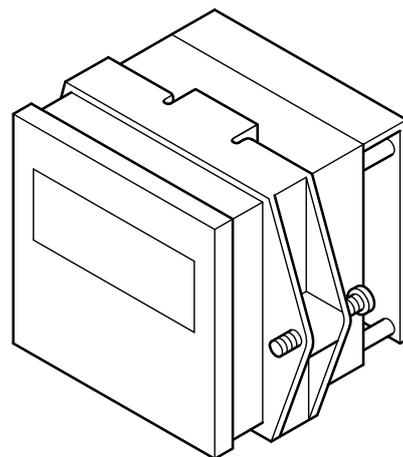


INSTRUCTION MANUAL

ELECTRODELESS CONCENTRATION ANALYZER/CONTROLLER

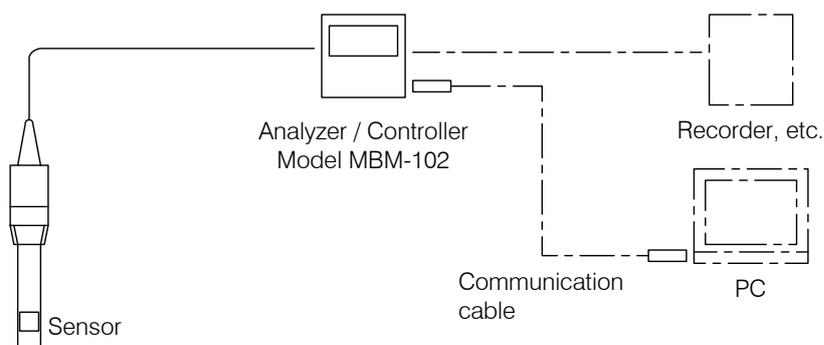
MODEL MBM-102A



- Please keep this instruction manual close at hand of the persons who are in charge of the operation of this product.
- Before operating this product, please read this instruction manual carefully for its correct handling.

Introduction

- (a) Thank you for your purchase of our product. The Model MBM-102A Electrodeless Concentration Analyzer / Controller (hereafter called the controller or the product) is an indicating controller in a measurement system that measures the electrical conductivity of a solution continuously using the electromagnetic induction method and converts the measured value into concentration value and then displays and outputs its concentration value.



Example of a Measurement System

- (b) If the product is equipped with an RS-232C connector (option), the following can be performed from the PC screen by using an application program (option). For details, refer to the instruction manual of the application program.
- Import the digital measured value data (concentration, temperature and conductivity) to the PC.
 - Change the concentration conversion data stored in the controller (using an optional dedicated software program).
- (c) The concentration conversion data (linear approximate expression) determined by the ordered specification is preinstalled in this product. The concentration conversion data represents the relationship between concentration, temperature and conductivity. For standard specification, the concentration conversion data is based on the International Critical Table (I.C.T.) and DKK-TOA analysis data.
- (d) The entire concentration measuring range is 0.00 to 99.99% (it may be 0.000 to 4.000% depending on how the setting is made). However, the concentration measuring range of each product depends on the preset concentration conversion data. In accordance with the preset concentration conversion data, one of the following conductivity measuring ranges is automatically selected.
- 0.000 to 2.100/ 0.00 to 7.00/ 0.00 to 21.00/ 0.0 to 70.0/ 0.0 to 210.0/ 0 to 700/ 0 to 2100mS/cm (at 25°C)
- The transmission output range can be set arbitrarily based on the range of the concentration conversion data.
- (e) This product can be combined with a sensor whose reference cell constant (designed cell constant) is 9.00 or 2.60/cm (depending on the ordered specification). Sensors with other reference cell constants cannot be combined. Power supply is 90 to 264VAC and two circuits are provided for alarm outputs. For other specifications, refer to 7.1 “Standard Specifications”.
- (f) There is a possibility that the product indicates or outputs an erroneous measured value by the following causes. Prepare a backup system so that no damage occurs to the related facilities even in the case like these.
- Any problem of the product such as deterioration or damage of the detecting section or inappropriate insulation of cables.

- Improper setting of operating conditions or calibration operation.
- Electrical interference such as noise in the vicinity or improper grounding.
- Other unpredictable phenomena

(g) Since important items are described in “Safety Information”, read the contents carefully.

