After calibration is completed, return the conductivity sensor and other equipment to the installed operating status. Run all the equipment composing the loop. Continue doing a test run for a while and after confirming that there are no faulty points, place the system in steady operation. For reference, the SC400G conductivity converter setting functions (signals) for obtaining optimum operation are summarized below.

[Output Signal]

- The signal can be held (at the value immediately before an instant or arbitrary value) during calibration or, if the output signal at the setting / service level adversely affects the operation of the equipment composing the loop.
- The signal can be burned up, e.g., if the output signal when a FAIL contact signal is generated is identified as a normal one (default setting: no burn-up).
- When conducting concentration management, etc., the interrelationship between the conductivity value and output signal can be made non-linear (default: linear).
- In the case of a process encountering temporary over-ranging, the range can be changed to 10 times that of the set range using a remote command.

  Note : It is necessary to have the wiring for the input contact signal that is made.

[High or Low Alarm Contact Output]

- If control is improper, the delay time and hysteresis can be changed (default settings: delay time of 0.2 second, hysteresis of 2 %/span).
- A high or low alarm contact output can be switched to the contact output FAIL after an arbitrary period of time has elapsed, e.g., if a failure in the control system is detected (default setting: function stop)
- For a FAIL contact output due to a specific error (number 1, 5, 6, 7, 8 or 22), a high or low alarm contact output can be provided (default: output off) (see page 5 - 32).

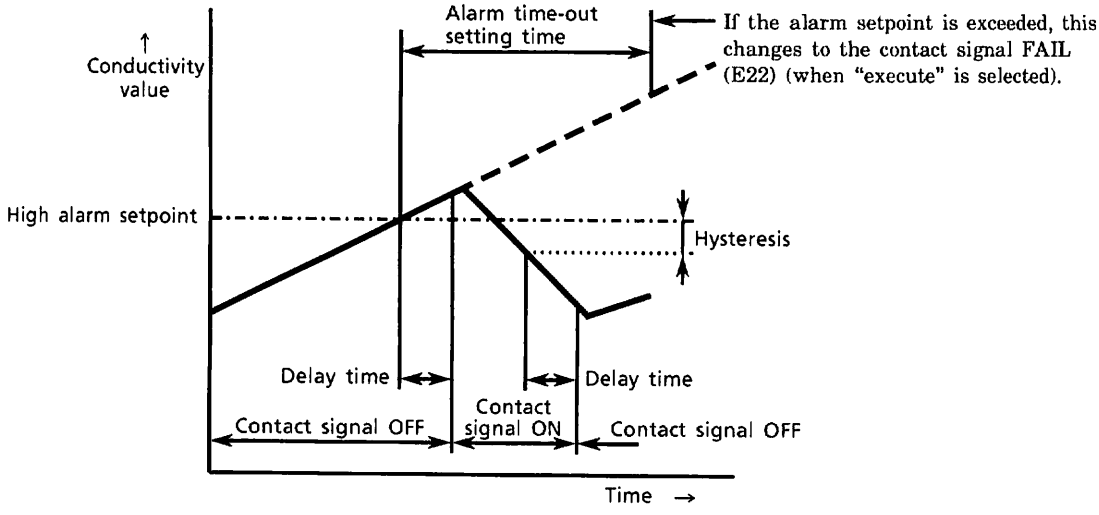


Figure 4.1 Delay Time and Hysteresis for Alarm Contact Output (example of high alarm)

- When being used to control the high / low limit alarm of conductivity, the contact output can be made proportional-duty output or proportional-frequency output in order to acquire ideal control results (default: status output). [See pages 5 - 21 and 22, CODE 08, 09, and 10].

<Contact Output Mode of High / Low Limit Alarms>

(1) Status output

This is the output mode which continues, when the contact remains "closed (ON)", while the measured value exceeds the alarm point (high or low limit).

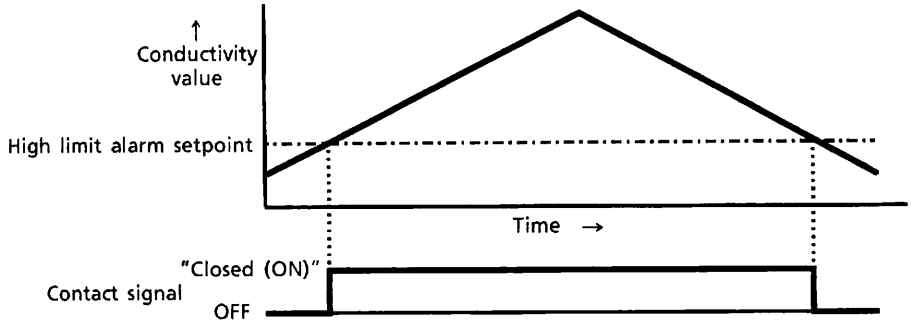
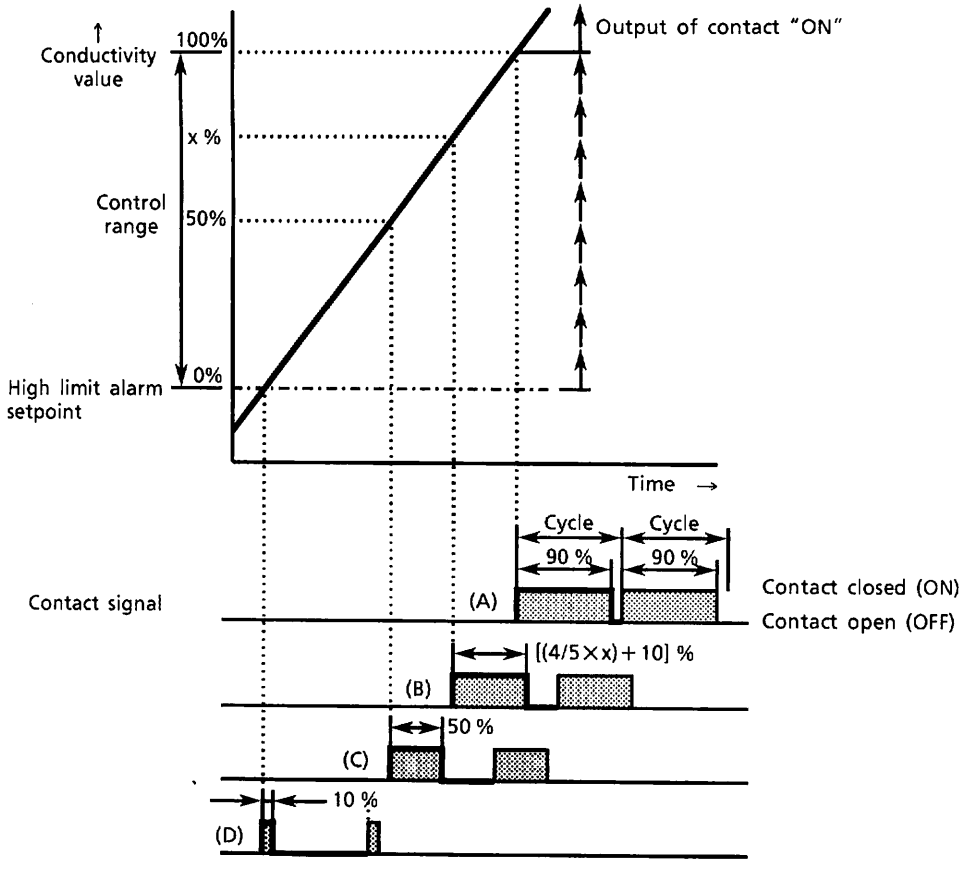


Figure 4.2 Status Output (example of high limit alarm)

(2) Proportional duty output

Proportional duty output is valid for high and low limit alarms. As shown in Figure 4.3, the pulse width of contact output varies according to the level of the measurement value that is regulated in the control range.



Note • The control range (0 to 100 % span value) is set with CODE 12 of the service level.
• The cycle (sec) is set with CODE 13 of the service level.

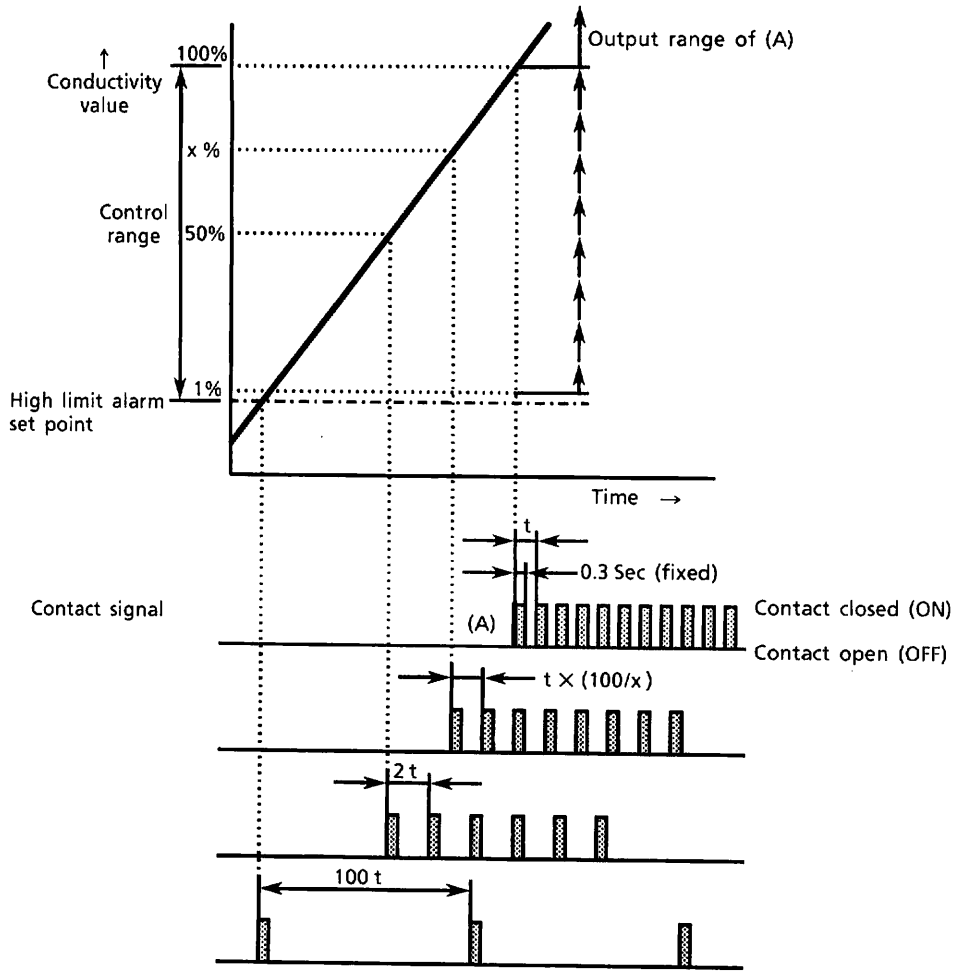
Figure 4.3 Proportional Duty Output (example of high limit alarm)

The pulse width of the contact output varies with the measured value level that is controlled by the range. When the measured value reaches the high limit alarm set point (0% of control range), the contact signal turns on/off with a ratio of 0.1 : 0.9. The output turns of/off with a ratio of 0.9 : 0.1 at 100 % measurement range. The output pulse width at a measurement level that corresponds to x% of the control range is [(4/5×x) + 10] %. When the measured value exceeds 100 % of the control range, it is fixed to the output of contact "ON". The control range is set with CODE 12 of the service level. And, the pulse width is set with CODE 13.

(3) Proportional frequency output

Proportional frequency, too, is valid for high and low limit alarms. As shown in Figure 4.4, the pulse width of the contact output varies in proportion to the regulated measured value of the control range (1 to 100 % of control range). The pulse width is fixed at 0.3 sec.

If the measured value exceeds 100% of control range, it becomes fixed at the pulse cycle that is at 100%. This pulse cycle "t" is determined by the maximum frequency (number of pulses per minute) that has been set with CODE 14 of the service level. The control range is the value that has been set in CODE 12 of the service level.



Note • The control range (0 to 100 % span value) is set with CODE 12 of the service level.
• Cycle "t" [sec] is determined by the maximum frequency (pulses / min) that is set with CODE 14 of the service level.

Figure 4.4 Proportional Frequency Output (example of high limit alarm)

[Failure (FAIL) contact output]

- The specific contact output FAIL can be changed to a pulse output which turns ON / OFF every 3 seconds.

  Note : Burn up of the output signal becomes impossible when this operation is selected.

- The "E6" error (electrode open ; caused by an open circuit in the conductivity input circuit) detection function can be turned off.

  Note : The "E6" error is displayed when the resistance between electrodes is 500kΩ or greater. To prevent this error from occurring, use Service Level Code 27 to turn it off.

4.2 Steady Operation

Normally, it is not necessary to adjust the SC400G Conductivity Converter except for implemented calibration. In principle, check and maintain the sensor when calibration is implemented except if a failure occurs. In addition, the converter has a function which disables the setting operation of parameters and calibration execution unless the same password as the set one is entered. If this function is required for operation management, set a password. Passwords can be set for each of the operations, settings, and service levels by selecting one of the nine types of passwords (default setting: all level functions stop). Set the password at CODE 33 at the service level.

4.2.1 Measures for Failure Occurrence

If the SC400G conductivity converter detects a failure, a FAIL contact output is sent out. If the burn-up function is active, the output signal causes burn-up (current output: 22 mA; voltage output: 1.1 V). The content of the failure is given in the data display through an error number. If a failure occurs, check the reason and quickly take measures. Table 4.1 shows the error numbers for failures generated in the measurement mode. For details on failures, see Section 8.2.

Table 4.1 Failures Generated in Measurement Mode

Error No.	Cause of Failure	Measure Against Failure
E 1	The electrodes of conductivity sensor have exceeded the permissible level.	Clean the conductivity sensor.
E 5	Electrode short (2 Ω or less)	Check the connector, etc. of the sensor cable.
E 6	Electrode open	Check the connection of the sensor cable.
E 7	Measured temperature exceeds 250°C.	If different from the fluid temperature, check the sensor and wiring connections.
E 8	Measured temperature is less than −10°C.	If different from the fluid temperature, check the sensor and wiring connections.
E10	An EEPROM writing error is detected.	If the failure cannot be returned to normal by first turning off the power and then turning it back on, contact Yokogawa.
E20	An EEPROM memory check failure is detected.	Request repair by Yokogawa.
E22	High or low alarm exceeds the time-out instant.	Reset the alarm with the [YES] key and examine the measuring point and others.

4.2.2 Inspection and Maintenance

When using with a general process solution containing few adhesive components, the EXA SC Conductivity Metering System can be used over a prolonged length of time, without doing any maintenance. If the measurement fluid contains components which damage the O-ring of seal, or contains adhesive components, periodically check to confirm that they do not give rise to problems. Dirt adhering to the sensor becomes a cause of polarization (error E1 is issued, when the polarization reaches a constant level). Calibration (correction of cell constant) is done in cycles which do not allow errors in measurement to exceed the permissible limits. When calibrating, also do maintenance (cleaning) on the conductivity sensor. For details on checks and maintenance, see Chapter 7.

4.3 Operation Shutdown and Restarting

4.3.1 Measures for Shutdown

Data set in this device are retained even if the power is turned off. If the operation is shutdown over a prolonged period, turn off the power. If the sensor is to be left exposed to the air, YOKOGAWA recommends that any measurement fluid which remains on it be rinsed off. If an adhering component hardens or if a corrosive component becomes concentrated, it may cause problems.

4.3.2 Measures for Restarting

When the power is turned on again, the conductivity converter goes into the measurement mode. As a rule, calibrate (conductivity) before restarting measurement.

When conductivity of the measurement fluid at restart differs greatly from normal level, start operation after conductivity returns to normal.

When the measured value exceeds the range, the range can be increased to 10 times the range with a remote command. But pay attention during control because the alarm set value, etc. will not change.

5. Parameter Setting

When the SC400G conductivity converter is to be used, set the data and select the functions according to its usage and measuring conditions. This chapter describes the setting procedures for parameters.

5.1 Setting Operation Summary

5.1.1 Operation, Setting, and Service Levels

Parameter setting should be carried out by selecting the relevant mode. These modes are classified into three levels: the operation, setting, and service levels.

[Operation Level]

This is basically a level for daily inspection and / or maintenance such as calibration. At this level only, key operations can be carried out externally with the front cover mounted. At this level, high and low alarm values of message display items can be set.

[Setting Level]

There are modes at this level for setting data related to output signals and contact outputs.

[Service Level]

The SC400G conductivity converter has a number of functions. At this level, there are modes to select the functions necessary for operation.

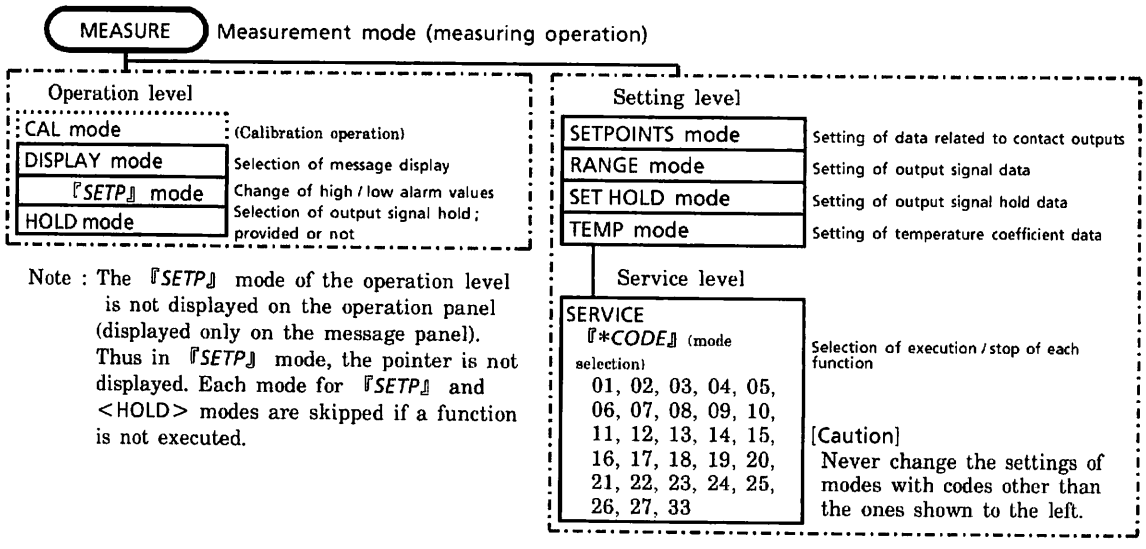


Figure 5.1 Classification of Modes Related to Setting at Levels

5.1.2 Key Operations

Key operations can be carried out in the form of "interactions." Operate keys according to the display in the data display or the message display, pointer (mode indication) display positions, and / or display in the key operation display. For basic key operations, see Chapter 1.

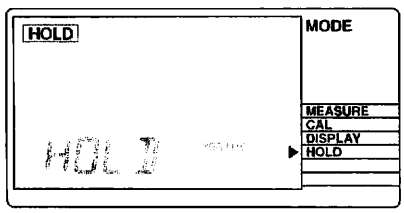
[Interactions]

- **Pointer flashing display**
  This inquires whether an indicated mode is to be entered or the pointer is to be moved to the next mode. When the modes at the setting or service level are to be indicated, an asterisk (*) is displayed at the head of the message display. When a mode is entered, the pointer display stops flashing and remains continuously lit.
  Note : The pointer disappears while in the 『SETP』 mode of the operation level.
- **Flashing key operation display**
  Select the relevant presentation indicated and press the corresponding key.
- **Flashing data display (numerals)**
  This inquires whether a flashing numeral is to be changed or a flashing digit is to be moved. Press the relevant key. If neither item is necessary, press the [ENT] key.

[Aborting the Setting Operation]

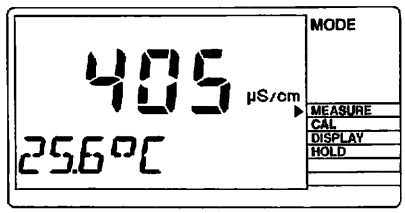
Press the [MODE] key. Normally, the [MODE] key is used to change the measurement mode to a mode at the operation level. It is also used to return to the measurement mode while in some other mode. If the [MODE] key is pressed while in other than the measurement mode, the "hold selection mode" of the operation level sets in, provided the hold function of the output signal has been executed.

(1) Hold selection mode display



In the "hold selection" mode, the display in the message display and 『YES』 and 『NO』 in the key operation display flash. If the current status is "hold," 『HOLD』 is also displayed.