(h) The product should be handled by persons who have received proper training. In addition, for technical services such as repairs, ask a specialist to do who is qualified for the technical certification system in our company or a person who has technical skills equivalent to that certification system.

Safety Information

(1) Meaning of markings

Meaning of symbols such as the ones used in notations of warning in the instruction manual is described below. In addition, the alert symbol (: General caution symbol) used on a product label, etc. is meant to notify the existence of hazard/loss and it also means “Refer to the Instruction Manual”.

WARNING:

Indicates the degree of hazard which can lead to death or serious injury if you fail to operate the product properly.

Serious injury means an injury such as loss of sight, burns (high temperature or low temperature), electric shock, bone fracture and poisoning, and the aftereffects of the injury remains or the injury requires hospitalization or long periods of outpatient treatment.

CAUTION:

Indicates the degree of hazard/loss which can result in minor injury or property damage if you fail to operate the product properly.

Minor injury means an injury not requiring hospitalization or long periods of outpatient treatment. Property damage refers to damage that affects property around the product such as equipment and buildings (wide-ranging damage).

[IMPORTANT] : Indicates important matters such as to prevent damage to the product main body, prevent data destruction, prevent wasting time, and maintain performance.

[NOTE] : Indicates comments, reasons, background information, a case example and other items to help the reader understand the meaning.

 : Indicates reference items.

①, ②, ③ : Indicates item numbers such as the ones used in operations.

(2) Safety compliance items

WARNING

Hazardous Gasses

- Do not use the product in an area where explosive gas, flammable gas exists. Using the product in any of these areas can cause explosion or fire.

Electric Shock

- Do not touch the terminals in the analyzer while power is applied. Touching the terminals may cause electric shock.
 - The ground terminal must be grounded. If the terminal is not grounded and a problem occurs in the power supply system, electric shock may result.
-



Disassembly and Modification

- Do not disassemble or modify the sections of the product that are not described in the instruction manual. The product can be damaged.

Warning Label Lost

- If any warning label affixed to this product becomes too difficult to read or lost, please order a new one through your local sales agent or our sales office and affix it to its original position.

Disposal

- In case you dispose of this product or any part of this product, handle it as industrial waste as specified by law.
-

(3) Notes on use of the instruction manual

Important items such as “Safety compliance items” are described in this manual. Handle the manual as follows:

- (a) The instruction manual is required not only at the start of operation but also required when maintenance is performed or in case a failure occurs. Please keep the manual at hand all the time so that the operator who actually operates the product can read the manual at any time.
- (b) If the manual is lost or too smeared to read, please order a new copy through your local sales agent or directly from our sales office.
- (c) Some of the diagrams used in the manual or on product labels may be modified with part of their shapes or displays omitted or they may be described in abstract form. In addition, numbers etc. shown on the screen example are just examples for such cases.
- (d) The contents of the manual may be changed without prior notice for reasons such as to improve performance.
- (e) Intellectual property right of the manual belongs to DKK-TOA. All or part of the manual must not be reproduced without permission.

Product Warranty

- (a) If a delivered product fails during warranty period, we repair it free of charge. However, if such failure falls under any of the following categories, repair cost shall be borne by the Customer even if failure has occurred within the warranty period.
- Failure or damage caused by improper operation, use outside of the specification limit, or actions such as improper maintenance, repair or modification.
 - Failure or damage caused by consumables, parts, optional equipment, software, etc. of nonconforming products.
 - Failure or damage occurred caused by other equipment connected to this instrument.
 - Failure or damage caused by such incidents as transportation, location transfer, fall of this product after delivery.
 - Failure or damage caused by fire, force majeure (such as earthquake, damage from wind and flood, lightning strike), salt damage, gas damage or abnormal voltages.
- (b) Warranty period is one year from the date of delivery. If the date of delivery is unclear, the warranty period shall be 24 months from the month that comes immediately after the manufactured date described on the product nameplate.
- (c) This warranty is limited to the repair of the product itself.
- (d) We cannot assume responsibility for direct or indirect damage caused by purpose or operating method exceeding the limit described in the instruction manual.
- (e) The target region of warranty is Japan only. Use outside of Japan shall be warranted by an individual contract prepared separately.
- (f) If an individual agreement is provided between the Customer and our company regarding each item described above, its agreement has precedence over the items described above. In addition, in cases other than the ones described above, if failure or damage is attributable to our company, we shall assume responsibility under the conditions set forth by law.
- (g) Other items
- The minimum retention period of performance parts for repair of this product is 5 years after manufacturing of this product is stopped. The performance parts for repair are parts to maintain the function of this product.
 - For failure of the product and its cause, except when law is required to determine, our personnel in charge of technical matter shall determine the failure status and its cause.
 - Small products used in laboratories or portable analyzers shall be repaired in our respective sections. Please send each product to a location that our company specifies.