(2) Measurement mode display



In the display shown in (1), if the [YES] or [NO] key is pressed, the mode changes to the measurement mode.

Figure 5.2 Display when [MODE] Key Is Pressed in Other Than Measurement Mode

[Automatic Return to Measurement Mode]

If no key operation is performed for 10 minutes, the converter in maintenance operation returns to measuring operation. However, if it is in the calibration mode, this time is one hour. When 『*H.ON』 is selected in the hold parameter setting mode, the converter is initially set to the output signal hold selection mode and an automatic return is performed from this mode after 10 minutes elapse. An automatic return is not executed if the function is set to "shutdown" (see CODE 16 on page 5 - 25 for details). This automatic return is effective only when the function is executed ; if "shutdown" is set, no return occurs.

5.1.3 Points to Be Noted in Implementing Setting

(1) Password

If a password is set, the converter cannot enter a mode unless its password is entered. A "password entry request" is issued at the following times:

- Operation level : when the [MODE] key is pressed in the measurement mode
- Setting level : when the [*] key is pressed in the measurement mode
- Service level : when the [YES] key is pressed at the appearance of 『*SERV』 in the message display

(2) Related Items

When a data item is changed, check its relationship to the data set in other modes so that there is no inconsistency.

[Items to Check When the Measuring Range Is Changed]

a. High and low alarm points and contact output hysteresis
b. Fixed value for output signal hold

[Item to Check When Current Output Signal Is Changed (from 4 to 20 mA DC to 0 to 20 mA DC and vice versa)]

a. Fixed value for output signal hold

[Items to Check When High and Low Alarm Points Are Changed]

a. Measuring range
b. Alarm actions (low alarm or high alarm operation)
c. Delay time and hysteresis

5.2 Setting Item List

Sections 5.2.1 to 5.2.3 show the setting items for each level.

5.2.1 Setting Items at Operation Level

Table 5.1 Setting Items at Operation Level

Mode / Setting Item		Display	Setting Contents	Default Value
CAL	(standard fluid calibration operation)	*CALIB*	—	—
DISPLAY	Indication selection in message display	*DISP*	(This mode is selected with the [YES] key.)	(See page 5-9.)
		XX.X ℃	Temperature	Temperature displayed in °C
		X.X *mA*	Output current	
		X.XXX *V*	Output voltage	
		XX.X %	Weight % density (when the function is in the "execution" mode	
		C.C X.XXX	Cell constant	
		T.R XX ℃	Reference temperature	
		T.C XX.XX	Temperature coefficient	
		(NaCl)	(based on NaCl characteristics)	
		REL X.X	Software version	
	Alarm point setting (changing) mode	*SETP*	(Same as the setting at the setting level)	(Function stop)
HOLD	Output signal hold selection mode	*HOLD*	Provided / not provided	(Function stop)

Note: ● A mode is skipped if its function stops.
● The display of mass % density is done with CODE 21 of the service level.
● The functions in the alarm point changing mode are executed with CODE 4 of the service level.
● Functions in the output signal hold setting mode are executed by selecting 『*H.ON』 in the hold parameter setting mode at the setting level.

Remarks: The items in the display column appear in the message display.
X in the display column indicates an unspecified numeral.

5.2.2 Setting Items at Setting Level

Table 5.2 Setting Items at Setting Level

Mode / Setting Item		Display	Setting Contents	Default value
SETPOINTS	Alarm point setting mode	* SETP	(This mode is selected with the [YES] key.)	(See page 5-11.)
	Alarm point setting for contact output S1	* SETP.1		(High alarm)
	Conductivity value	* SC1	0.001 [µS/cm] to 1999 [mS/cm]	1 [mS/cm]
	Temperature	* T1	0 to 250 [°C]	(25.0 [°C])
	Alarm point setting for contact output S2	* SETP.2		(Low alarm)
	Conductivity value	* SC2	0.001 [µS/cm] to 1999 [mS/cm]	10 [µS/cm]
	Temperature	* T2	0 to 250 [°C]	(25.0 [°C])
	Alarm point setting for contact output S3	* SETP.3		(Function stop)
	Conductivity value	* SC3	0.001 [µS/cm] to 1999 [mS/cm]	(10 [mS/cm])
	Temperature	* T3	0 to 250 [°C]	(25.0 [°C])
RANGE	Measuring range setting mode	* RANGE	(This mode is selected with the [YES] key.)	(See page 5-12.)
	Minimum value setting in the measuring range (conductivity)	* 0%	0.000 to [mS/cm] Less than 60% of maximum value	0.000 [mS/cm]
	Maximum value setting in the measuring range (conductivity)	* 100%	to 1999 [mS/cm] Greater than minimum value +0.5 µS/cm	1 [mS/cm]
SET HOLD	Hold parameter setting mode	* HOLD	(This mode is selected with the [YES] key.)	(See page 5-13.)
	Selection of hold "execute / stop"	* H. OFF * H. ON	"Stops" with the [YES] key "Executes" with the [YES] key	"Stop"
	Selection of the value immediately before or the fixed value	* H. LST	The value immediately before is selected with the [YES] key.	("Value immediately before")
		* H. FIX	The "fixed value" is selected with the [YES] key.	
	Current signal level of the fixed valuexed value	* H. mA	4.0 to 20.5 [mA]	(10.0 [mA])
	Voltage signal level of the fixed valuexed value	* H. mV	000 to 1025 [mV]	(500 [mV])
TEMP	Temperature compensation method setting mode	* TEMP	(This mode is selected with the [YES] key.)	(See page 5-14.)
	Selection of "NaCl" or "measurement fluid features"	* NaCl	NaCl features are selected with [YES] key.	[NaCl]
		* T.C.	Features of measurement fluid are selected with [YES] key.	
	Temperature coefficient entry operation in the case of "measurement fluid features" selection		When the conductivities at the reference temperature and room temperature are input, the temperature coefficient is computed. [Valid temperature coefficient: ±10%/°C]	

Note : • The default value of the output object for contact output S1 or the S2 alarm point is set to the conductivity. The operating function is set to high alarm (status output) for S1 and low alarm (status output) for S2. If these are to be changed, re-set them using CODE 08 or CODE 09.

• The default value of contact output S3 is set to "function stop" using CODE 10 at the service level. If this is set to "cleaning," 『*SETP3』 is skipped.

• If the operation to find out the temperature coefficient is executed with 『*T.C』 in TEMP mode, the temperature coefficient that has been set in CODE 19 of service level becomes invalid (the later set one takes priority).

Remarks : The values in parentheses in the default value column are effective when their functions are executed.

5.2.3 Setting Items at Service Level

At the service level, each setting mode is selected by specifying the relevant code numbers.

Table 5.3 Setting Items at Service Level (first of two tables)

Mode / Setting Item	Display	Setting Contents	Default Value
CODE 01 Temperature measurement specification setting mode	*CODE	This mode is set by entering "01".	(See page 5-16)
Selection of "temperature element / temperature unit"	*T.CODE	0.X : Pt 1000 Ω 1.X : Ni 100 Ω 2.X : NTC 3.X : Pt 100 Ω X.0 : °C X.1 : °F	0.X X.0
CODE 02 Cell constant setting mode	*CODE	This mode is set by entering "02".	(See page 5-17)
Setting of cell constant	X.X × C	0.008 to 50 [1/cm] (Input the value of C)	0.10 [1/cm]
CODE 03 Electrode setting mode	*CODE	This mode is set by entering "03".	(See page 5-17)
Selection of electrode type	*4.ELEC	0: 2 electrodes ; 1: 4 electrodes	0
CODE 04 Current output signal setting mode	*CODE	This mode is set by entering "04".	(See page 5-18)
Selection of output signal	*mA	0: 0 to 20 mA 1: 4 to 20 mA	1
CODE 05 Features setting mode of output signal	*CODE	This mode is set by entering "05".	(See page 5-18)
Selection of "linear / non-linear"	*TABLE	0: linear output ; 1: non-linear output	0
CODE 06 Non-linear output data setting mode	*CODE	This mode is set by entering "06".	(See page 5-18)
Entry of 21-point data	*0% : *100%	Sets the conductivity value of each output, after every 5% beginning from 0% output signal.	
CODE 07 Temperature output function setting mode	*CODE	This mode is set by entering "07".	(See page 5-20)
Selection of applicable output signal	*T.OUTP	0: none ; 1: voltage output signal ; 2: current output signal	0
Setting of measurement range minimum value	*0%	−10 to 200	(0 [°C])
Setting of measurement range maximum value	*100%	Minimum value +25 [°C]	(100 [°C])
CODE 08 Function setting mode of contact output S1	*CODE	This mode is set by entering "08".	(See page 5-21)
Selection of operation function / output mode	*S1	0.X : function stop ; 1.X : low alarm ; 2.X : high alarm X.0 : status ; X.1 : proportional duty X.2 : proportional frequency ; X.3 : temperature alarm status	2.0
CODE 09 Function setting mode of contact output S2	*CODE	This mode is set by entering "09".	(See page 5-21)
Selection of operation function / output mode	*S2	0.X : function stop ; 1.X : low alarm ; 2.X : high alarm X.0 : status ; X.1 : proportional duty X.2 : proportional frequency ; X.3 : temperature status	1.0
CODE 10 Function setting mode of contact output S3	*CODE	This mode is set by entering "10".	(See page 5-22)
Selection of operation function / output mode	*S3	0.X : function stop ; 1.X : low alarm ; 2.X : high alarm X.0 : status ; X.1 : proportional duty X.2 : proportional frequency ; X.3 : temperature status	0.0
CODE 11 Delay time / hysteresis setting mode of alarm contact output (conductivity)	*CODE	This mode is set by entering "11".	(See page 5-22)
Setting of delay time	*DTIME	0.0 to 199.9 [s]	0.2 [s]
Setting of hysteresis	*HYST	0.1 to 100 [%]	2.0 [%]
CODE 12 Control range setting mode of contact output	*CODE	This mode is set by entering "12".	(See page 5-23)
Setting of control range	*RANGE	0 to 100 [%]	10 [%]
CODE 13 Frequency setting mode of proportional duty contact output	*CODE	This mode is set by entering "13".	(See page 5-24)
Setting of frequency	*PER.	5 to 100 [s]	10 [s]
CODE 14 Maximum frequency setting mode of proportional frequency contact output	*CODE	This mode is set by entering "14".	(See page 5-24)
Setting of maximum frequency	*FREQ.	50 to 120 Pulses / min.	70 Pulses / min.

Note : • CODE 06 can be set only when "non-linear" has been selected with CODE 05.

Remarks : The values in parentheses in the default value column are effective when the function is executed.

Table 5.4 Setting Items at Service Level (second of two tables)

Mode / Setting Item	Display	Setting Contents	Default Value
CODE 15 Reference temperature setting mode	*CODE	This mode is set by entering "15".	(See page 5-25)
Setting of reference temperature	*T.R.	0 to 100 [°C]	25 [°C]
CODE 16 Measurement mode auto return setting mode	*CODE	This mode is set by entering "16".	(See page 5-25)
Selection of "execute / stop"	*RET.	0: stop; 1: execute	1
CODE 17 Burn up function setting mode	*CODE	This mode is set by entering "17".	(See page 5-26)
Selection of "execute / stop"	*BURN	0: stop; 1: execute	0
CODE 18 "Temperature input signal / cable capacitance" correction mode	*CODE	This mode is set by entering "18".	(See page 5-26)
Entry of actual temperature	*T.ADJ	If the displayed temperature is corrected to the temperature that is measured with a standard thermometer or the like and is then input, the correction value is computed. Correction range: ±2.5°C	Correction value 0°C
Entry of sensor cable length	*L.ADJ	2 to 10 [m]	2 [m]
CODE 19 Temperature coefficient setting mode	*CODE	This mode is set by entering "19".	(See page 5-27)
Setting of temperature coefficient	*T.C.	−9.99 to 9.99 [%/°C]	2.1 [%/°C]
CODE 20 Polarization check function setting mode	*CODE	This mode is set by entering "20".	(See page 5-28)
Selection of "execute / stop"	*POL.CK	0: stop; 1: execute	0
CODE 21 Weight % display function setting mode	*CODE	This mode is set by entering "21".	(See page 5-28)
Selection of "execute / stop"	*%	0: stop; 1: execute	0
Setting of display range minimum value	*0%	0 to 100 [wt %]	0 [wt%]
Setting of display range maximum value	*100%	0 to 100 [wt %]	100 [wt%]
CODE 22 Alarm time out function setting mode	*CODE	This mode is set by entering "22".	(See page 5-29)
Selection of "execute / stop"	*EXPIR	0: stop; 1: execute	0
Setting of time-out time	*tE.min.	0.2 to 199.9 [min]	(15 [min])
CODE 23 Hysteresis setting mode of temperature alarm contact output	*CODE	This mode is set by entering "23".	(See page 5-30)
Setting of hysteresis	*T.HYST	0.1 to 5.0 [°C]	(0.5 [°C])
CODE 24 Alarm value change operating function setting mode	*CODE	This mode is set by entering "24".	(See page 5-30)
Selection of "execute / stop"	*MODE	0: stop; 1: execute	0
CODE 25 Matrix temperature compensating function setting mode	*CODE	This mode is set by entering "25".	(See page 5-31)
Selection of compensation features	*MATRX	0: stop 1: hydrochloric acid (0 to 100 ppb) 2: ammonia (0 to 50 ppb) 3: morpholine (0 to 500 ppb) 4: hydrochloric acid (0 to 5 % concentration) 5: nitric acid (0 to 5 % concentration)	0
CODE 26 Error detection operation setting mode	*CODE	This mode is set by entering "26".	(See page 5-32)
Selection / detect operation of error number	*Err.XX	Applicable errors : E1, E5 to E8, E22 0: SOFTFAIL 1: HARDFAIL	All 1
CODE 27 Electrode open detection function setting mode	*CODE	This mode is set by entering "27".	(See page 5-33)
Selection of "execute / stop"	*EN.E6	0: stop; 1: execute	1
CODE 33 Password set mode	*CODE	This mode is set by entering "33".	(See page 5-34)
Selection of password	*PASS	0.0.0. : none on all levels X.0.0. : password of operation level 0.X.0. : password of setting level 0.0.X. : password of service level (A three-digit password where X is a numeric from 1 to 9.)	0.0.0

Note : • In 『*L.AD』 of CODE 18, the cable capacitance is compensated for. When measuring low conductivity, invariably enter the length of sensor cable (5 m or 10 m).
• After setting CODE 19, if the operation to find out the temperature coefficient is executed in 『*T.C.』 of the setting level TEMP mode, the setting of CODE 19 becomes invalid.
• The function of CODE 20 is usable only in case of a 2-electrode sensor.

Remarks : The values in parentheses in the default value column are effective when the function is executed.

5.3 Setting Procedures

Selection of setting modes is carried out by developing the pointer indicating position and message display.

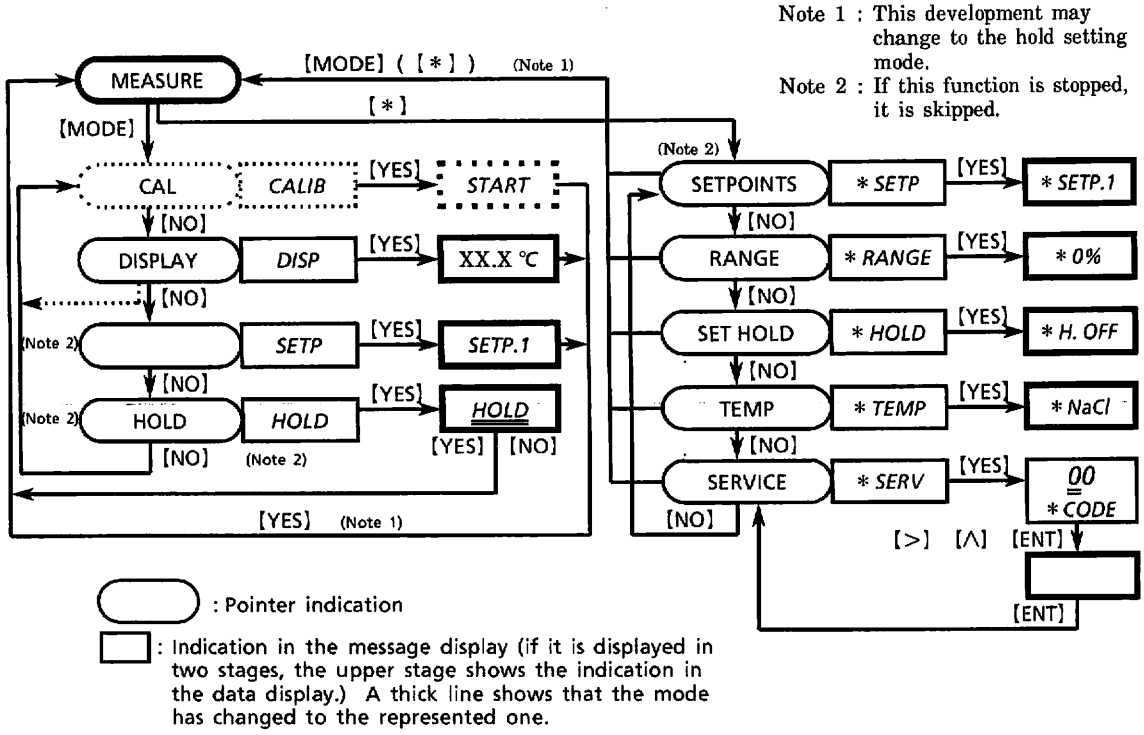


Figure 5.3 Setting Mode Development

5.3.1 Parameter Setting at Operation Level

There is the calibration mode other than the measurement mode at the operation level. Here, operation procedures in each mode at the operation level are described in paragraphs (1) to (3). The calibration operation mode (CAL) is described in Chapter 6.

(1) 『*DISP*』 Selection Mode for Indication in the Message Display

In the measurement mode, select the items to be displayed in the message display. There are 8 items and the 8 displays are repeated with every press of the [NO] key.

1. 『XX.X℃』 Measured temperature value
2. 『X.X*mA*』 Output current value
3. 『X.XXX*V*』 Output voltage value
4. 『XX.X%』 Weight % density (skipped, when the function is stopped)

   Note: The function is executed with CODE 21 at the service level.
   In the case that the conductivity of the measurement fluid is not proportionally related to the concentration of the fluid, input the nonlinear output data with CODE 06 with CODE 06. If the nonlinear output data are not input, the displayed value of the concentration may be largely different from the actual value.

5. 『*C.C*.X.XXX』 Cell constant

   Note: Shows the value that is corrected by calibration.

6. 『*T.R* XX℃』 Reference temperature
7. 『*NaCl*』 『*T.C*.X.XX』 Temperature compensation method (temperature coefficient)

   Note: 『*NaCl*』 appears when temperature compensation is done with the retained temperature coefficient of the sodium chloride solution.

8. 『*RELX.X*』 Software version

By pressing the [YES] key with the desired item displayed, that item is set and the measurement mode is selected (or the hold selection mode).

The default setting is the measured temperature value.

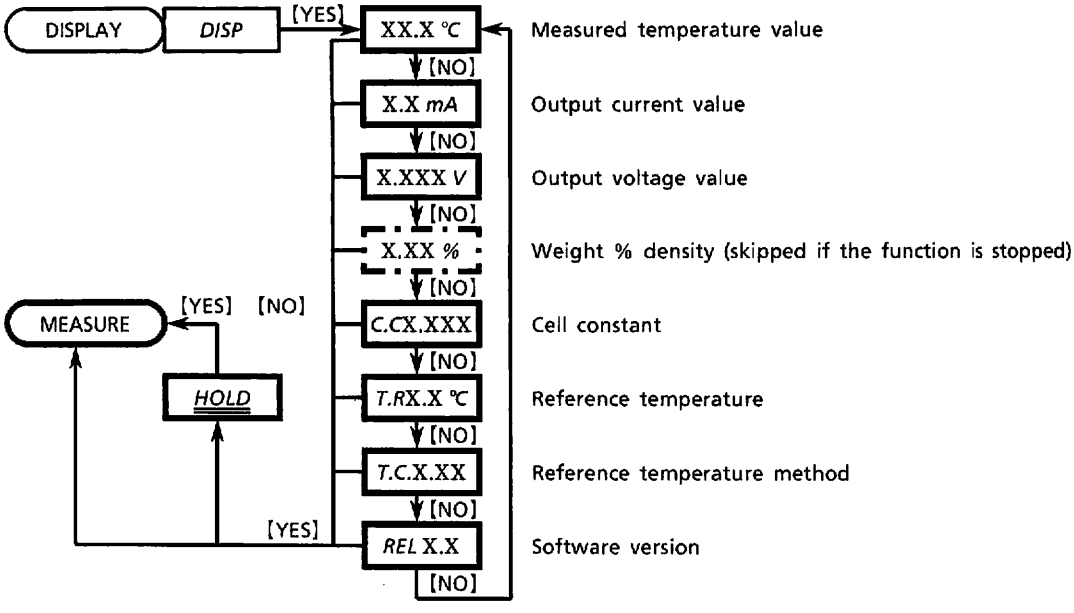


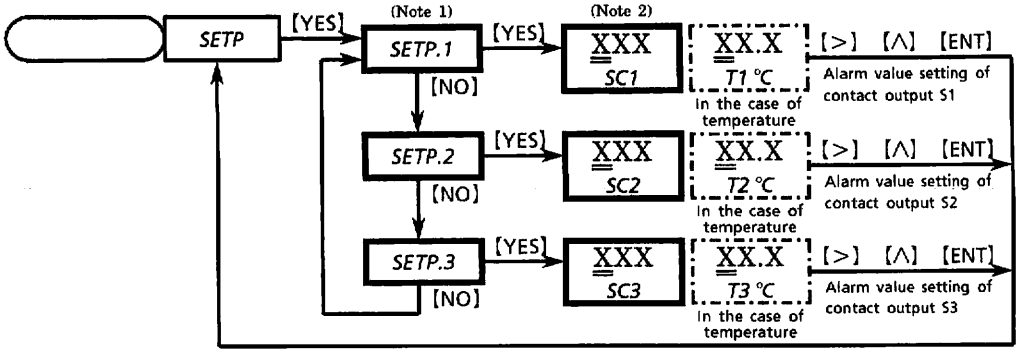
Figure 5.4 Flow of Selecting Indication in the Message Display

(2) 『*SETP*』 **Alarm Point Changing mode (pointer disappears while in this mode)**

This is the function to change a high or low alarm point setting with a key operation while the front cover is mounted. This function is effective only when execution is selected with CODE 24 at the service level. If the function is stopped, 『*SETP*』 is skipped.

Operation in this mode is the same as that in the alarm point setting mode (SETPOINTS) at the setting level. [See Subsection 5.3.2 (1) on page 5-11.]

Note : What is executed at operation level is only the setting (changing) of alarm values. Alarm operation (high/low limit alarm operations) is the operation that has been set in service level CODE 08, CODE 09, and CODE 10.



Note 1 : Items which are not for alarm purposes are skipped.
Note 2 : The conductivity value is input in the order of the numerical value, position of the decimal point, and unit (μS/cm or mS/cm) (see Subsection 1.3.3).

Figure 5.5 Operation Flow of Alarm Value Change Mode

(3) 『*HOLD*』 **Output Signal Hold Selection Mode**

This is the mode in which selection is made as to whether the output signal is held or not during the automatic cleaning time. This mode is effective when the hold function is executed (*H.ON) in the hold parameter setting mode at the setting level. In stop (*H.OFF), this mode is skipped.

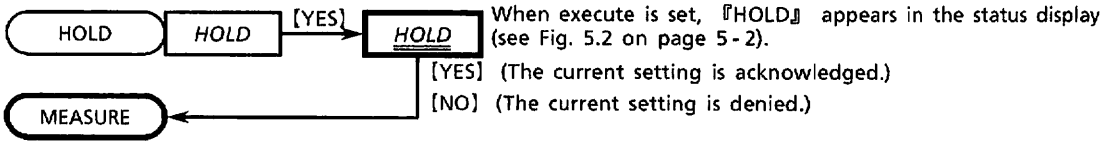


Figure 5.6 Operation Flow for Output Signal Hold Setting

If hold is selected in this mode, selection is required when a return to the measurement mode from all statuses is executed. If no holding is selected, selection in this mode is required only when a return to the measurement mode from the setting level or service level is executed.

5.3.2 Parameter Setting at Setting Level

At the setting level, data are mainly set (e.g., the measuring range). When a setting operation is to be carried out, remove the front cover. If values are entered at the setting level, no operation occurs when the relevant function at the service level is stopped. Take into consideration the relationship between modes.

There are the following four setting modes at the setting level

(1) 『*SETP』 Alarm point setting mode
(2) 『*RANGE』 Measuring range (conductivity) setting mode
(3) 『*HOLD』 Hold parameter setting mode
(4) 『*TEMP』 Temperature compensation method setting mode

The setting procedures for the items 1 to 4 are described in the sequence of key operations for mode selection.

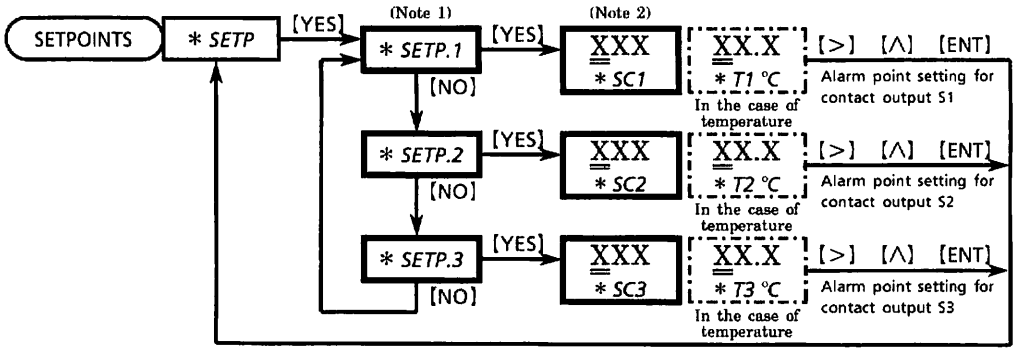
(1) 『*SETP』 Alarm Point Setting Mode

Set the alarm point values when contact outputs S1, S2, and S3 are set for a high alarm or for a low alarm in CODES 08, 09 and 10 at the service level. If not all of the contact outputs S1, S2 and S3 are set for an alarm, skip this mode.

The default settings for CODES 08, 09 and 10 at the service level are as follows.

- CODE 08: contact output S1 → high alarm for conductivity value
- CODE 09: contact output S2 → low alarm for conductivity value
- CODE 10: contact output S3 → function stop

Figure 5.7 shows the operation flow in the alarm point setting mode.



Note 1 : Items of a function stop are skipped.
Note 2 : The conductivity value is input in the order of the numerical value, position of the decimal point, and unit.

Figure 5.7 Operation Flow of Alarm Point Setting Mode

The setting range and setting upon shipment for each item in this mode are as follows. If a value outside of the setting range is entered, error E19 is issued.

『*SETP1』 (setting upon shipment: conductivity high alarm value 1 mS/cm)
Setting range for conductivity : 0.001 to 1999 [mS/cm]
Setting range for temperature : 0 to 250 [°C]

『*SETP2』 (setting upon shipment: low alarm value 10 µS/cm)
Setting range for conductivity : 0.001 to 1999 [mS/cm]
Setting range for temperature : 0.00 to 250.0 [°C]

『*SETP3*』 (setting upon shipment: skipped because of a function stop)
Setting range for conductivity : 0.001 to 1999 [mS/cm]
Setting range for temperature : 0.00 to 250.0 [°C]

[Associated setting mode]

- Selection of operating function / output object: CODE 08, Code 09, and CODE 10
  Note : CODE 12, etc. also needs to be set when proportional duty and proportional pulse are selected as output features.
- Related to delay time and hysteresis: Service level CODE 11 (conductivity) and CODE 23 (temperature)
- Alarm time-out: CODE 22

(2) 『*RANGE*』 Measuring Range Setting Mode

Set the conductivity (reference temperature conversion value) measuring range corresponding to the current output signal (4 to 20 mA DC / 0 to 20 mA DC) and voltage output signal (0 to 1 V DC).

Note : The measuring range in the case of temperature is set with service level CODE 07.

Use a method to enter conductivity values corresponding to the minimum (0 %) and maximum (100 %) values of the output signal for setting. Set it so that the span becomes more than 0.5 [μS/cm]. Set it so that the minimum value of the range becomes less than 60 % of its maximum value. If the value exceeds 60 %, error "E17" is issued and the value cannot be set. Figure 5.8 shows the operation flow for the measuring range setting mode.

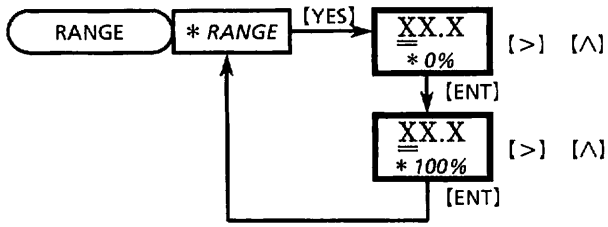


Figure 5.8 Operation Flow for Measuring Range Setting Mode

The setting range and setting upon shipment for each item set in this mode are as follows. If a value out of the setting range is entered, error E19 is issued.

『*0%*』 (Setting upon shipment: 0.000 mS/cm)
Setting range: 0.000 to (less than 60 % of the maximum value of the range) [mS/cm]

『*100%*』 (Setting upon shipment: 1 [mS/cm])
Setting range: 0.5 [μS/cm] to 1999 [mS/cm]

[Associated setting mode]

- Alarm value: alarm point setting mode <SETPOINTS> of setting level
- Temperature coefficient: service level CODE 19

(3) 『*HOLD』 Hold Parameter Setting Mode

Set the following contents for the output signal hold.

- Whether the hold function is executed (*H.ON) or stopped (*H.OFF)
- Whether the hold value in the case of execution is at the value immediately before holding (*H.LST) or at a fixed value (*H.FIX)
- If a fixed value is selected, what values the current and voltage are set to

If the hold function is executed, the output signal holds when the level is changed to the setting or service level or when calibration is done.

Figure 5.9 shows the operation flow for the hold parameter setting mode.

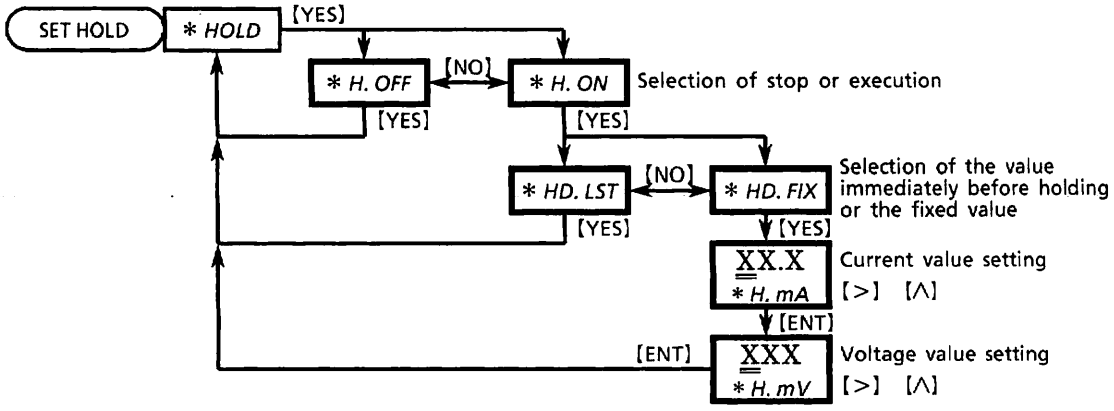


Figure 5.9 Operation Flow for Hold Parameter Setting Mode

[Setting Procedures]

- Selection of the hold function to execute (*H.ON) or stop (*H.OFF) (Setting upon shipment: "stop")
  When the mode is changed to the hold parameter setting mode, 『*H.OFF』 or 『*H.ON』 is indicated in the message display. If it is not the correct indication, switch the display using the [NO] key and then press the [YES] key. If execute (*H.ON) is selected, selection of execute / stop is enabled even at the operation level. When returning to the measurement mode from the setting level / service level, an indication to require the selection of hold execute / stop appears (for details, see item (3) on page 5-10).

- Selection of the value immediately before holding (*HD.LST) or fixed value (*HD.FIX) (Setting upon shipment: value immediately before holding)
  If execute is selected, 『*HD.LST』 or 『*HD.FIX』 is indicated in the message display. When the value immediately before holding is to be output, press the [YES] key at the indication of 『*HD.LST』. When an arbitrarily determined value is to be output, press the [YES] key at the indication of 『*HD.FIX』. If the indication is not correct, change the indication with the [NO] key and then press the [YES] key. If the value immediately before holding (*HD.LST) is selected, the hold function is actuated at that point.

- Current output value (*H.mA) setting (Setting upon shipment: 10.0 mA)
  If the fixed value (*HD.FIX) is selected, 『*H.mA』 appears in the message display and the current value to be output is requested to be set.
  Indicate the value to be set in the data display using the [>] or the [Λ] key and enter it with the [ENT] key. If a value out of the setting range is entered, error E19 is issued.

  Setting range: 04.0 to 20.5 mA

  [Note] : The current value set here is output at a hold regardless of whether the output signal is 4 to 20 mA DC or 0 to 20 mA DC.

- Voltage output value (*H.mV) setting (Setting upon shipment: 500 mV)
  After the current value is entered, 『*H.mV』 appears in the message display and the voltage value to be output is requested to be set. Set the voltage value in mV.
  Indicate the value to be set in the data display using the [>] or the [Λ] key and enter it with the [ENT] key. If a value out of the setting range is entered, error E19 is issued.

  Setting range: 000 to 1025 mV

  The hold function is actuated at the time when the voltage value is entered.

(4) 『*TEMP』 **Temperature Compensation Method Setting Mode** (Setting upon shipment: Temperature compensation with the features of NaCl)
In this mode, the appropriate temperature compensation method is selected in order to accurately convert into conductivity at the reference temperature. Upon entering the temperature compensation method setting mode 『*NaCl』 or 『*T.C.』 appears in the message display. 『*NaCl』 is selected for temperature compensation with the features of an NaCl solution (sodium chloride) that have been retained in the SC400G. And 『*T.C.』 is selected in the case of a measurement fluid for which the features of an NaCl solution cannot be used. Display the appropriate message, and press the [YES] key.

Temperature compensation when "NaCl" has been set

T	K_t	α	T	K_t	α
0	0.54	1.8	100	2.68	2.2
10	0.72	1.9	110	2.90	2.2
20	0.90	2.0	120	3.12	2.2
25	1.0	—	130	3.34	2.2
30	1.10	2.0	140	3.56	2.2
40	1.31	2.0	150	3.79	2.2
50	1.53	2.1	160	4.03	2.2
60	1.76	2.2	170	4.23	2.2
70	1.99	2.2	180	4.42	2.2
80	2.22	2.2	190	4.61	2.2
90	2.45	2.2	200	4.78	2.2

The "conductivity" temperature characteristics of an NaCl solution that are memorized in the SC400G conform to the reference temperature 25°C data of IEC 746-3.
In the table, T stands for the temperature of the solution. K_t stands for the conductivity at temperature T, and this is the multiplier for the conductivity value at the reference temperature. α is the coefficient (change ratio of the conductivity per 1°C) obtained from the following expression.

$$\alpha = \frac{K_t - K_{ref}}{T - T_{ref}} \times \frac{100}{K_{ref}}$$

T : temperature of solution [°C]
K_t : multiplier at the time of T
T_{ref} : reference temperature
K_{ref} : multiplier = 1, at the time of the reference temperature

To output raw conductivity value

To output the conductivity value without a reference temperature conversion, set the temperature coefficient at 0.0 in service level CODE 19.

The operating flow for the temperature compensation method setting mode is shown in Figure 5.10.

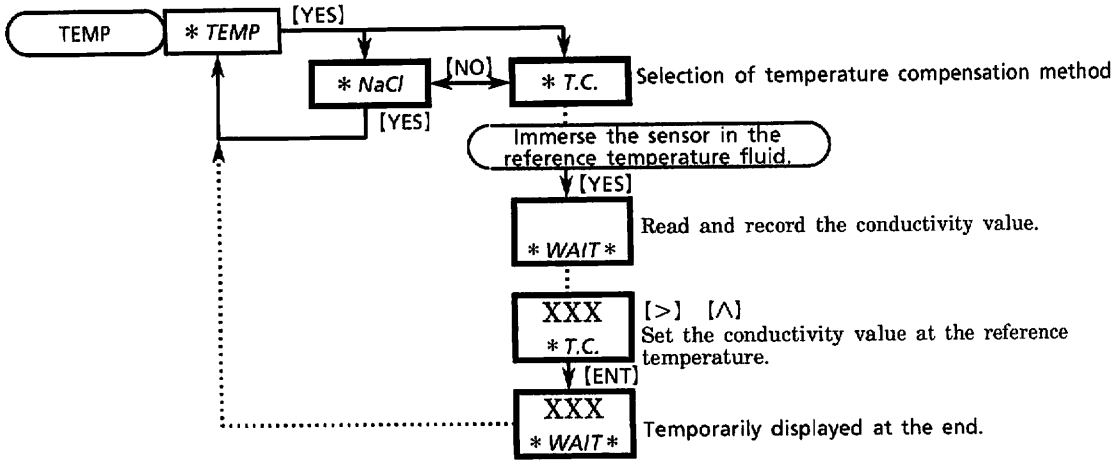


Figure 5.10 Operating Flow in Temperature Compensation Method Setting Mode

As shown in Figure 5.10, when 『*T.C.』 is selected, the operation to find the temperature coefficient becomes necessary more accurate temperature coefficient will be found by making temperature input signal compensation in CODE 18 at the service level in advance. And, once again, check the reference temperature.

Note: To select 『*T.C.』 to find the temperature coefficient, find out the conductivity value of the measurement fluid at reference temperature in advance. However, in case the temperature coefficient is entered in CODE 19 at the service level or in case matrix temperature compensation data stored in CODE 25 is utilized, it is unnecessary to find out the conductivity value because the temperature coefficient found here is invalidated.

If the temperature coefficient of the measurement fluid is clearly known, it can be entered in service level CODE 19. And from service level CODE 25, a fluid with temperature compensation characteristics matching the measurement fluid can be selected from these 5 (Temperature / Concentration) matrix temperature compensation data items: diluted hydrochloric acid, ammonia, morpholine, or 1 % to 5 % concentrated hydrochloric / nitric acid.

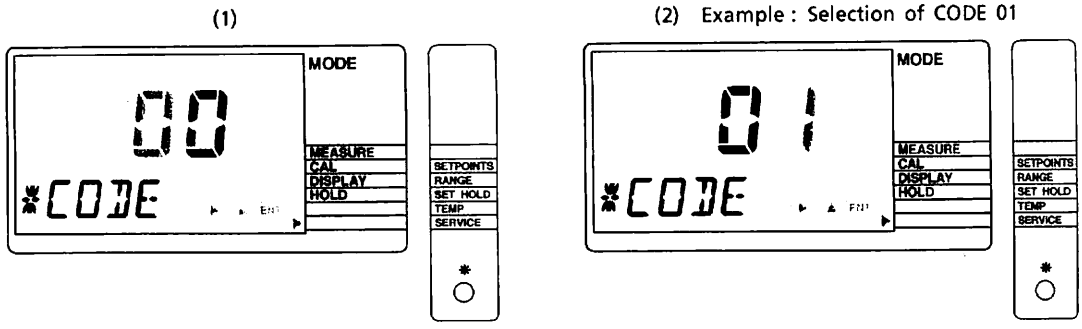
5.3.3 Parameter Setting at Service Level

Enter the relevant code numbers to go into each setting mode at the service level.

CAUTION

Do not enter codes other than those listed in Table 5.3 (page 5 - 6) and Table 5.4 (page 5 - 7). Changing set data may impair normal operation of the converter. If a code number is entered by mistake, return to the measurement mode by pressing the [MODE] key as a rule.

Note : If the data are not changed in this case, the [ENT] key can be used to exit that mode.



By pressing the [YES] key with 『*SERV』 displayed, the display changes as shown above.

When the [ENT] key is pressed in this display, the displayed code number is entered and the display changes to the indication of the setting mode.

Figure 5.11 Example of Code Number Entry at Service Level

The setting procedures at the service level are described below in ascending order of the code numbers.

CODE 01 Temperature Measurement Specification setting (*T.CODE) Mode

(factory setting : 0.0 = Pt 1000 Ω / °C)

When this mode is entered by inputting Code No. 01, the display in the message display field changes to 『*T.CODE』. Here, select the type of temperature element that is built into the conductivity sensor, and the unit of temperature.