Reading Guide

Refer to the necessary sections of this instruction manual depending on your purposes such as understanding the outline of this product or starting the product as shown below. The numbers in circles indicate sections to be referred to in sequential order.

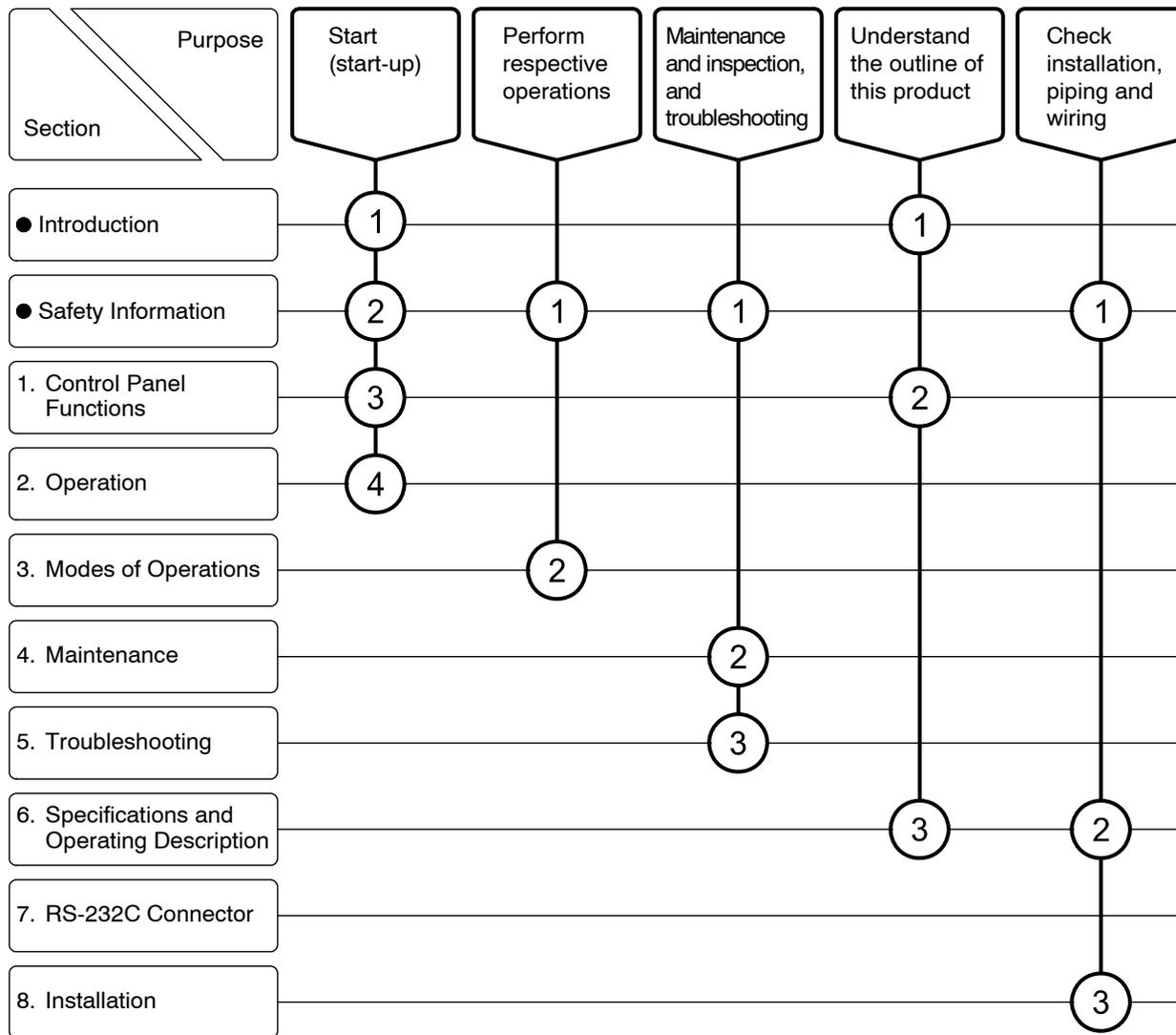


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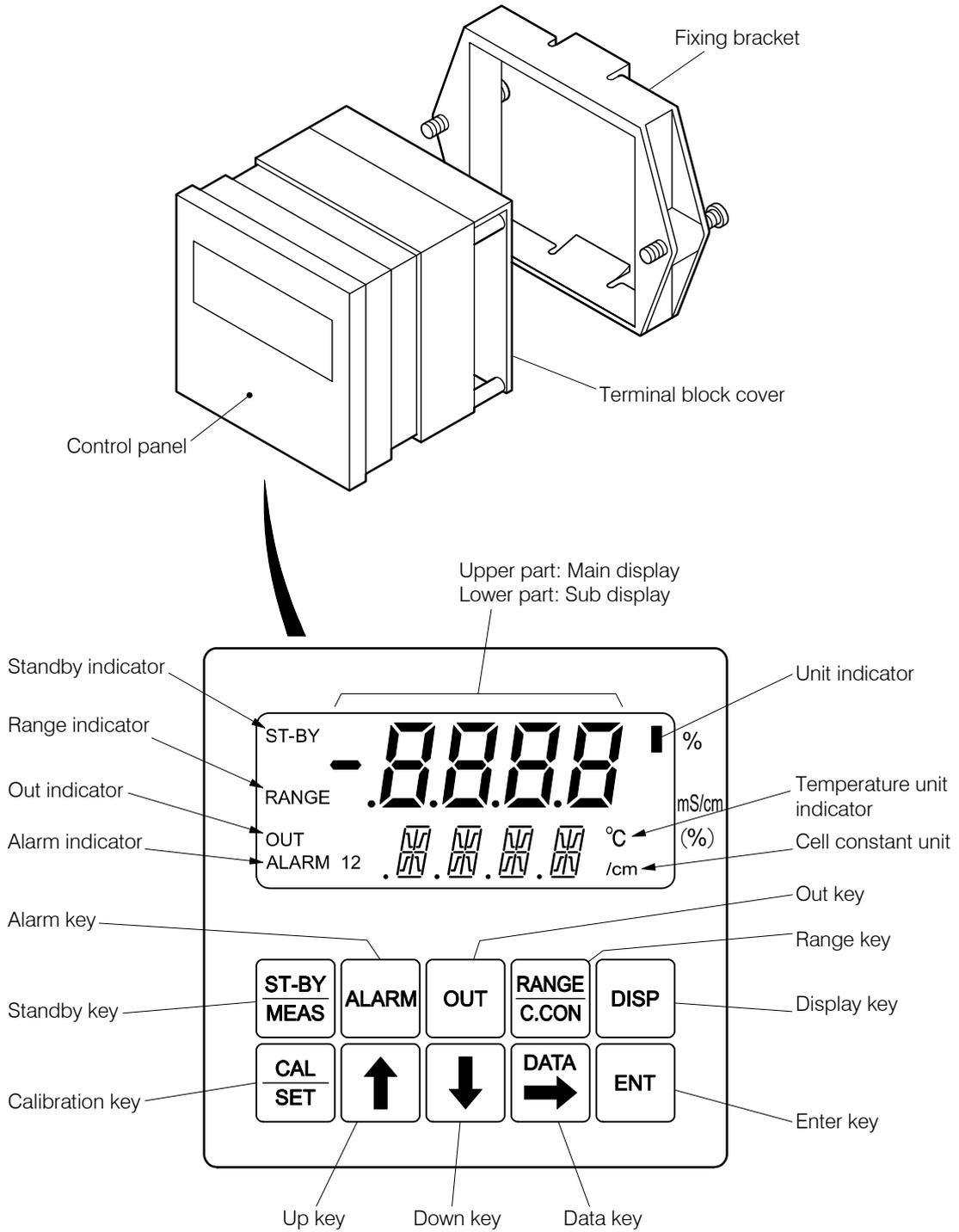
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1. Control Panel Functions

(1) Names of main components



Names of Main Components

(2) Functions of keys and indicators

Functions of Keys

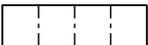
Name (notation in the text)	Operation mode			Function
	Measurement	Setting	Transmission adjustment	
Stand-by key  ([ST-BY/MEAS])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key longer (3 seconds or more) changes the screen to “Standby” screen (the initial screen of the setting mode).
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key longer returns the screen to the “Concentration measured value” screen.
Alarm key  ([ALARM])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key in the measured value screen group causes the screen to go to the alarm screen group, and if this key is pressed repeatedly, the screen switches to another one in the group and finally returns to the “Concentration measured value” screen.
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key after [CAL/SET] is pressed when “Standby” screen is displayed, “Alarm 1 On/Off” setting” screen, the initial screen of the alarm setting screen group, appears.
OUT key  ([OUT])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key in the measured value screen group causes the screen to go to the transmission output range screen group, and if this key is pressed repeatedly, the screen switches to another one in the group and finally returns to the “Concentration measured value” screen. Pressing this key longer enters the transmission output adjustment mode.
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key after [CAL/SET] is pressed when “Standby” screen is displayed, “Transmission output range 4mA value setting (4mA)” screen, the initial screen of the transmission output range, etc. setting screen group, appears.
			<input type="radio"/>	<ul style="list-style-type: none"> Pressing this key longer returns to the “Concentration measured value” screen.
Range key  ([RANGE/C.CON])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key in the measured value screen group causes the screen to go to the proper cell constant, etc. display screen group, and if this key is pressed repeatedly, the screen switches to another one in the group and finally the screen returns to the “Concentration measured value” screen.
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key after [CAL/SET] is pressed when “Standby” screen is displayed, “Proper cell constant setting (C.CON)” screen, the initial screen of the of the proper cell constant, etc. screen group, appears.
DISP key  ([DISP])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key repeatedly in the measured value screen group switches the screen to another one in the measured value screen group and finally the returns to the “Concentration measured value” screen.
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key after [CAL/SET] is pressed when “Standby” screen is display, “Concentration correction on/off setting” screen, the initial screen of the correction setting screen group, appears.

(To be continued)

(Continued from previous page)

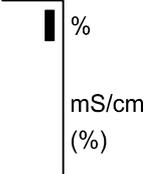
Name (notation in the text)	Operation mode			Function
	Measurement	Setting	Transmission adjustment	
CAL key  ([CAL/SET])		<input type="radio"/>		<ul style="list-style-type: none"> If the key assigned to each setting screen group is pressed after this key is pressed when “Standby” screen is displayed, the initial screen of each group appears.
Up key  ([↑])		<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Pressing this key in the setting mode or in the transmission output adjustment mode increases the number to set or switches the symbol.
Down key  ([↓])		<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Pressing this key in the setting mode or in the transmission output adjustment mode decreases the number to set or switches the symbol.
Data key  ([DATA →])	<input type="radio"/>			<ul style="list-style-type: none"> Pressing this key in the measured value screen group causes the screen to go to the compensation conversion data, etc. screen group and, if this key is pressed repeatedly, the screen switches to another one in the group and finally the screen returns to the Home position screen (such as “Concentration measured value” screen).
		<input type="radio"/>		<ul style="list-style-type: none"> Pressing this key when the numeric value input screen is displayed in the setting mode moves the digit of the number to the right.
Enter key  ([ENT])		<input type="radio"/>	<input type="radio"/>	<ul style="list-style-type: none"> Pressing this key switches the screen in the setting mode or in the transmission output adjustment mode screen group. In addition, this key is used to confirm the entered number or symbol and switches to the next screen at the same time.