Note : The temperature element of the SC8SG Conductivity Sensor is Pt 1000 Ω.

Figure 5.12 shows the operating flow of the temperature measurement specification setting mode.

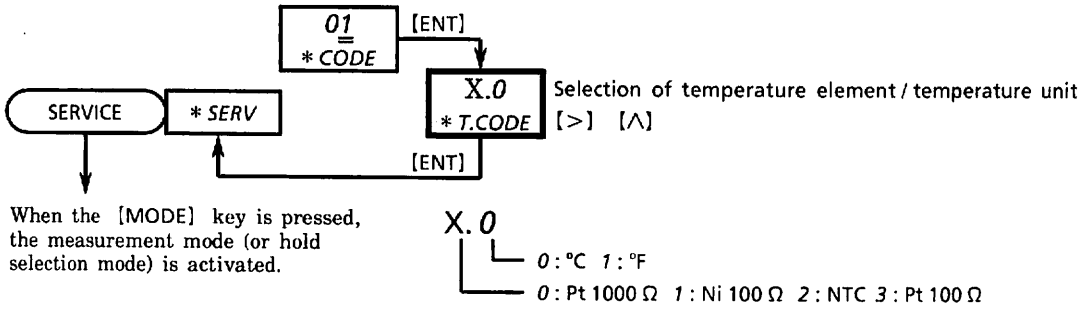


Figure 5.12 Operating Flow of Temperature Measurement Specification Setting Mode

CODE 02 Cell Constant Setting (X.XxC) Mode (factory setting: 0.10 cm^{-1})

The cell constant of the conductivity sensor being used in entered. When this mode is entered by inputting Code No. 02, 『0.01XC』 appears in the message display. Every time the [NO] key is pressed, "0.1" (coefficient) changes in succession to "0.1", "1.0", and "10". 'C' shows the value that is entered in the data display field. That is, the cell constant is set in the form of a "coefficient x input value."

Note: The cell constant of the SC8SG-R31 conductivity sensor is 0.01 cm^{-1}.
The cell constant of the SC8SG-R61 conductivity sensor is 10 cm^{-1}.

[Setting procedure]

(1) Display the desired coefficient in the message display, and press the [YES] key.
(2) Input into the data display field a value that makes its product with the coefficient equal to the cell constant, and then press the [ENT] key.
Settable range is 0.008 to 50 cm^{-1}. If a value outside this range is input, error "E19" is generated.

Figure 5.13 shows the operating flow of the cell constant setting mode.

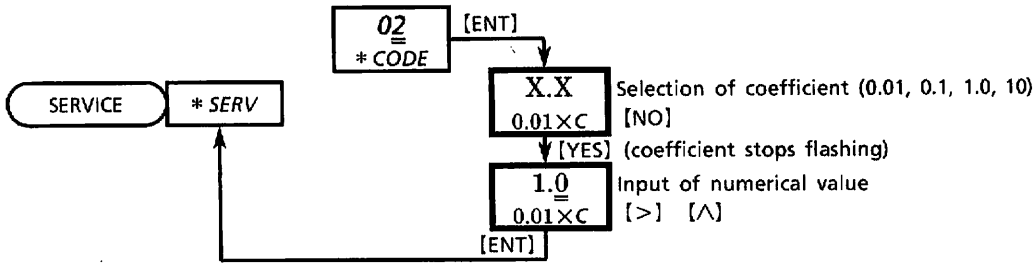


Figure 5.13 Operating Flow of Cell Constant Setting Mode

CODE 03 Electrode Type (*4.ELEC) Mode (factory setting: 0=2 electrodes)

The type of electrode to be used with the conductivity sensor is entered. When this mode is entered by inputting Code No. 03, the message display changes to 『*4.ELEC,』 asking for selection of the electrode type. In the case of the 2-electrode sensor, display 『0』 in the data display and press the [ENT] key. And, in the case of the 4-electrode sensor, display 『1』 in the data display and press the [ENT] key.

Note: The SC8SG-R31-T and SC8SG-R61-T conductivity sensors are 2-electrode sensors.
The SC8SG-R61-F conductivity sensor is a 4-electrode sensor.

Figure 5.14 shows the operating flow of the electrode type setting mode.

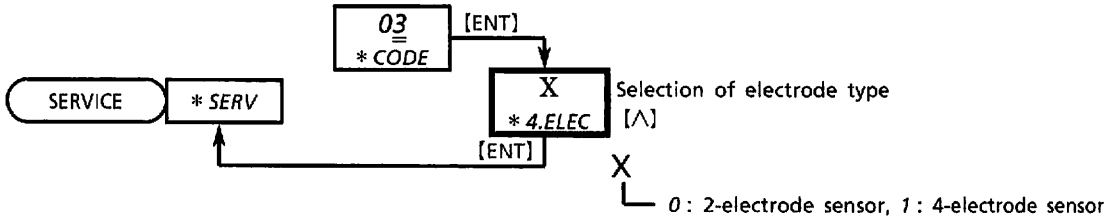


Figure 5.14 Operating Flow of Electrode Type Setting Mode

CODE 04 Current Output Signal Setting Mode (Setting upon shipment: 1 = 4 to 20 mA DC)

Either 0 to 20 mA DC or 4 to 20 mA DC can be selected for the current output signal. When the mode is changed to this mode by entering code number 04, 『*mA』 appears in the message display and selection of the current output signal is requested. If 0 to 20 mA DC is required, indicate 『0』 in the data display and press the [ENT] key. If 4 to 20 mA DC is required, indicate 『1』 in the data display and press the [ENT] key.

Note : If the setting has been changed, check that the associated item settings, e.g., alarm point setting, are correct.

Figure 5.15 shows the operating flow of the current output signal setting mode.

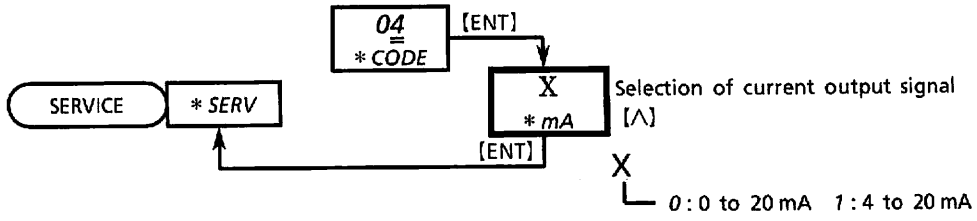


Figure 5.15 Operating Flow of Current Output Signal Setting Mode

CODE 05 Output Signal Features Setting (*TABLE) Mode (factory setting: 0 = linear output)

In the SC400G, the conductivity value and output signal value can be made either linear output signals having a proportional relationship or non-linear output signals not having a proportional relationship. Non-linear output applies to concentration management in which the solution concentration and output signal value are approximately interrelated. When this mode is entered by inputting Code No. 05, the message display changes to 『*TABLE』 asking for selection of the current output signal. To select linear output, display 『0』 in the data display and press the [ENT] key. And, to select non-linear output, display 『1』 in the data display and press the [ENT] key.

Figure 5.16 shows the operating flow in the features setting mode of the output signal

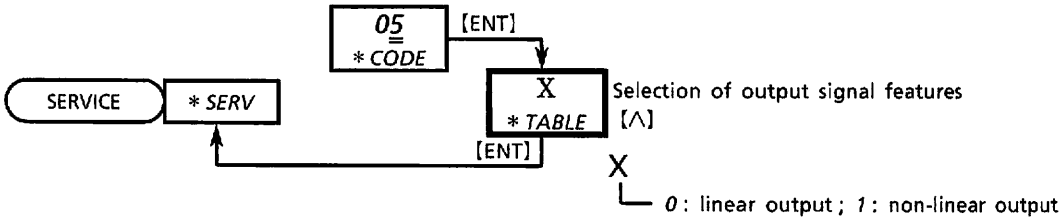


Figure 5.16 Operating Flow in Features Setting Mode of Output Signal

If non-linear output is selected here, the data that have been set in the measurement range setting mode of the setting level become invalid. When non-linear output is selected, enter non-linear output data with CODE 06.

CODE 06 Non-Linear Output Data Setting (*0 % ... *100 %) Mode

When non-linear output is selected with CODE 05, the conductivity value corresponding to the output signal values (21-point; 21-dotted line), in 5 % steps from 0 % to 100 %, is entered so that the desired output is obtained.

[Setting Conditions]

- Enter so as to increment or decrement in succession.
- Invariably enter the output signal 0%, 100%, and the conductivity value at the output signal value which forms the bend point (operate the [YES] and [ENT] keys). The operation to enter the conductivity value at a point on a straight line can be omitted (press the [NO] key).

  Note : If omitted, the previously set value becomes invalid (automatically corrected so as to form a straight line linking the previous and following setpoints).
- To change the set data of a certain point, enter at all the set points prior to the point (press the [YES] or [NO] key). It can be omitted at setpoints beyond the changed setpoint (press the [NO] key).

When this mode is entered by inputting Code No. 06, the message display changes to 『*0 %,』 requesting entry of the conductivity value at output signal 0%. Press the [YES] key and input the conductivity value.

Note : If the [NO] key is pressed, the message display changes to 『*5 %.』

After inputting the conductivity value, press the [ENT] key. The message display changes to 『*5 %』. Repeating the same operation, enter the conductivity values of up to output signal 100 %.

Figure 5.17 shows the operating flow of the non-linear output data setting mode.

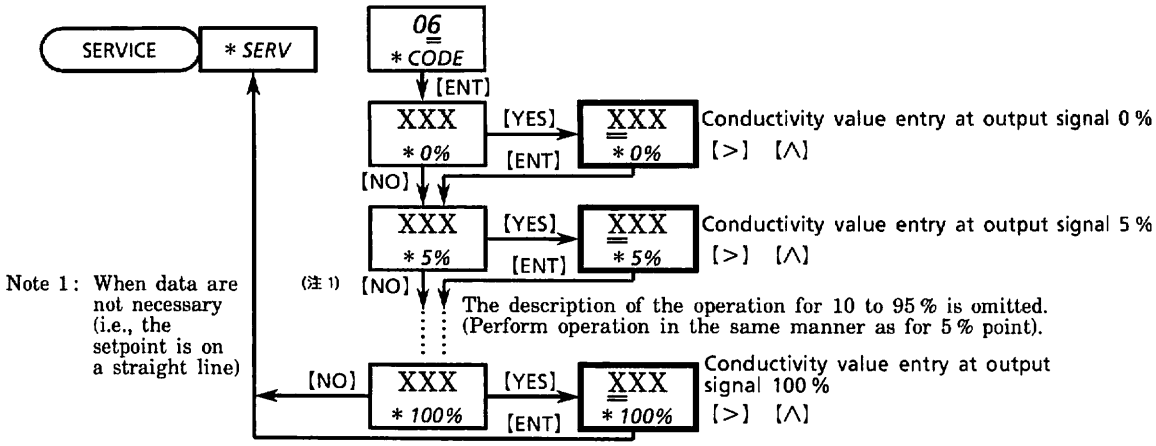
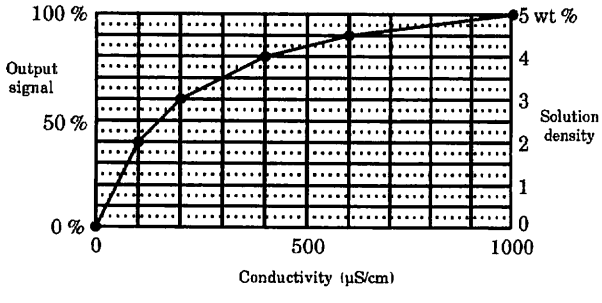


Figure 5.17 Operating Flow of Non-linear Output Data Setting Mode

[Example of setting] Entry at the time of conducting density management: When matching 0 to 5 wt % solution density to output signal

Setting Data Table

Output signal value (4 to 20 mA DC)	Conductivity value µS/cm	Output signal value (4 to 20 mA DC)	Conductivity value µS/cm
0 %(4.0 mA)	0		
5 %(4.8 mA)	12.5	55 %(12.8 mA)	175.0
10 %(5.6 mA)	25.0	60 %(13.6 mA)	200
15 %(6.4 mA)	37.5	65 %(14.4 mA)	250
20 %(7.2 mA)	50.0	70 %(15.2 mA)	300
25 %(8.0 mA)	62.5	75 %(16.0 mA)	350
30 %(8.8 mA)	75.0	80 %(16.8 mA)	400
35 %(9.6 mA)	87.5	85 %(17.6 mA)	500
40 %(10.4 mA)	100.0	90 %(18.4 mA)	600
45 %(11.2 mA)	125.0	95 %(19.2 mA)	800
50 %(12.0 mA)	150.0	100 %(24.0 mA)	1000



Note : In this example, since the bend points are only at 40, 60, 80, and 90% of the output signal, enter the conductivity at these bend points and at 0% & 100%. Other data entries can be omitted.

CODE 07 Temperature Output Function Setting (*T.OUTP) Mode (Setting upon shipment: 0 = no temperature output)

If an output signal of the measured temperature is required, it can be sent out as a current or voltage signal. Specify the temperature signal in this mode. When the mode is changed to this mode by entering code number 07, 『*T.OUTP』 appears in the message display and specification of the temperature signal is requested. If a temperature signal is not required, indicate 『0』 and press the [ENT] key. If it is to be sent out as a voltage signal, indicate 『1』, or if it is to be sent out as a current signal, indicate 『2』, and then press the [ENT] key.

Note : When using a voltage signal as the temperature signal, the conductivity signal becomes a current signal. And, when using a current signal as the temperature signal, the conductivity signal becomes a voltage signal.

When 『1』 or 『2』 is selected, setting of measurement range is requested. Set it by entering the temperature values that correspond to the minimum and maximum values (0% and 100%) of the output signal. Set it so that the span becomes 25 [°C] or more. If the span is smaller than the tolerable lower limit, a type "E17" error occurs.

Figure 5.18 shows the operating flow of the temperature output function setting mode.

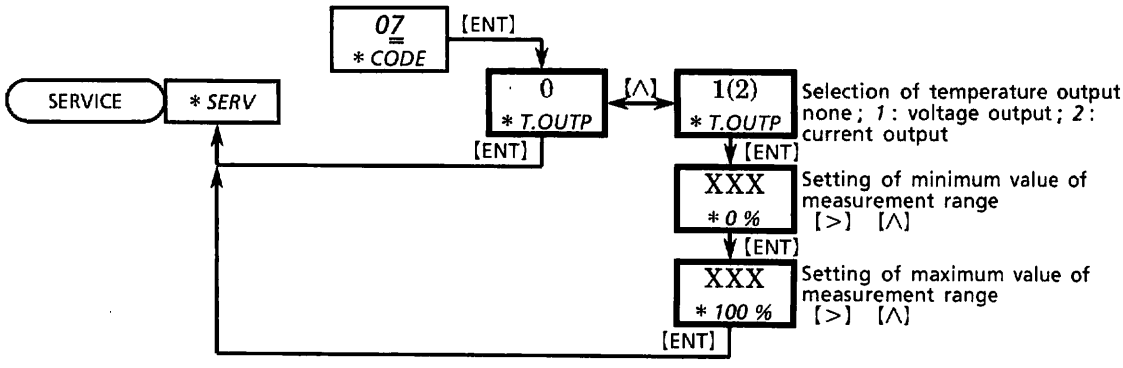


Figure 5.18 Operating Flow of Temperature Output Function Setting Mode

The setting range of items which are set in this mode and the factory settings are as follows.

Error E19 is issued if any value out of the setting range is entered.

『*0%』 (factory setting: 0°C)
Setting range: −20 (250) to 250 (−20) [°C]

『*100%』 (factory setting: 100°C)
Setting range: −20 (250) to 250 (−20) [°C]

CODE 08 Contact Output S1 Function Setting Mode (Setting upon shipment: 2.0 = high alarm for conductivity / status)

Contact output S1 can be used as the high or low alarm for conductivity or the temperature. In this mode, select an action including whether it is used or not (high alarm / low alarm) and select the output mode (status / proportional duty / proportional pulse) and output object (temperature).

Note: Refer to pages 4-4 to 4-6 for the details of output pattern.

When code number 08 is input and the [ENT] key is pressed, 『*S1』 appears in the message display and function setting of the contact output S1 function is requested. Indicate the desired function in the data display and enter it with the [ENT] key.

Figure 5.19 shows the operating flow of the contact output S1 function setting mode.

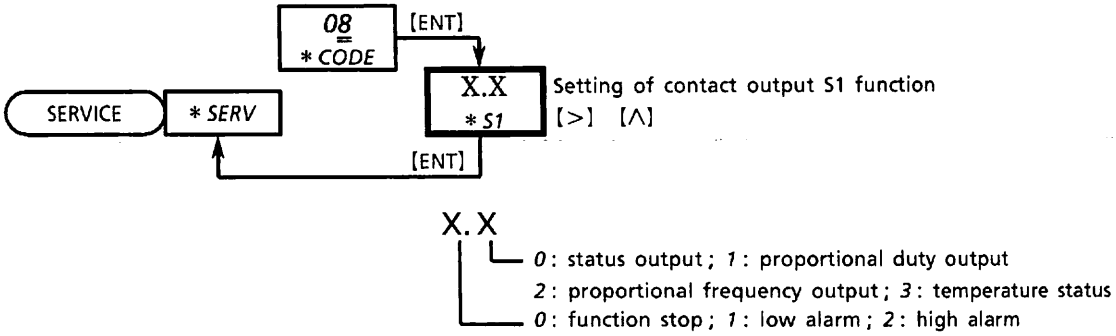


Figure 5.19 Operation Flow in Contact Output S1 Function Setting Mode

CODE 09 Contact Output S2 Function Setting Mode (Setting upon shipment: 1.0 = low alarm for conductivity)

Contact output S2 can be used as the high or low alarm for conductivity or the temperature. In this mode, select an action including whether it is used or not (high alarm / low alarm) and select the output mode (status / proportional duty / proportional pulse) and output object (temperature).

When code number 09 is input and the [ENT] key is pressed, 『*S2』 appears in the message display and function setting of the contact output S2 function is requested. Indicate the desired function in the data display and enter it with the [ENT] key.

Figure 5.20 shows the operating flow of the contact output S2 function setting mode.

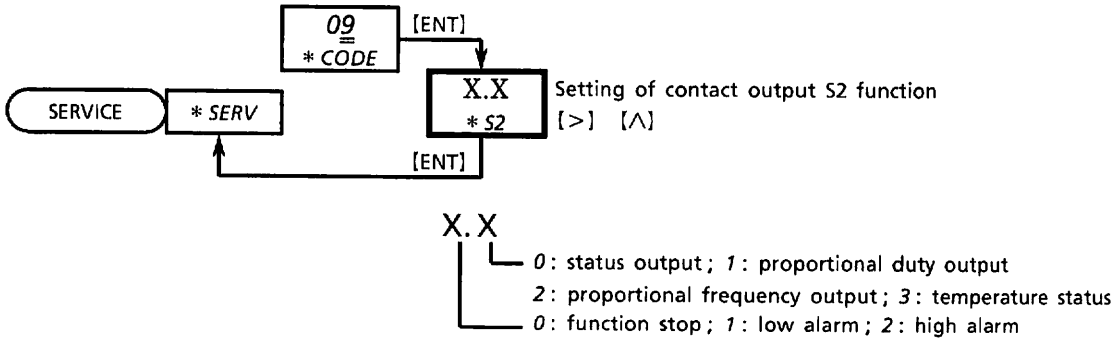


Figure 5.20 Operation Flow in Contact Output S2 Function Setting Mode

CODE 10 Contact Output S3 Function Setting Mode (Setting upon shipment: 0.0 = function stop)

Contact output S3 can be used as the high or low alarm for conductivity or the temperature. In this mode, select an action including whether it is used or not (high alarm / low alarm) and select the output mode (status / proportional duty / proportional pulse) and output object (temperature). When code number 09 is input and [ENT] key is pressed, 『*S3』 appears in the message display and function setting of the contact output S3 function is requested. Indicate the desired function in the data display and enter it with the [ENT] key.

Figure 5.21 shows the operating flow of the contact output S3 function setting mode.

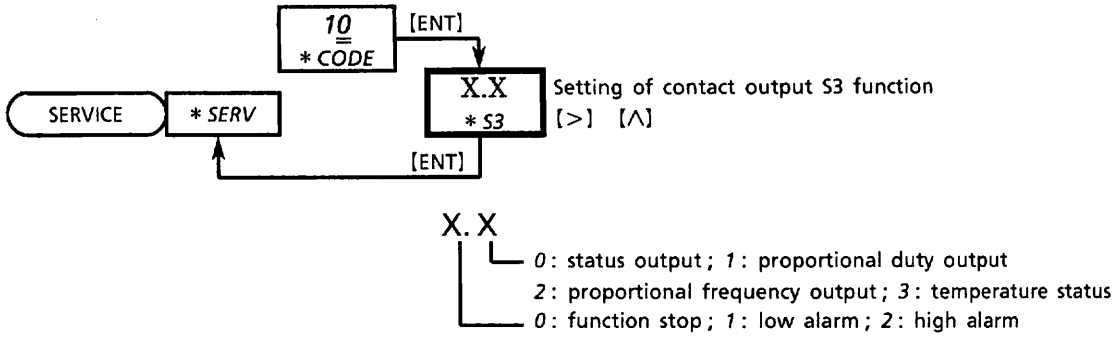


Figure 5.21 Operation Flow in Contact Output S3 Function Setting Mode

CODE 11 Delay Time (*D.TIME) and Hysteresis (*HYST) Setting Mode

If the high or low alarm is set with either CODE 08, CODE 09, or CODE 10, the delay time and hysteresis for the contact output can be set. Hysteresis set in this mode is for a case where the output object is conductivity. Hysteresis for the temperature is set in CODE 23.

Figure 5.22 shows the delay time and hysteresis action for a low alarm.

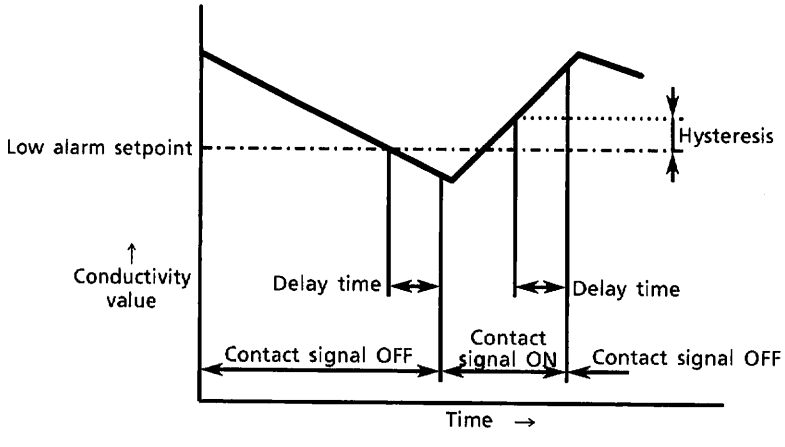


Figure 5.22 Delay Time and Hysteresis for Alarm Contact Output (example of low alarm)

Figure 5.23 shows the operation flow in the delay time and hysteresis setting mode.

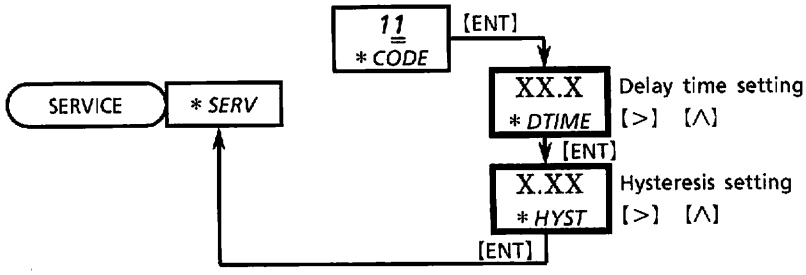


Figure 5.23 Operation Flow in Delay Time and Hysteresis Setting Mode

- **Manual setting of delay time (*D.TIME)** (Setting upon shipment: 0.2 second)
  When the mode is changed to this mode by entering code number 11, 『*D.TIME』 appears in the message display and delay time setting is requested. Indicate the value to be set in the data display using the [>] or [^] key and enter it with the [ENT] key. If a value outside of the setting range is entered, error E19 is issued.
  Setting range: 0.0 to 199.9 seconds

- **Hysteresis (*HYST) setting** (Setting upon shipment: 2.0 %)
  When the delay time is entered, 『*HYST』 appears in the message display. Indicate the value to be set in the data display using the [>] or [^] key (% value as against the span of the measurement range), and enter it with the [ENT] key. If a value outside of the setting range is entered, error "E19" is issued.
  Setting range: 0.1 to 100 %

CODE 12 Alarm Output Control Range Setting (*RANGE) Mode (Setting upon shipment: 10 %)

The range of alarm output control is set, when high / low limit alarms are to be selected with CODES 08, 09, or 10, and proportional duty output or proportional frequency output is to be issued.

Note : For information about proportional duty output and proportional frequency output, see Item 4.1.5 on page 4-4.

When this mode is entered by inputting Code No. 12, 『*RANGE』 appears in the message display, requesting a control range setting. Display the desired value (percent value of measured range span) in the data display and press the [ENT] key to enter it. The entry of an over-range value causes error "E19" to be issued.

Setting range: 0 to 100 [%]

Figure 5.24 shows the operating flow of the alarm output control range setting mode.

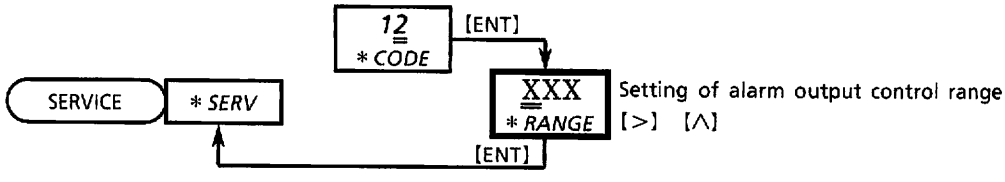


Figure 5.24 Operating Flow of Alarm Output Control Range Setting Mode

CODE 13 Cycle Setting Mode of Proportional Duty Output (*PER.) (Setting upon shipment: 10 sec.)

The cycle of proportional duty output is set, when high / low limit alarms are to be selected with CODES 08, 09, & 10, and proportional duty output is to be issued. When this mode is entered by inputting Code No. 13, 『*PER.』 appears in the message display, requesting setting the cycle of proportional duty. Display the desired value in the data display, and enter it with the [ENT] key. If a value outside the setting range is input, error "E19" is issued.

Setting range: 005 to 100 [s]

Figure 5.25 shows the operating flow of the cycle setting mode of proportional duty output.

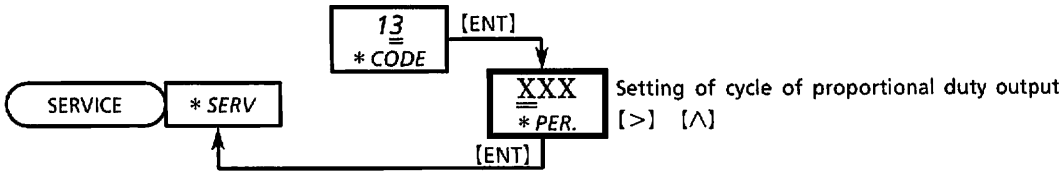


Figure 5.25 Operating flow of Cycle Setting Mode of Proportional Duty Output.

CODE 14 Maximum Frequency Setting Mode of Proportional Frequency Output (*FREQ.) (Setting upon shipment: 070 Pulses/Min.)

The maximum frequency of proportional frequency output (pulses per minute) is set when high / low limit alarms are to be selected with CODES 08, 09, or 10, and proportional frequency output is to be issued. When this mode is entered by inputting Code No. 14, 『*FREQ.』 appears in the message display, requesting setting of the maximum frequency of proportional frequency output. Display the desired value in the data display, and enter it with the [ENT] key. If a value outside the setting range is input, error "E19" is issued.

Setting range: 050 to 120 [pulses/min]

Figure 5.26 shows the operating flow of the maximum frequency setting mode of proportional frequency output.

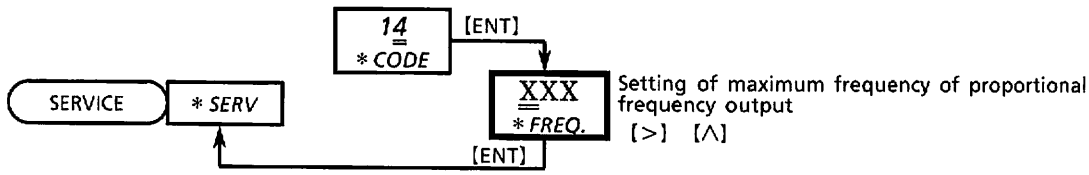


Figure 5.26 Operating Flow of Maximum Frequency Setting Mode of Proportional Frequency Output

CODE 15 Reference Temperature Setting Mode (*T.R.) (Setting upon shipment: 25°C)

Since conductivity changes with the temperature, it is usually converted into the conductivity at the reference temperature. Here, the reference temperature is set (generally, 25°C). When this mode is entered by inputting Code No. 15, 『*T.R.』 appears in the message display, requesting setting of the reference temperature. Display the desired value in the data display, and enter it with the [ENT] key. If a value outside the setting range is input, error "E19" is issued.

Setting range: 0 to 100 [°C]

Figure 5.27 shows the operating flow of the reference temperature setting mode.

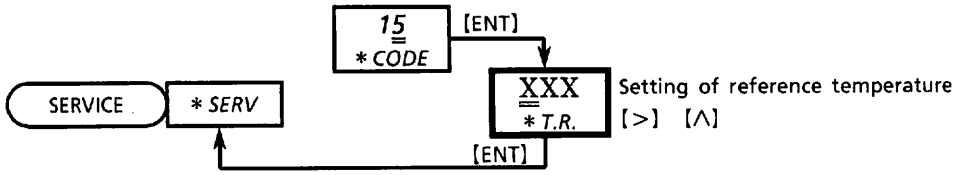


Figure 5.27 Operating Flow of Reference Temperature Setting Mode

CODE 16 Setting Mode for Function of Automatic Return to Measurement Mode (*RET) (Setting upon shipment: 1 = execution)

This mode enables the converter to return to the measurement mode automatically if no key operation has been carried out for at least 10 minutes (1 hour when calibration is performed) at each level.

Note : When [Execute (*H.ON)] is selected in the hold parameter setting mode in the setting level, the converter is set to the output signal hold selection mode before it returns to the measurement mode. An automatic return to the measurement mode is performed from this mode after 10 minutes elapse.

In this mode, select "execute / stop" of the function for automatic return to the measurement mode.

When the mode is changed to this mode by entering code number 16, 『*RET』 appears in the message display and the selection of "execute / stop" of the function for automatic return to the measurement mode is requested. If the function is to be stopped, indicate 『0』 in the data display and press the [ENT] key. If it is to be executed, indicate 『1』 and press the [ENT] key.

Figure 5.28 shows the operating flow of the automatic return function setting mode.

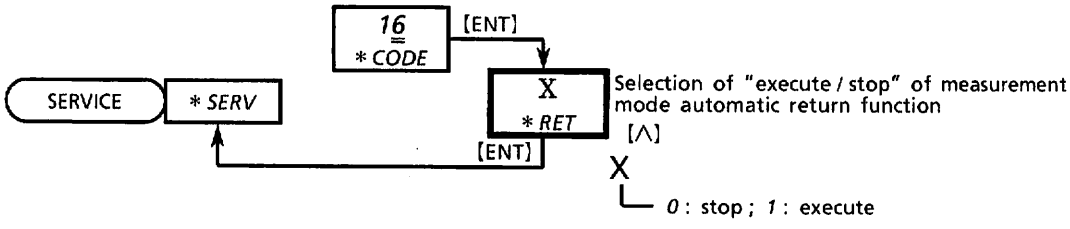


Figure 5.28 Operating Flow of Measurement Mode Automatic Return Function Setting Mode

CODE 17 Burn-up Function Setting Mode (Setting upon shipment: 0 = stop)

The converter has a burn-up function which sets the output signal to 22 mA for a current signal and to 1.1 V for a voltage signal if a failure is detected. In this mode, select "execute / stop" of the burn-up function.

Note : The maximum value of an output signal due to normal overranging is either 20.5 mA for a current signal or 1.025 V for voltage signal.

In addition, for failures having error numbers set for SOFTFAIL operation in CODE 26, burn-up is not performed. When the mode is changed to this mode by entering code number 17, 『*BURN』 appears in the message display and the selection of "execute / stop" of the burn-up function is requested. Indicate 『0』 in the data display and press the [ENT] key. If the function is to be executed, indicate 『1』 in the data display and press the [ENT] key.

Figure 5.29 shows the operating flow of the burn-up function setting mode.

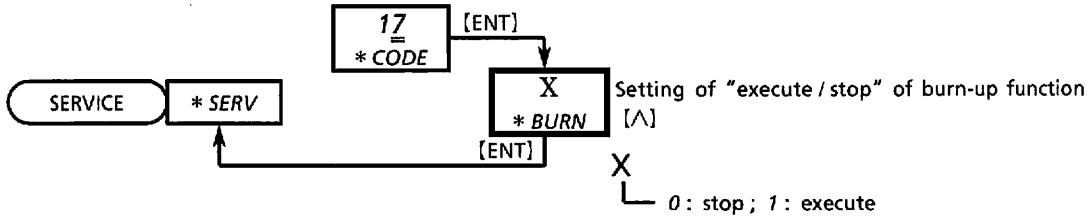


Figure 5.29 Operating Flow of Burn-up Function Setting Mode

CODE 18 "Temperature Input Signal (*T.ADJ) / Cable Capacitance (*L.ADJ)" Compensation Mode (Setting upon shipment: no compensation / cable length 2 m)

The indicated temperature value (in the measurement mode) of this device is compensated so that it matches the actual temperature. And, the length of the connected sensor cable is entered in order to compensate for its capacitance.

CAUTION

When compensating for temperature, make sure that the type of the temperature element has been correctly set in CODE 01.

When this mode is entered by inputting Code No. 18, 『*T.ADJ』 appears in the message display, requesting setting of the actual temperature. Accurately measure the temperature of the measurement fluid and input it. Then press the [ENT] key. The compensation value is calculated. The possible compensation range is ±2.5°C. If the amount of compensation exceeds this range, error "15" is issued.

Note : If error "15" is issued, check that its cause is other than a fault in the temperature sensor.

As soon as temperature compensation ends, 『*L.ADJ』 appears in the message display, requesting entry of the sensor cable length. When measuring low conductivity, measurement is affected by cable capacitance, so enter the length of the sensor cable (nominal value). When using the SC8SG conductivity sensor, enter 5 [m] or 10 [m], whichever is correct. Input can be from 2 m to 10 m. If a value outside this range is input, error "E19" is issued.

Figure 5.30 shows the operating flow of the "temperature input signal / cable capacitance" compensation mode.

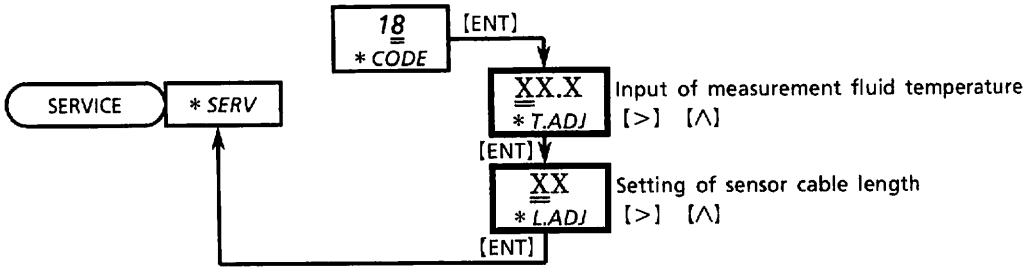


Figure 5.30 Operating Flow of "Temperature Input Signal / Cable Capacitance" Compensation Mode

CODE 19 Temperature Coefficient Setting (*T.C.) Mode (Setting upon shipment: 2.1 %/°C)

The temperature coefficient of the measurement fluid can be entered here if it is clearly known. However, in the temperature compensation method setting mode of the setting level, it is necessary to select 『*T.C.』. If 『*NaCl』 has been selected in the temperature compensation method setting mode, CODE 19 is skipped.

CAUTION

When the temperature coefficient is entered here, the coefficient (feature of the measurement fluid) that has been set in the temperature compensation method setting mode is erased.

When this mode is entered in by inputting Code No. 19, 『*T.C.』 appears in the message display, requesting entry of the temperature coefficient. Display the temperature coefficient in the data display, and enter it with the [ENT] key. If a value outside the setting range is input, error "E19" is issued.

Setting range: −9.99 to 9.99 (%/°C)

If a conductivity value that is not converted to the reference temperature is to be output, set 0.0.

Figure 5.31 shows the operating flow of the temperature coefficient setting mode.

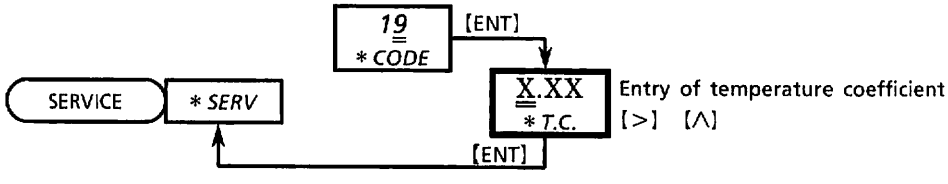


Figure 5.31 Operating Flow of Temperature Coefficient Setting Mode

[Related setting items]

- Setting of temperature compensation method (TEMP mode of setting level)
- Matrix temperature compensation (CODE 25 of service level)

CODE 20 Polarization Check Function Setting (*POL.CK) Mode (Setting upon shipment: 0 = Stopped)

This device comes with a function to check the polarization state of the conductivity sensor from the waveform of a conductivity input signal. However, it can be used only when employing a 2-electrode conductivity sensor (intent of use: estimation of conductivity sensor defects). This is a function that generally issues error "E1" if sags are generated in the waveform and if they have reached a certain level, as a result of polarization caused by a rectangular conductivity input signal. The check is conducted by setting up measuring points at the former and latter halves of a rectangular signal, and by comparing the sizes of the signal at both points. An error is issued, when the size of the signal at the latter measuring point falls below 80 % that at the former measuring point.

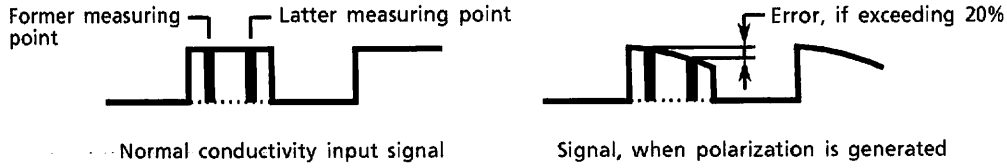


Figure 5.32 Principle of Polarization Check

In this mode, "Execute / Stop" of the polarization check function is selected. When this mode is entered by inputting Code No. 20, 『*POL.CK』 appears in the message display, requesting "Execute / Stop" of the polarization check function. To keep the function stopped, display 『0』 in the data display and press the [ENT] key. And, to execute it, display 『1』 and press the [ENT] key.

Figure 5.33 shows the operating flow of the polarization check function setting mode.

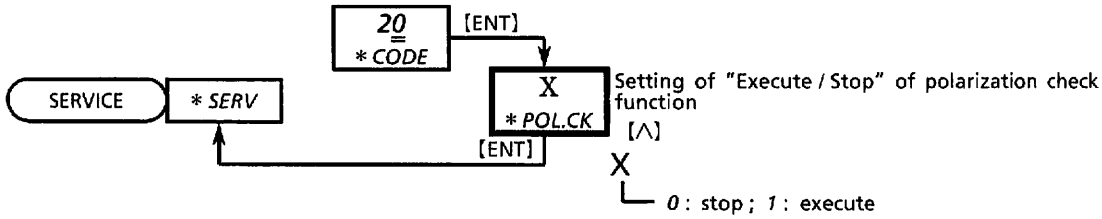


Figure 5.33 Operating Flow of Polarization Check Function Setting Mode

CODE 21 Weight % Display Function Setting (*%) Mode (Setting upon shipment: 0 = Function stopped)

The function is executed with this code when the mass % is to be displayed in the message display in order to find out the approximate density (Note) of the measurement fluid.

Note: In the case that the conductivity of the measurement fluid is not proportionally related to the concentration of the fluid, set up the nonlinear output data with CODE 06. If the nonlinear output data are not set up, the displayed value is calculated on the assumption that the concentration is proportional to the conductivity in a range from 0 to 100 % of the output signal. Therefore, the displayed value may have a big error.