Functions of Indicators

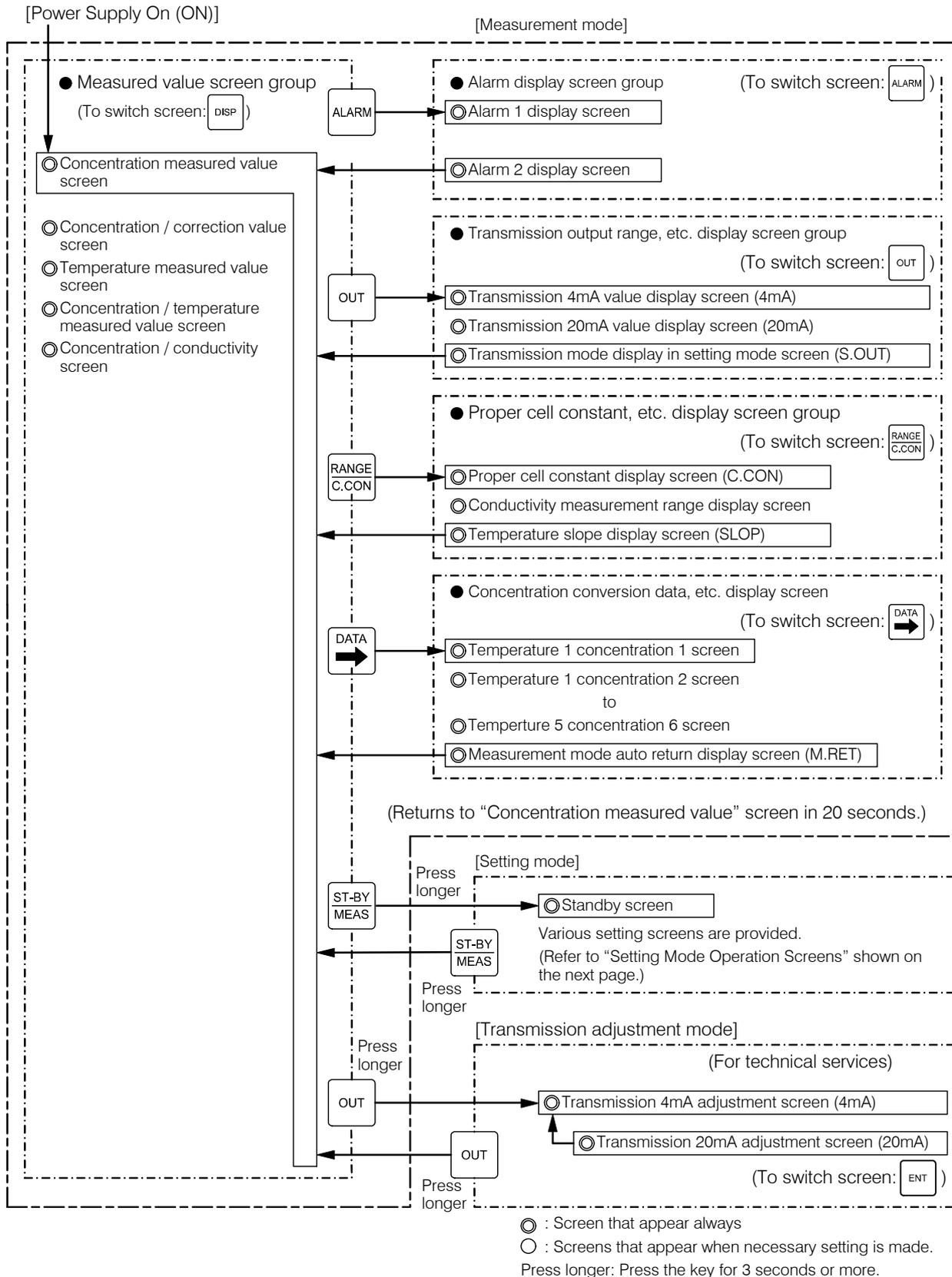
Display function	Function
Main display 	<ul style="list-style-type: none"> 4-digit number or 4 alphabetic characters can be displayed. The minus symbol can be displayed on the left. Displays mainly the measured value in the measurement mode, and setting values, selected items, etc. in the setting mode, and the transmission output value in the transmission output adjustment mode.
Sub display 	<ul style="list-style-type: none"> 4-digit number or 4 alphabetic characters can be displayed. Displays temperature, selected items, supplementary items of main display, symbols representing screen names, etc.