When this mode is entered by inputting Code No. 21, 『*%』 appears in the message display, requesting selection of "Execute / Stop" of the weight % display function. If the display of weight % is not required, display 『0』 and press the [ENT] key. But if it is required, display 『1』 and press the [ENT] key. If 『1』 is selected, setting of the display range is requested. The setting is done by entering the solution densities [wt %]

indicating the conductivities corresponding to the minimum (0 %) and maximum (100 %) values of the output signal.

Figure 5.34 shows the operating flow of weight % display function setting mode.

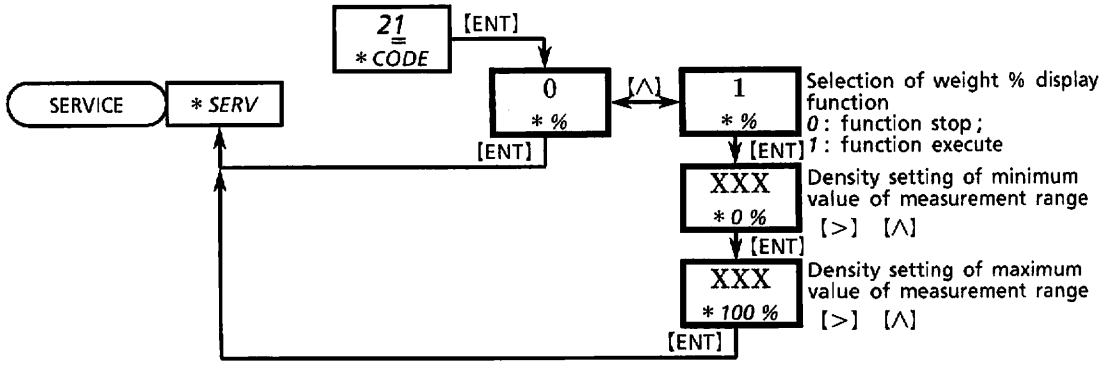


Figure 5.34 Operating Flow of Weight % Display Function Setting Mode

The setting range of the items which are set in this mode and the factory settings are as follows.

『*0 %』 (Factory setting : 0 [wt %])
Setting range : 0 to 100 [wt %]

『*100 %』 (Factory setting : 100 [wt %])
Setting range : 0 to 100 [wt %]

When the set value in 『*100 %』 is less than 100 [wt %], if a conductivity value corresponding to a density larger than this is measured, the density corresponding to it is also displayed.

CODE 22 Alarm Time-out Setting (*EXPIR) Mode

The converter has an alarm time-out function which can transfer a high or low alarm contact output to a FAIL contact output after a certain time has elapsed [S1, S2, S3 are collectively set]. In this mode, select "execute / stop" of the alarm time-out function and set the time-out time in the case of execution.

Figure 5.35 shows the operation flow in the alarm time-out setting mode.

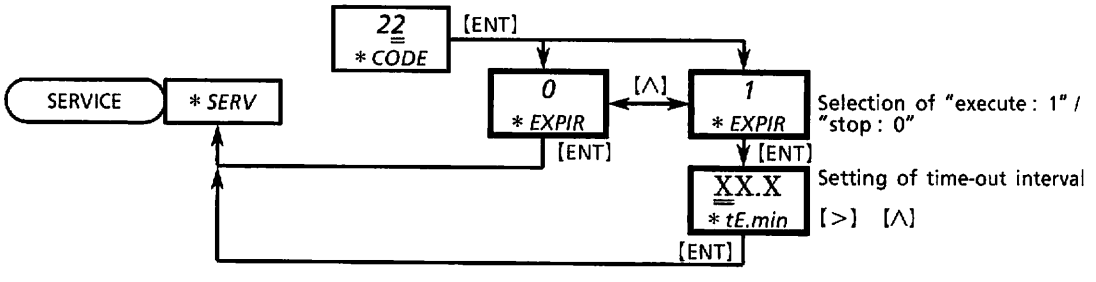


Figure 5.35 Operation Flow in Alarm Time-out Setting Mode

- **Alarm time-out function (*EXPIR) selection** (Setting upon shipment : 0 = stop)
  When the mode is changed to this mode by entering code number 22, 『*EXPIR』 appears in the message display and selection of "execute / stop" of the alarm time-out function is requested. If the function is to be stopped, indicate 『0』 in the data display

and press the [ENT] key. If it is to be executed, indicate 『*1*』 and press the [ENT] key.

In addition, if the function is executed, error E22 is issued if a time-out occurs. Reset this error using the [YES] (or [NO]) key.

Note : If the alarm is still output even after you reset this error, error E22 is issued again after time-out time has elapsed.

- **Time-out interval (*tE.min) setting** (Setting upon shipment: 15.0 minutes)
  After selecting "execute," 『**tE.min*』 appears in the message display and setting of the time-out interval is requested. Indicate the value to be set in the data display using the [>] or [∧] key and enter it with the [ENT] key. If a value outside of the setting range is entered, error E19 is issued.
  Setting range: 0.2 to 199.9 minutes

CODE 23 Temperature Alarm Contact Output Hysteresis Setting Mode (Setting upon shipment: 0.5°C)

If high and low alarms are operated taking temperature as the output object, set the hysteresis in this mode. When the mode is changed to this mode by entering code number 23, 『**T.HYST*』 appears in the message display and hysteresis setting is requested. Indicate the value to be set in the data display using the [>] or [∧] key and enter it with the [ENT] key. If a value outside of the setting range is entered, error E19 is issued.

Setting range: 0.1° to 5.0°C

Figure 5.35 shows the operating flow of the temperature alarm contact output "hysteresis" setting mode.

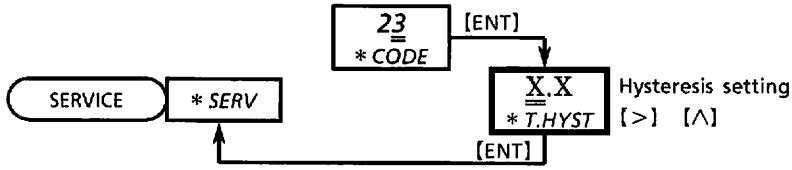


Figure 5.35 Operating Flow of Temperature Alarm Contact Output "Hysteresis" Setting Mode

CODE 24 Alarm Value Change Operation Function Setting Mode (Setting upon shipment: 0: function stop)

In this mode, "Execute / Stop" of the alarm value change operating function at the operation level is selected. However, this function is effective only when the high / low limit alarm function has been selected with CODE 08, 09, or 10. When this mode is entered by inputting CODE 24, 『**MODE*』 appears in the message display, requesting selection of "execute / stop" of the function. To keep the function stopped, display 『*0*』 in the data display and press the [ENT] key. To execute it, display 『*1*』 and press the [ENT] key (see Figure 5.36).

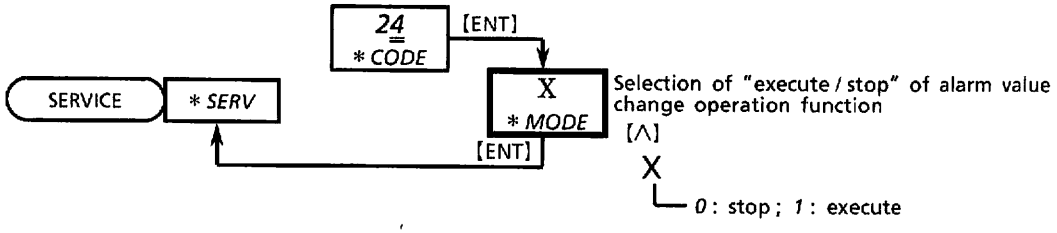


Figure 5.36 Operating Flow of Alarm Value Change Operation Function Setting Mode

CODE 25 Matrix Temperature Compensation Function Setting Mode (Setting upon shipment: 0: Function stop)

Generally, the temperature coefficient changes with the density of the solution also. Therefore, when measuring the conductivity of a solution (reference temperature conversion) whose temperature and density both change, one important factor in order to obtain accurate measurement is to compensate for the temperature taking into account the temperature coefficient also, as per the solution density. Matrix temperature compensation is the method of reference temperature conversion, which finds the temperature coefficient from the aspect of both the temperature and density of the measurement fluid.

In this device, the 5 types of matrix temperature compensation data which are listed in Table 5.5 are retained. When the measurement fluid comes under any of these categories, or when its characteristics are similar, matrix temperature compensation can be done by setting it here.

Table 5.5 Matrix Temperature Compensation Data Retained in SC400G (Conductivity value by temperature / density)

Selection Object / Type of Fluid	Temp. (°C)	Data #1	Data #2	Data #3	Data #4	Data #5
1		Concentration 0 ppb	Concentration 4 ppb	Concentration 10 ppb	Concentration 20 ppb	Concentration 100 ppb
Water containing hydrochloric acid	10	0.023 µS/cm	0.0352 µS/cm	0.0631 µS/cm	0.116 µS/cm	0.565 µS/cm
	20	0.0419	0.055	0.0844	0.145	0.677
	30	0.071	0.085	0.115	0.179	0.787
	40	0.113	0.129	0.159	0.225	0.897
	50	0.173	0.190	0.220	0.286	1.008
2		Concentration 0 ppb	Concentration 2 ppb	Concentration 5 ppb	Concentration 10 ppb	Concentration 50 ppb
Water containing ammonia	10	0.023 µS/cm	0.0337 µS/cm	0.0651 µS/cm	0.122 µS/cm	0.535 µS/cm
	20	0.0419	0.0512	0.0842	0.150	0.648
	30	0.071	0.0788	0.111	0.181	0.758
	40	0.113	0.120	0.149	0.221	0.866
	50	0.173	0.178	0.203	0.273	0.974
2		Concentration 0 ppb	Concentration 20 ppb	Concentration 50 ppb	Concentration 100 ppb	Concentration 500 ppb
Water containing morpholine	10	0.023 µS/cm	0.0402 µS/cm	0.0807 µS/cm	0.139 µS/cm	0.431 µS/cm
	20	0.0419	0.0584	0.108	0.185	0.592
	30	0.071	0.0851	0.140	0.235	0.763
	40	0.113	0.124	0.181	0.289	0.938
	50	0.173	0.181	0.234	0.351	1.12
4		Concentration 1 wt %	Concentration 2 wt %	Concentration 3 wt %	Concentration 4 wt %	Concentration 5 wt %
Hydrochloric acid solution	0	65 mS/cm	125 mS/cm	179 mS/cm	229 mS/cm	273 mS/cm
	15	91	173	248	317	379
	30	114	217	313	401	477
	45	135	260	370	474	565
	60	159	301	430	549	666
5		Concentration 1 wt %	Concentration 2 wt %	Concentration 3 wt %	Concentration 4 wt %	Concentration 5 wt %
Nitric acid solution	0	39.5 mS/cm	76.1 mS/cm	113.4 mS/cm	147.2 mS/cm	179.5 mS/cm
	20	57.4	108.5	161.4	210	258
	40	81.4	148.1	215	275	330
	60	99.9	180.8	260	331	397
	80	127.8	217	299	374	448

When this mode is entered by inputting CODE 25, 『*MATRX』 appears in the message display, requesting selection related to the matrix temperature compensation function. If there is none matching the memory data given in Table 5.5, display 『0』 and press the [ENT] key. If 『0』 is selected, the temperature coefficient that was entered with CODE 19 (or the temperature coefficient that is set in the 『TEMP』 mode of the setting

level) becomes valid. But if there is a match with the memory data in Table 5.5, display the relevant number from 『1』 to 『5』 and press the [ENT] key. When 『1』 to 『5』 is set here, the temperature coefficient that was entered with CODE 19 (or the temperature coefficient that was found in the 『TEMP』 mode of the setting level) becomes invalid.

Figure 5.37 shows the operating flow of the matrix temperature compensation function setting mode.

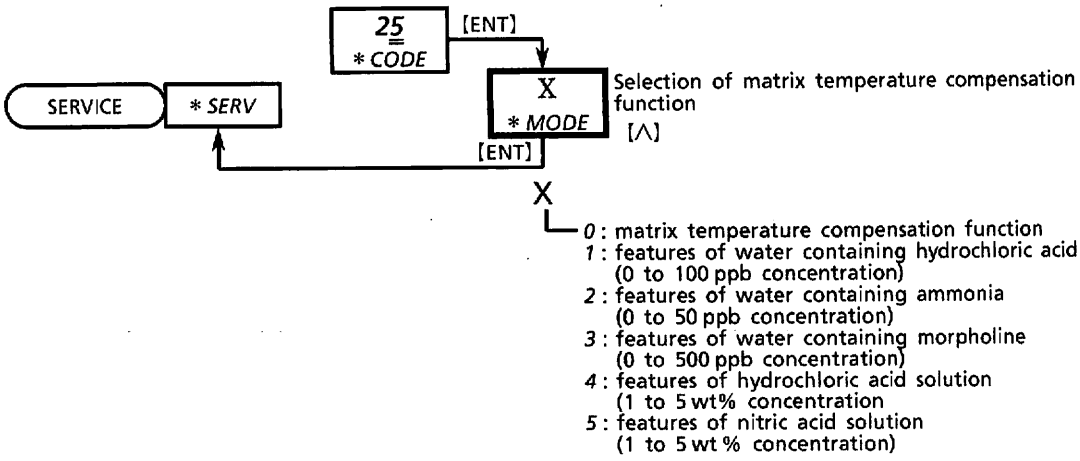


Figure 5.37 Operating Flow of Matrix Temperature Compensation Function Setting Mode

CODE 26 Error Output Operation Setting Mode (Setting upon shipment: All errors 1 = HARDFAIL)

The FAIL contact output operation which is executed when this device detects a failure is of 2 types: HARDFAIL and SOFTFAIL.

Table 5.6 FAIL Contact output operation upon detecting a failure

HARDFAIL Operation	SOFTFAIL Operation
• Output signal burns up (in the case of "execute" function). • The contact of contact output FAIL remains closed. • High / low limit operation is not executed. • 『FAIL』 lights up in the status display. • Error No. appears in the message display.	• Does not burn up even with "execute" function. • The contact of contact output FAIL opens / closes every 3 seconds. • High / low limit operation is executed. • 『FAIL』 flashes in the status display. • Error No. appears in the message display.

In this mode, the operation, upon detecting a failure concerning errors (see section 8.2) for which a FAIL contact signal is output, is prescribed. The procedure for setting is as follows.

a. When this mode is entered by inputting CODE 26, 『*Err.1』 appears in the message display, asking whether or not to change the operation type of error E1.

b. To not change, press the [NO] key; to change, press the [YES] key.
   - When the [NO] key is pressed, 『*Err.5』 (error E5) appears in the message display.
   - When the [YES] key is pressed, 『0』 or 『1』 indicating the currently set operation appears in the data display. 『0』 stands for SOFTFAIL, and 『1』 stands for HARDFAIL.

To change the currently set operation type, change the display with the [∧] key and press the [YES] key. When the [YES] key is pressed, 『*Err.5』 (error E5) appears in the message display.

c. The operation after 'b' conforms to 'b'. Continue the key operation for the displayed Error No. To terminate the setting operation in this mode, press the [ENT] key.

Figure 5.38 shows the operating flow of the error output operation setting mode.

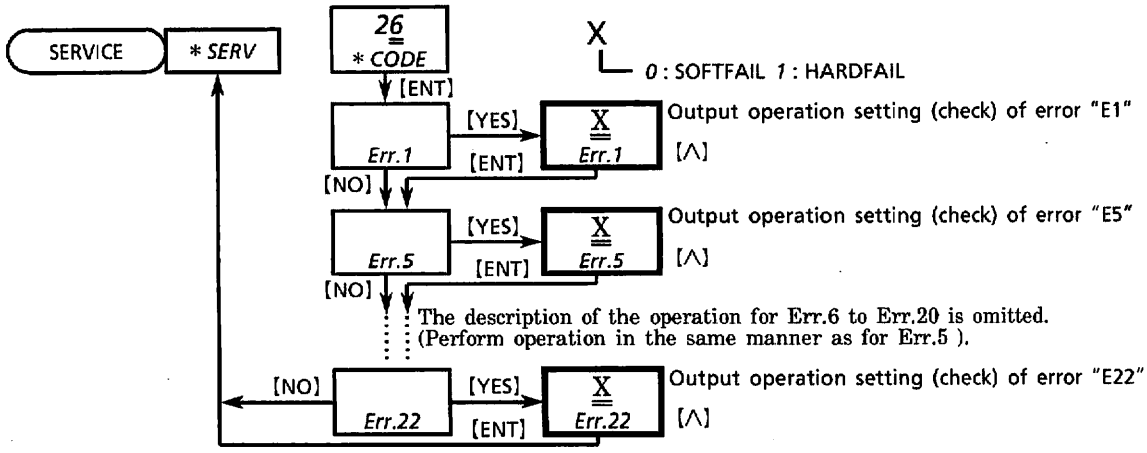


Figure 5.38 Operating Flow of Error Output Operation Setting Mode

CODE 27 Electrode Open Detection Function Setting Mode

(default setting: 1=Execute)

The model is equipped with a function that uses the FAIL connect output of the "E6" error to notify whether a sensor dip error or a conductivity input circuit error has occureed. This error is generated when the resistance between electrodes is 500kΩ or greater and can therefore also be used to detect water impurities (when the error will indicate normal operation state).

Select Execute or Stop for the electrode open detection function in this mode.

When this mode is invoked by entering code No. 27, the message display panel shows 『*EN.E6』 and the system requests you to select Execute or Stop for the electrode open detection function. To stop the function, enter 『0』 and press the [ENT] key. To activate the function, enter 『1』 and press the [ENT] key.

A function flow chart for the electrode open detection function is shown below.

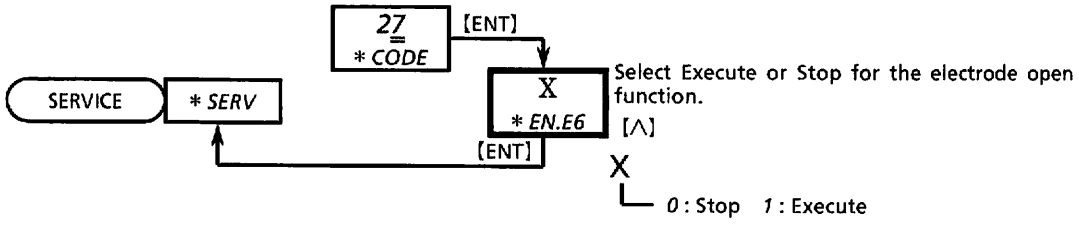
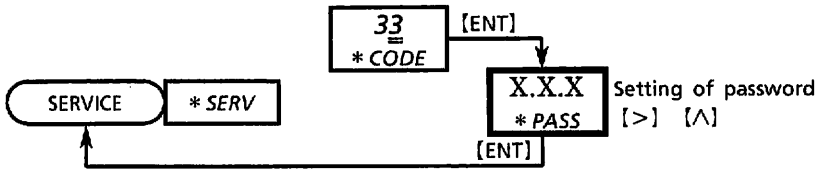
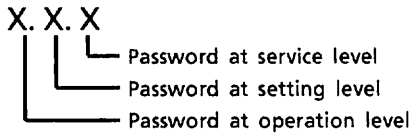


Figure 5.39 Operating Flow of Electrode Open Detection Function Setting Mode

CODE 33 Password Setting (*PASS) Mode (Setting upon shipment: 0.0.0 = No setting at any level)

A password is set in a case where, e.g., a change in set data is prohibited. A password can be set for every operation, setting, and service level (allowing nine passwords). When a password is set, the mode cannot be changed to the setting mode unless the relevant three-digit numeric value is entered.





Note : Password entry request (if a password is set)
At the operation level, a request is issued when the [MODE] key is pressed in the measurement mode. At the setting level, it is issued when the [*] key is pressed. At the service level, it is issued when the [YES] key is pressed while 『*SERV』 is displayed.
For the password entry procedure, see Subsection 1.3.4.

Passwords

X (Setting)	Description
(0)	(Not set)
1	111
2	333
3	777
4	888
5	123
6	957
7	331
8	546
9	847

Figure 5.40 Password Setting

6. Calibration Procedure

The purpose of calibrating the conductivity meter is to obtain accurate measurements by finding out the stringent cell constant. Calibration is done in the following cases.

- When using a new conductivity sensor
  (Even if the nominal cell constant is identical, the actual cell constant is somewhat different.)
- If a measurement error exceeds the permissible range, or if operation has been stopped for a prolonged length of time
- When the measurements of this device have to match those of another device

Usually, since reference temperature conversion accompanies measurement of conductivity, calibration of the measurement temperature value is also done. However, temperature calibration is done only once when beginning to use a new conductivity sensor. In this chapter, the procedure for calibrating the EXA SC Conductivity Metering System" is described based mainly on the SC400G.

6.1 Procedure for Temperature Calibration

6.1.1 Fluid Temperature Used for Calibration

A solution with a temperature almost identical to that of a regularly used measurement fluid is used for temperature calibration. Arrange for a somewhat large quantity of solution (1 to 2 liters) in order to decrease temperature fluctuations.

6.1.2 Temperature Calibration (1-point Calibration)

Calibration is done with service level CODE 18 (temperature input signal compensation mode). Immerse the conductivity sensor into the solution up to the measurement fluid outlet.

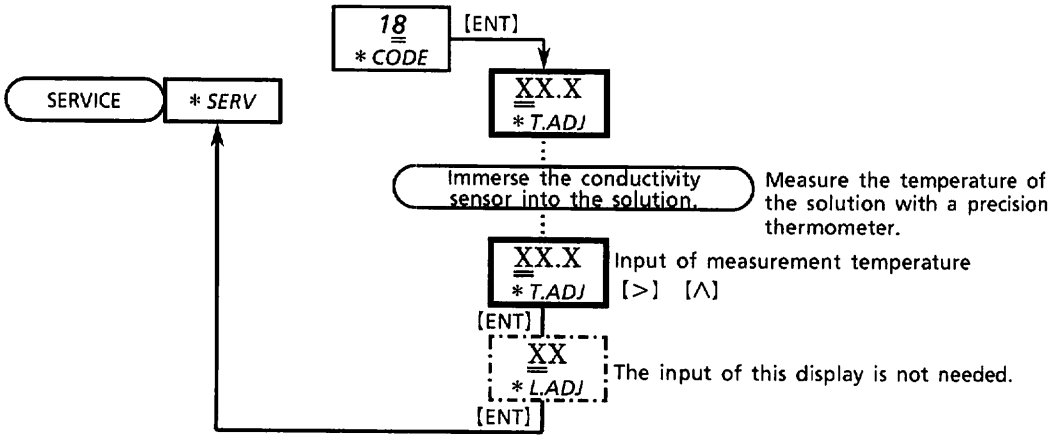


Figure 6.1 Operating Flow of Temperature Calibration (Temperature Input Signal Compensation) Mode

6.1.3 Errors Generated in Temperature Calibration

Failures generated in temperature calibration include error "E15" (compensation value error). It is issued when the compensation value exceeds the range from −2.5 to 2.5°C (factory compensation value: 0°C). If this error is issued, re-calibrate, making sure that measurement of the solution temperature and input of the temperature value are done properly.

6.2 Procedure of Standard Fluid Calibration

6.2.1 Arrangements

[Cleansing of Conductivity Sensor]

Bring the conductivity sensor to the maintenance site and clean its electrodes. For details on the cleaning method, refer to the Description Manual, "SC8SG Conductivity Sensor" (IM 12D8G2 - 01E).

[Preparation of Standard Solution for Calibration]

Standard fluid calibration is done using a sodium chloride solution (NaCl) of a temperature not different from the reference temperature (generally, 25°C). The concentration of NaCl solution, whose conductivity value at reference temperature is clearly known, is selected from between 50% to 100% of the set measurement range. Table 6.1 gives the conductivity values of an NaCl solution at 25°C. And, for reference purposes, Table 6.2 gives the adjustment method and conductivity values of a standard potassium chloride solution (KCl) (according to JIS K0102).

Table 6.1 Conductivity Values of NaCl Solution at 25°C

Concentration of NaCl Solution		Conductivity Value (at 25°C)	
wt %	mg/kg		
0.001	10.	21.4	µS/cm
0.003	30	64.0	µS/cm
0.005	50	106	µS/cm
0.01	100	210	µS/cm
0.03	300	617	µS/cm
0.05	500	1.03	mS/cm
0.1	1 000	1.99	mS/cm
0.3	3 000	5.69	mS/cm
0.5	5 000	9.48	mS/cm
1	10 000	17.6	mS/cm
3	30 000	48.6	mS/cm
5	50 000	81.0	mS/cm
10	100 000	140	mS/cm

Note : As a rule, do the standard fluid calibration of an EXAsc "Conductivity Metering System" using a standard NaCl solution. This manual assumes that a standard NaCl solution is being used. When calibrating with a standard KCl solution (see Table 6.2), pay attention to the set temperature coefficient, etc.

Table 6.2 Adjusting method of KCl standard solution & its conductivity (according to JIS K0102)

KCl Standard Solution	Adjustment Method	Conductivity (µS/cm)		
		0°C	18°C	25°C
A	Dissolve 74.2460g of KCl in enough water and to make 1 liter at 20±1°C.	65 176	97 838	111 342
B	Dissolve 7.5365g of KCl in enough water and to make 1 liter at 20±1°C.	7 138	11 167	12 856
C	Dissolve 0.7440g of KCl in enough water and to make 1 liter at 20±1°C.	773.8	1 220.5	1 408.8
D	Dilute standard solution C with 100 ml of water to make 1 liter at 20±1°C.			146.93

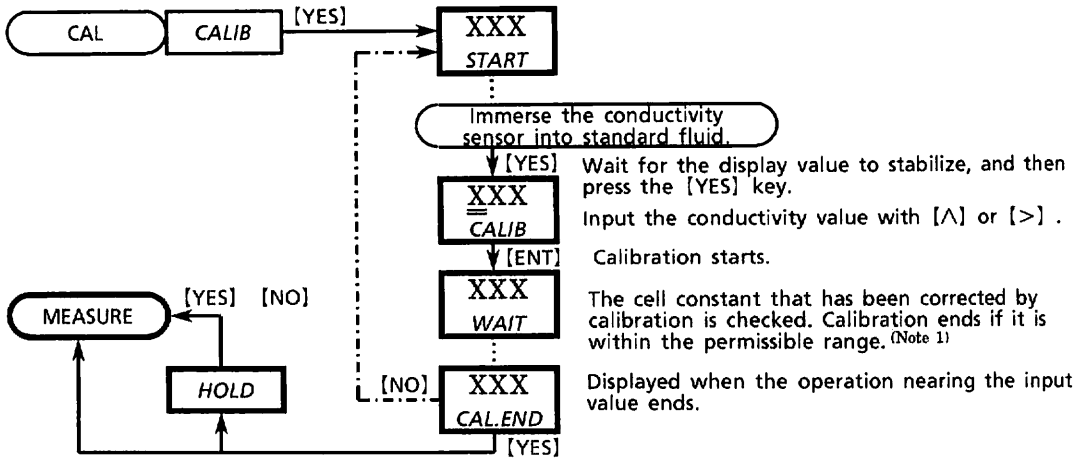
[Check of Parameters Related to Calibration]

Check the 『*TEMP*』 mode of the setting level and the date that is set in CODE 15 of the service level, and change it if necessary.

- 『*TEMP*』 Mode
  Set it at the temperature compensation, based on the characteristics of an NaCl solution (『*NaCl*』 appears in the message display).
- CODE 15
  Set the reference temperature to 25°C.

6.2.2 Operating Procedure for Standard Fluid Calibration

Immerse the conductivity sensor into a standard fluid at a temperature near the reference temperature (25°C) up to the outlet of the measurement fluid. An error will be generated if there is froth adhering to the electrodes. So, immerse it after shaking it up and down 2 to 3 times. The operating flow for standard fluid calibration is shown in Figure 6.2.



Note 1 : Error E3 is issued (no calibration) if the corrected cell constant is not within the permissible range.

Figure 6.2 Operating Flow for Standard Fluid Calibration

6.2.3 Errors Generated in Standard Fluid Calibration

The "error" generated in calibration is error "E3" (calibration value error). It is issued when the computed value, as against the cell constant which has been entered in CODE 2 exceeds the ±20% range. When issued, accurately adjust the concentration of the standard fluid and repeat the calibration. Even then, if the error recurs, take countermeasures referring to Chapter 8.

6.3 Matching Measurement Values

The procedure for matching the reading of this device to that of the standard conductivity meter, when necessary, is described here. This is an application of the standard fluid calibration given in section 6.2.

[Cautions on matching measurement values]

- If identical samples cannot be concurrently measured with the SC400G and standard conductivity meter, arrange for a conductivity meter (Note) that has been calibrated with the standard conductivity meter.

  Note : YOKOGAWA manufactures Model SC82 Personal Conductivity Meter for research or experimentation laboratories.

- Confirm that the temperature coefficients set in each conductivity meter and the reference temperature are identical.

6.3.1 Arrangements

[Cleaning of Conductivity Sensor]

Bring the conductivity sensor to the maintenance site, and clean its electrodes. For information about the cleaning method, refer to the manual "SC8SG Conductivity Sensor" (IM 12D8G2 - 01E).

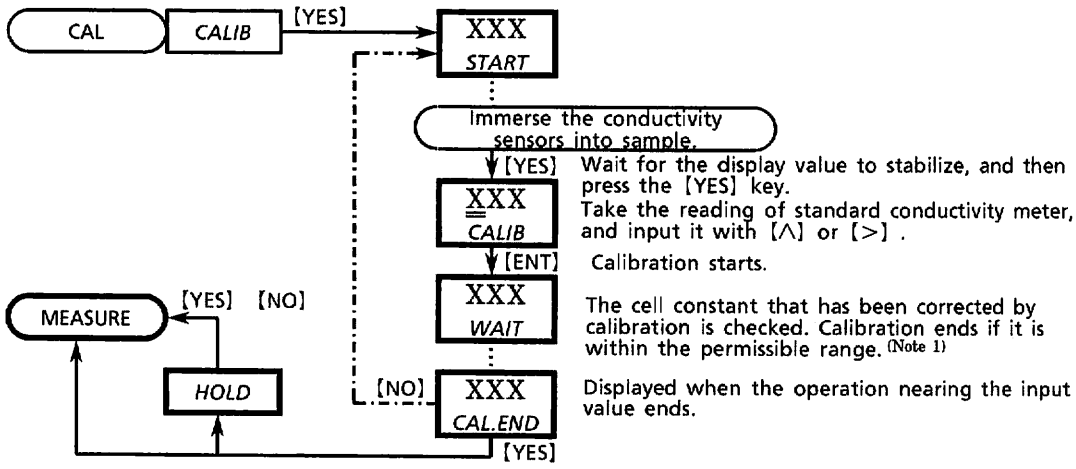
[Cautions on Sample]

- As a rule, when making a reference temperature conversion, take the temperature of the sample as the reference temperature. But, when not making a reference temperature conversion, take the temperature of the sample as the process fluid temperature.
- Use a solution that is within the measurement range, and whose conductivity is nearest the maximum value.

6.3.2 Procedure of Matching Operation

Immerse the standard conductivity meter, or a sensor that has been calibrated with it, into the sample.

Figure 6.3 shows the operating flow for matching measurements.



Note 1 : Error E3 is issued (no calibration) if the corrected cell constant is not within the permissible range.

Figure 6.3 Operating Flow for Matching Measurements

7. Inspection and Maintenance

It is important for maintaining the measurement accuracy of the EXA SC series of conductivity metering systems to perform inspection and maintenance at fixed intervals. It also serves to prevent problems from arising. This chapter describes daily inspection and maintenance for the purpose of maintaining system performance.

7.1 Overall Conductivity Metering System

Tables 7.1 and 7.2 show the inspection and maintenance items for equipment composing conductivity metering systems. The procedure of inspection and maintenance for the conductivity converter is described in Section 7.2. For inspection and maintenance of the conductivity sensors, see the instruction manual "SC8SG Conductivity Sensor" (IM 12D8G2-01E).

7.1.1 Inspection and Maintenance to Be Implemented Periodically

Table 7.1 shows the items which are recommended to be inspected and maintained periodically.

Table 7.1 Items for Periodic Inspection and Maintenance of Conductivity Metering System

Instrument or Apparatus	Item	Recommended interval
All equipment	a. Standard fluid calibration	a. 6 to 12 months
Conductivity sensor	a. Cleaning of electrodes b. Replacement of O-ring	a. 2 to 12 months b. 1 to 2 years
Conductivity converter	a. Check of temperature indication (error check) b. Replacement of fuse	a. 1 to 2 years b. 1 to 2 years

7.1.2 Inspection and Maintenance to Be Implemented on Occasion

Occasionally implement maintenance that is not directly related to measurement functions or maintenance associated with errors.

Table 7.2 Items for Occasional Inspection and Maintenance of Conductivity Metering System

Faulty Phenomenon	Content of Inspection
Error E1 occurrence	Check whether the wetted part of the conductivity sensor is contaminated or not.
Error E22 occurrence	Search for the cause of abnormal conductivity of the measurement fluid (problem in control equipment, etc.).
It is difficult to see the inside of the conductivity converter through the window.	Wipe off dirt on the transparent window using tissue paper or the like. (Use detergent for hard-to-clean dirt.)

7.2 Inspection and Maintenance Procedure for SC400G Conductivity Converter

7.2.1 Wiping off Front Cover (window section)

CAUTION

Do not use organic solvents to wipe the window. Otherwise, this may cause fogging or cracks.

Wipe off any dirt on the window (material: polycarbonate resin, weather-resistant processing sheet) on the front cover with tissue paper or a soft, damp cloth. If the dirt is difficult to remove, use detergent.

7.2.2 Check of Temperature Indication

Check that the indication that appears in the message display correctly indicates the temperature of the measuring solution. It may not indicate correct temperatures if the sensor cable fails (partial disconnection or degraded insulation).

7.2.3 Replacement of Fuse

It is recommended that the fuse in the converter be replaced every one or two years.

CAUTION

Guard against electrical shock !

Be sure to turn off the power before replacing the fuse.

The fuse is located on the printed circuit board deep inside the case (see Figure 7.1). Remove the fuse box cover (the fuse is mounted) by pulling it forward. Use a fuse with a rating meeting the specification.

Power supply of a 100 V system: 0.1 A time-lag fuse (part number: K9313PS)
Power supply of a 200 V system: 0.063 A time-lag fuse (part number: K9313PT)

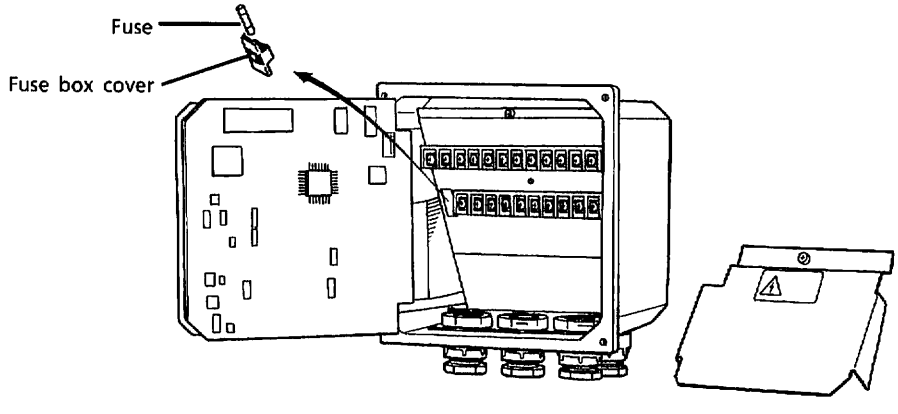


Figure 7.1 Fuse of Converter

8. Troubleshooting

This chapter describes the countermeasures for failures, classifying the cases into three categories: conductivity converter failure, detection of failure with the self-diagnosis function, and abnormal measured values.

The causes for abnormal measured values are not limited to equipment failures. If an abnormal phenomenon occurs, first check the following items:

- Is the property of the measuring solution different than normal?
- Is the conductivity sensor properly installed?

  Note : Check whether the conductivity sensor is immersed in the measurement fluid up to the outlet of the measurement fluid, and whether the output of the measurement fluid is facing downstream.

8.1 Measures in the Case of Converter Operation Failure

8.1.1 No Conductivity Converter Operation

If the converter does not operate even when the power is on, one cause may be a blown fuse inside the converter. Examine the fuse after turning off the power supply (see Subsection 7.2.3 on page 7-2). If the fuse is blown, replace it with a new one. If fuses blow frequently and the cause is not clear, request an inspection from Yokogawa. If the fuse is normal, examine the wiring system.

8.1.2 Operation Key or Display Failure

If the operation keys do not operate smoothly or the display fails (e.g., a missing character segment), repair of the printed circuit board (digital board) (replacement with a new one) is required. After the printed circuit board is replaced, operation checks and parameter settings are necessary. Contact Yokogawa and request board-replacement work.

8.2 Measures in the Case of Failure (Error) Detection

If a failure is detected through the self-diagnosis of the SC400G conductivity converter at the time of measurement, a FAIL contact signal is output. Also, the FAIL lamp on the operation panel lights up and an error number appears in the data display.

Note : If an error is detected by way of key operations or a certain action, a FAIL contact signal is output immediately but the error number is displayed after that action or operation has completed. A FAIL contact signal is not output if the failure is generated due to errors such as input of a value outside the possible setting range, etc. during calibration or a setting operation.

Errors for which a FAIL contact signal is not output: E2, E3, E10, E15, E17, E18, E19, or E20

When a FAIL (error) is detected, take measures according to Tables 8.1 and 8.2.

Table 8.1 Measures in the Case of Failure (Error) Detection (first of two tables)

Error No.	Generation Mode	Error Content and Causes	Measure
E 1	All modes	Polarization of electrodes The sagging of the conductivity input signal (rectangular wave) exceeds the permissible range (for details, see page 5-28). ● Sensor is severely contaminated.	Clean the conductivity sensor and calibrate the standard fluid.
E 2	TEMP mode	Temperature coefficient abnormal Operation result exceeds ±10 %/°C range. ● Error in the input conductivity value	Repeat the setting operation.
E 3	CAL mode	Calibration error The calculated cell constant exceeds ±20 % of the rated value range. ● There is dirt adhering to the sensor. ● The concentration of the standard fluid is different.	Readjust the standard fluid, and recalibrate.
E 5	All modes	Short in conductivity input circuit ● Problem in sensor / wiring	Check the wiring, and if no fault is detected, replace the conductivity sensor.
E 6	All modes	Non-continuity or snapped wire of conductivity input circuit ● Problem in sensor / wiring	Check the wiring, and if no fault is detected, replace the conductivity sensor.
E 7	All modes	Non-continuity or snapped wire of temperature input circuit (Non-continuity or open temperature input circuit wire) First, turn off the power to check if the error recurs. ● Problem in sensor / wiring	Check the wiring, and if no fault is detected, replace the conductivity sensor.
E 8	All modes	Insulation fault or short in temperature input circuit ● Problem in sensor / wiring	Check the wiring, and if no fault is detected, replace the conductivity sensor.
E10	All modes	EEPROM Write inappropriate Fault in electronic circuit	Non-continuity or snapped wire of temperature input circuit (Non-continuity or open temperature input circuit wire) First, turn off the power to check if the error recurs. If the error recurs, ask for repair from Yokogawa.

Table 8.2 Measures in the Case of Failure (Error) Detection (second of two tables)

Error No.	Generation Mode	Error Content and Causes	Measure
E15	SERVICE mode CODE 18	Temperature compensation value abnormal Compensation value exceeds −2.5 to 2.5°C range. • Fault in wiring of the sensor cable, etc. • Problem with temperature sensor	Check connections, etc. of the sensor cable. If the temperature sensor is faulty (abnormal resistance), replace the conductivity sensor.
E17	RANGE mode	Inappropriate input for minimum value of measurement range • A value exceeding 60 % of the maximum value has been input.	Set it again so as to satisfy the condition (less than 60 % of the maximum value).
	SERVICE mode CODE 07	nappropriate temperature measuring span • The span is not equal to or above 25°C.	Set it again to satisfy the conditions.
E18	SERVICE mode CODE 06	Inappropriate input of non-linear output data • Data is not simply incremented.	Set it again to satisfy the conditions (for details, see page 5 - 18).
E19	Setting modes	Inappropriate input of setting data value • Input data exceed the possible setting range.	Set it again to satisfy the conditions.
E20	All modes	Setting data lost. Fault in electronic circuit.	Contact Yokogawa to request repair.
E22	All modes	The time-out interval for the high or low alarm has elapsed. (if the function is executed for CODE 22)	Take measures depending on the purpose for using this function. Reset the error with the [NO] key or [YES] key.