(To be continued)

(Continued from previous page)

Display function	Function
Unit indicator 	<ul style="list-style-type: none"> • When this indicator is lit, the unit printed to the right of this indicator is the unit for main display. “%” is the unit for sub display.
Temperature indicator °C	<ul style="list-style-type: none"> • Indicates that the unit “°C” is the unit for main display or sub display.
Cell constant indicator /cm	<ul style="list-style-type: none"> • Indicates that the cell constant is displayed in the unit of centimeter.
Stand-by indicator ST-BY	<ul style="list-style-type: none"> • This indicator when lit indicates the screen is currently in the setting mode or in the transmission output adjustment mode. Blinking state indicates that the setting value is ready to be changed.
Range indicator RANGE	<ul style="list-style-type: none"> • Indicates that the main display shows the measuring range.
OUT indicator OUT	<ul style="list-style-type: none"> • Indicates that the displayed screen is related to the transmission output.
Alarm indicators ALARM1 ALARM2	<ul style="list-style-type: none"> • This indicator when lit indicates that the displayed screen is related to the alarm 1 or alarm 2. Blinking state indicates that an alarm signal is being output.

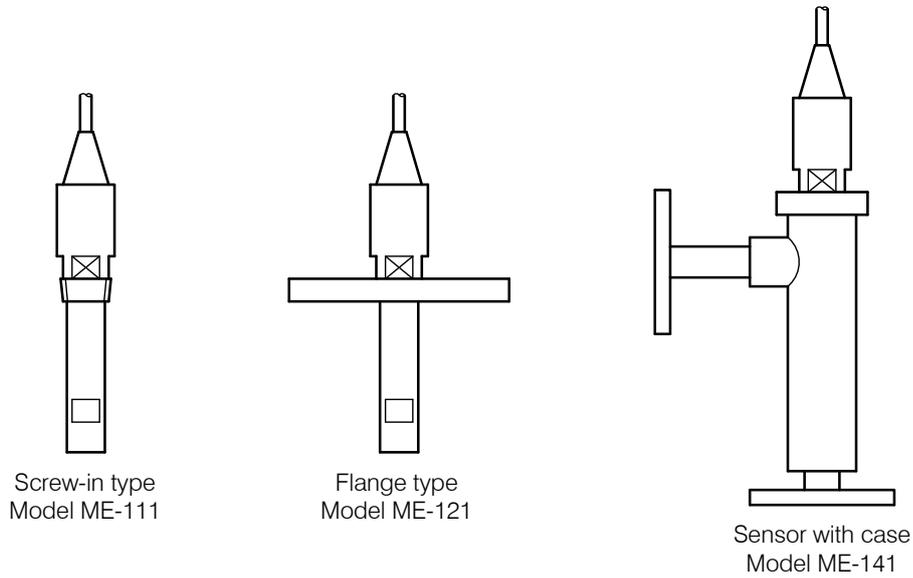
(3) Operation screen map



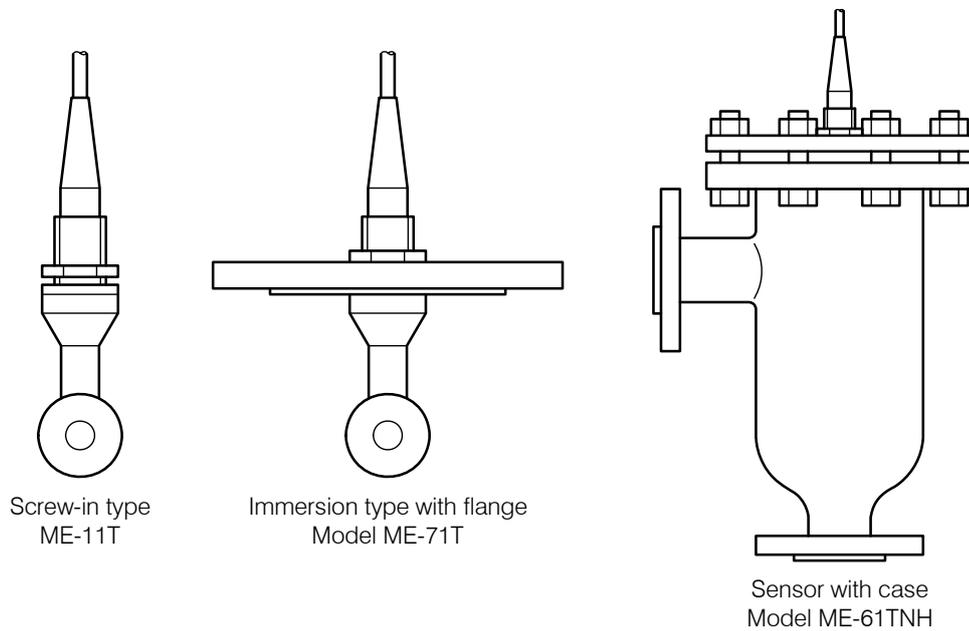
Operation Screen Map (1/2)