8.3 Measures in the Case of Measured Value Failure

If a measured (conductivity) value becomes abnormal to the extent that it interferes with normal operation, take measures according to Table 8.3.

Table 8.3 Measures in the Case of Measured Value Failure

Phenomenon	Cause	Measure
The actual value is stable but the converter shows an unstable value.	1. There is froth in the measurement fluid. 2. Insulation fault in the measurement circuit. 3. Power voltage fluctuation outside permissible range. 4. Effect of temperature fluctuation on measurement fluid.	1. Rearrange the conditions of the measurement point. 2. Wipe off moisture / dirt on the sensor connector and converter terminals. 3. Modify. 4. Check the temperature coefficient.
A significantly lower value than the actual value is shown.	1. Insulation fault in cable or wiring. 2. Fault in the connection of the temperature element (Pt 1000 Ω). 3. Conductivity sensor not immersed in the measurement fluid.	1. Recover the insulation resistance between cable cores / terminals to more than 10^8 Ω. 2. In the case of Pt 1000 Ω, check between 11 and 12 that the reading is approx. 1.097 kΩ, at 25°C. 3. Immerse up to the outlet of the measurement fluid.
A significantly higher value than the actual value is shown.	1. Insulation fault of temperature element (Pt 1000 Ω).	1. In the case of Pt 1000 Ω, check between 11 and 12 that the reading is approx. 1.097 kΩ, at 25°C.
Response is slow.	1. Solution stagnant at measuring point. 2. The mounted direction of the conductivity sensor is not along the flow direction of the measurement fluid. 3. The conductivity sensor is not fully immersed in the measurement fluid. 4. The amount of flow (flow rate) is insufficient.	1. Improve the situation. 2. Re-mount the conductivity sensor so that the measurement fluid outlet side faces downstream. 3. Immerse the sensor right up to the measurement fluid outlet. 4. Increase the amount of flow.
Measured value is hunting.	1. Froth in the measurement fluid.	1. Rearrange the measuring point conditions.

Remarks : Methods for assessing conductivity detector response and assessed values in diagnosing failures

Knowing the response of your conductivity detector to temperatures and conductivity is helpful in identifying abnormal conditions. It is a good idea to use the standard fluid calibration event to make the following rough assessment.

<Conductivity response>

Immerse the conductivity detector sensor in the standard fluid used for calibration and check how long it takes until the conductivity detector displays a stable value. A temperature coefficient of 0.0 should be set in the converter at this time (using CODE 19). When the SC8SG conductivity detector operates normally (there is no dirt on the detector, etc.) the reading should stabilize within a few seconds.

<Temperature response>

Immerse a conductivity sensor (at atmospheric temperature) in a 10°C fluid and check how long time it takes for the sensor to produce a fairly stable reading. Then calculate the temperature change per second. The rate of temperature change often determines whether the instrument will operate normally when measuring conductivity converted to standard temperature.

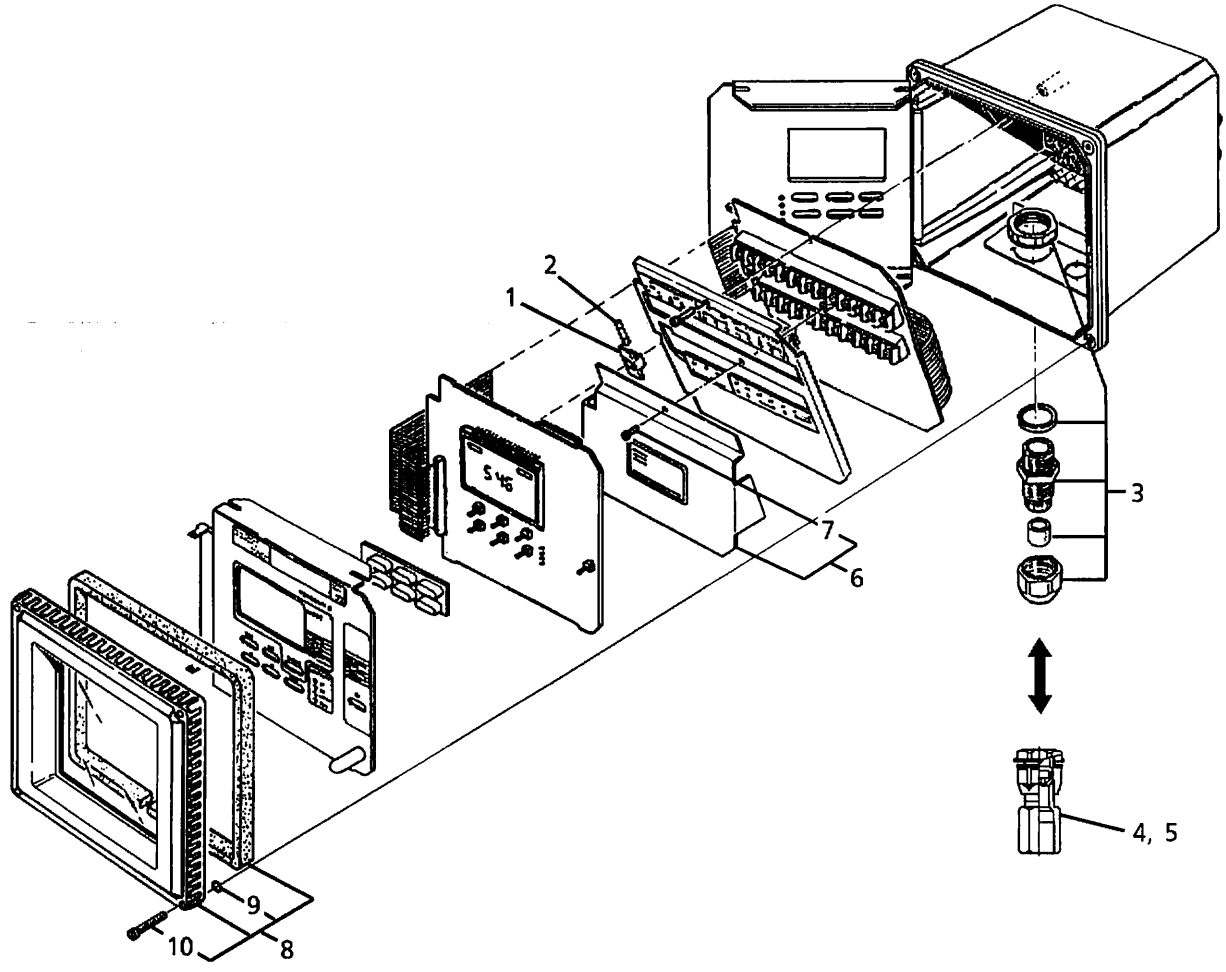
• Using assessed values in diagnosing failures

When changes in conductivity and temperature exceeds the response assessed for each mode, measured values become unstable or incorrect. In such cases, change the measuring point, lower flow velocity, etc. to adjust the conditions of the measurement fluid.

Normal measurements can be made when changes in conductivity and temperature are below the response. A slow response or other nonconformity is caused by an incorrect setup condition of the conductivity detector or other condition. Check these conditions and correct as necessary.

Customer Maintenance Parts List

4-wire Conductivity Metering System EXA SC
SC400G
Conductivity Converter

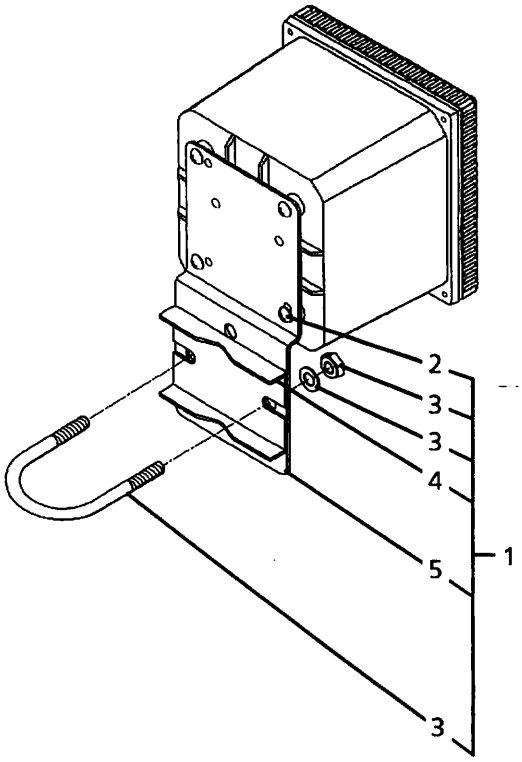


Item	Part No.	Qty	Description
1	L1823AA	1	Fuse Holder
2	—		Fuse (Time Lag Fuse)
	K9313PS	1	For 88 to 132 V AC Power, 0.1 A
	K9313PT	1	For 176 to 264 V AC Power, 0.063 A
3	K1500AR	6	Cable Gland
4	L9811CV	5	Gland (for Option Code : / AFTG)
5	K9141TN	5	Adapter (for Option Code : / AFTG)
6	K1541JH	1	Terminal Cover
7	Y9308JS	1	Screw
8	K9313DW	1	Cover Assembly
9	K9221US	4	O-Ring
10	Y9420LU	4	Screw

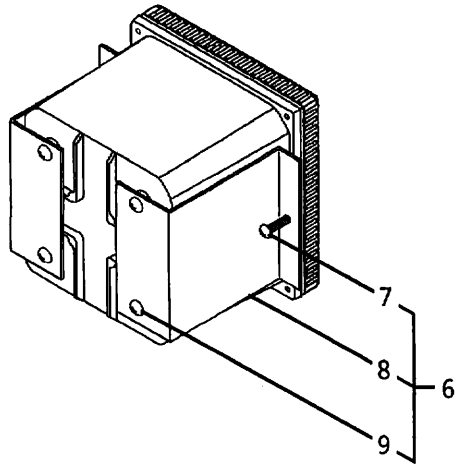
YOKOGAWA
Yokogawa Electric Corporation

CMPL 12D8N1 - 01E

Option Code : / U
Pipe / Wool Mounting Hardware



Option Code : / PM
Panel Mounting Hardware



Item	Part No.	Qty	Description
1	K9171SS	1	Mounting Set
2	Y9608KU	4	Screw
3	D0117XL-A	1	U-Bolt Assembly
4	K9171SY	1	Plate
5	K9171SX	1	Bracket
6	K9171ST	1	Mounting Set
7	Y9520LU	2	Screw
8	K9171SW	2	Bracket
9	Y9608KU	4	Screw

Worksheet for Operation Parameters

Setting Service Level (1)

Mode / Setting Item		Display	Default Value	. .	. .	. .
CODE 01	Setting mode using temp. measurement		(See page 5-16)			
	Selection of "temp element / temp unit"	*T.CODE	0.0	[ ], [ ]	[ ], [ ]	[ ], [ ]
CODE 02	Cell constant setting mode		(See page 5-17)			
	Setting of cell constant (rating)	X.X×C	0.10 [1/cm]	[ ]	[ ]	[ ]
CODE 03	Electrode setting mode		(See page 5-17)			
	Selection of electrode type	*4.ELEC	0 : 2-electrode sensor	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 04	Current output signal setting mode		(See page 5-18)			
	Selection of output signal	*mA	1 : 4 to 20 mA	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 05	Features setting mode of output signal		(See page 5-18)			
	Selection of "linear / non-linear"	*TABLE	0 : linear output	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 06	Non-linear output data setting mode		(See page 5-18)			
	Entry of 21-point data	*0 % ~	—	(See APPENDIX 3.)	(See APPENDIX 3.)	(See APPENDIX 3.)
CODE 07	Temp. output function setting mode		(See page 5-20)			
	Selection of corresponding output signal	*T.OUTP	0 : stop	☐0, ☐1, ☐2	☐0, ☐1, ☐2	☐0, ☐1, ☐2
	Setting of minimum value of measurement range	*0%	0 [°C]	[ ]	[ ]	[ ]
	Setting of maximum value of measurement range	*100%	100 [°C]	[ ]	[ ]	[ ]
CODE 08	Function setting mode of contact output S1		(See page 5-21)			
	Selection of operation function / output mode	*S1	2.0	[ ], [ ]	[ ], [ ]	[ ], [ ]
CODE 09	Function setting mode of contact output S2		(See page 5-21)			
	Selection of operation function / output mode	*S2	1.0	[ ], [ ]	[ ], [ ]	[ ], [ ]
CODE 10	Function setting mode of contact output S3		(See page 5-22)			
	Selection of operation function / output mode	*S3	0.0	[ ], [ ]	[ ], [ ]	[ ], [ ]
CODE 11	Delay time / hysteresis setting mode		(See page 5-22)			
	Setting of delay time	*D.TIME	0.2 [s]	[ ]	[ ]	[ ]
	Setting of hysteresis	*HYST	2.0 [%]	[ ]	[ ]	[ ]
CODE 12	Control range setting mode of contact output		(See page 5-23)			
	Setting of control range	*RANGE	10 [%]	[ ]	[ ]	[ ]
CODE 13	Cycle setting mode of proportional duty contact output		(See page 5-24)			
	Setting of cycle	*PER.	10 [s]	[ ]	[ ]	[ ]
CODE 14	Maximum frequency setting mode of proportional frequency contact output		(See page 5-24)			
	Setting of maximum frequency	*FREQ.	70 [Pulses/min]	[ ]	[ ]	[ ]
CODE 15	Reference temp. setting mode		(See page 5-25)			
	Setting of reference temp.	*T.R.	25 [°C]	[ ]	[ ]	[ ]
CODE 16	Measurement mode auto-return setting mode		(See page 5-25)			
	Selection of "execute / stop"	*RET.	1 : execute	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 17	Burn up function setting mode		(See page 5-26)			
	Selection of "execute / stop"	*BURN	0 : stop	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 18	Temp. input signal / cable capacitance compensation mode		(See page 5-26)			
	Operation result by actual temp. entry	*T.ADJ	(0 [°C])	[Δt]	[Δt]	[Δt]
	Entry of sensor cable length	*L.ADJ	(2 [m])	[ ]	[ ]	[ ]
CODE 19	Temp. coefficient setting mode		(See page 5-27)			
	Setting of temp. coefficient	*T.C.	(2.1 [%/°C])	[ ]	[ ]	[ ]
CODE 20	Polarization check function setting mode		(See page 5-28)			
	Selection of "execute / stop"	*POL.CK	0 : stop	☐0, ☐1	☐0, ☐1	☐0, ☐1
CODE 21	Weight % display function setting mode		(See page 5-28)			
	Selection of "execute / stop"	*%	0 : stop	☐0, ☐1	☐0, ☐1	☐0, ☐1
	Setting of minimum value of display range	*0%	0 [wt %]	[ ]	[ ]	[ ]
	Setting of maximum value of display range	*100%	100 [wt %]	[ ]	[ ]	[ ]

Service level (2)

	Mode / Setting Item	Display	Default Value	. .	. .	. .
CODE 22	Alarm time-out function setting mode		(See page 5-29)			
	Selection of "execute / stop"	* EXPIR	0 : stop	☐ 0, ☐ 1	☐ 0, ☐ 1	☐ 0, ☐ 1
	Setting of time-out time	* tE.min.	(15 [min])	[ ]	[ ]	[ ]
CODE 23	Hysteresis setting mode of temp. alarm contact output		(See page 5-30)			
	Setting of hysteresis	* T.HYST	(0.5 [°C])	[ ]	[ ]	[ ]
CODE 24	Alarm value change operating function setting mode		(See page 5-30)			
	Selection of "execute / stop"	* MODE	0 : stop	☐ 0, ☐ 1	☐ 0, ☐ 1	☐ 0, ☐ 1
CODE 25	Matrix temp compensation function setting mode		(See page 5-31)			
	Selection of compensation features	* MATRX	0 : stop	☐0, ☐1, ☐2, ☐3, ☐4, ☐5	☐0, ☐1, ☐2, ☐3, ☐4, ☐5	☐0, ☐1, ☐2, ☐3, ☐4, ☐5
CODE 26	Error output operation setting mode		(See page 5-32)			
	Selection / detection operation of Error No.	* Err.XX	All 1 (HARDFAIL)	E1 [ ], E5 [ ] E6 [ ], E7 [ ] E8 [ ], E22 [ ]	E1 [ ], E5 [ ] E6 [ ], E7 [ ] E8 [ ], E22 [ ]	E1 [ ], E5 [ ] E6 [ ], E7 [ ] E8 [ ], E22 [ ]
CODE 27	Electrode open detection function setting mode		(See page 5-33)			
	Selection of "execute / stop"	* EN.E6	1 : execute	☐ 0, ☐ 1	☐ 0, ☐ 1	☐ 0, ☐ 1
CODE 33	Password setting mode		(See page 5-34)			
	Selection of password	* PASS	0.0.0	[ ], [ ], [ ]	[ ], [ ], [ ]	[ ], [ ], [ ]

Setting Level

	Mode / Setting Item	Display	Default Value	. .	. .	. .
SETPOINTS	Alarm point setting mode	* SETP	(See page 5-11)			
	Setting of contact output S1 alarm point	* SETP.1	(High alarm)	☐High, ☐Low	☐High, ☐Low	☐High, ☐Low
	Conductivity value	* SC1	1 [mS/cm]	[ ]	[ ]	[ ]
	Temperature	* T1	—	[ ]	[ ]	[ ]
	Setting of contact output S2 alarm point	* SETP.2	(Low alarm)	☐High, ☐Low	☐High, ☐Low	☐High, ☐Low
	Conductivity value	* SC2	10 [µS/cm]	[ ]	[ ]	[ ]
	Temperature	* T2	—	[ ]	[ ]	[ ]
	Setting of contact output S3 alarm point	* SETP.3	(Low alarm)	[ ]	[ ]	[ ]
	Conductivity value	* SC3	—	[ ]	[ ]	[ ]
	Temperature	* T3	—	[ ]	[ ]	[ ]
RANGE	Measuring range setting mode	* RANGE	(See page 5-12)			
	Setting of minimum value in measuring range	* 0%	0.000 [mS/cm]	[ ]	[ ]	[ ]
	Setting of maximum value in measuring range	* 100%	1 [mS/cm]	[ ]	[ ]	[ ]
SET HOLD	Hold parameter setting mode	* HOLD	(See page 5-13)			
	Selection of hold "execute / stop	* H. OFF * H. ON	"Stop"	☐ Stop ☐ Execute	☐ Stop ☐ Execute	☐ Stop ☐ Execute
	Selection of value immediately before holding / fixed value	* H. LST * H. FIX	("alue immediately before holding")	☐ Value immediately before holding ☐ Fixed value	☐ Value immediately before holding ☐ Fixed value	☐ Value immediately before holding ☐ Fixed value
	Current signal level for fixed value	* H. mA	—	[ ]	[ ]	[ ]
	Voltage signal level for fixed value	* H. mV	—	[ ]	[ ]	[ ]
TEMP	Temp. compensation method setting mode	* TEMP	(See page 5-14)			
	Selection of "NaCl / measurement fluid" features	* NaCl * T.C.	"NaCl"	☐ NaCl ☐ Measurement fluid	☐ NaCl ☐ Measurement fluid	☐ NaCl ☐ Measurement fluid
	Computed temp. coefficient			[ ]	[ ]	[ ]

CODE 06 Non-Linear Output Data Setting Value (In the case of concentration management. See page 5 - 18.)

Output Signal Value				. .		. .		. .	
	4 to 20 mA	0 to 20 mA	0 to 1 V	Concent-ration Range	Conductivity (S/cm)	Concent-ration Range	Conductivity (S/cm)	Concent-ration Range	Conductivity (S/cm)
0 %	4.0	0.0	0.0						
5 %	4.8	1.0	0.05						
10 %	5.6	2.0	0.10						
15 %	6.4	3.0	0.15						
20 %	7.2	4.0	0.20						
25 %	8.0	5.0	0.25						
30 %	8.8	6.0	0.30						
35 %	9.6	7.0	0.35						
40 %	10.4	8.0	0.40						
45 %	11.2	9.0	0.45						
50 %	12.0	10.0	0.50						
55 %	12.8	11.0	0.55						
60 %	13.6	12.0	0.60						
65 %	14.4	13.0	0.65						
70 %	15.2	14.0	0.70						
75 %	16.0	15.0	0.75						
80 %	16.8	16.0	0.80						
85 %	17.6	17.0	0.85						
90 %	18.4	18.0	0.90						
95 %	19.2	19.0	0.95						
100 %	20.0	20.0	1.0						