(4) Main sensors

Sensor is selected according to the ordered specification. The shapes of main sensors are shown below.



ME-1□1 Series Sensors
(Reference cell constant: 9.00/cm)



ME-11T, ME-6□□□ and ME-7□□□ Series Sensors
(Reference cell constant: 2.60/cm)

2. Operation

2.1 Operation Start Procedure

Follow the procedure below, and then the controller can be placed in normal operation.

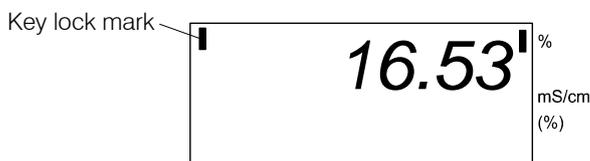
- ① **Check the installation.** Check that the necessary installation work (mounting and wiring) is completed. ▷ 8. “Installation”
- ② **Immerse the sensor in sample solution.** Make sure that the sensor is installed properly and the liquid-contact part of the sensor is immersed in sample solution.
- ③ **Supply power.** Make sure the power to be supplied to the controller is of the power voltage within the range described on the nameplate of the product or in the specification and then turn on power.

⚠ **WARNING**

Electric Shock

- Do not touch the terminals in the analyzer while power is applied. Touching the terminals may cause electric shock.

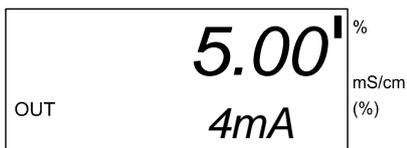
- When power is supplied, “Concentration measured value” screen, the initial screen of the measurement mode (“ST-BY” is unlit), appears and the concentration measured value is shown on the main display.



Example of Concentration Measured Value Screen

[NOTE] • If the key lock indicator is lit, refer to the [NOTE] in 3.1(1) “Checking the current mode”.

- ④ **Go to the transmission output range, etc. display screen group.** Press **[OUT]** while a screen of the measured value screen group is displayed.
- The “Transmission 4mA value display (4mA)” screen of the transmission output range, etc. display screen group appears.



Transmission 4mA Value Display Screen



Transmission 20mA Value Display Screen

- ⑤ **Check the 4mA transmission value.** Check that the value on the main display of “Transmission 4mA value display (4mA)” screen shows the necessary concentration value (%) that corresponds to 4mA value.

- Normally, the transmission output range is set in accordance with the ordered specification when the product is shipped from the factory.
- ⑥ **Check the 20mA transmission value.** Press **[OUT]** once and check that the value on the main display of “Transmission 20mA value display (20mA)” screen shows the necessary concentration value (%) that corresponds to 20mA value. Check that the transmission output range is appropriate for the conductivity of sample solution for 20mA value as well as 4mA value.
- The transmission output range can be changed. ▷ 3.3(5) “Setting the transmission output range and transmission mode”
- ⑦ **Return to “Concentration measured value” screen.** Press **[OUT]** twice.
- ⑧ **Check other setting values, if necessary.** Check the setting values of items among the screens shown in the table below if there are any other necessary items. Here, “Transmission 4mA value display (4mA)” screen and “Transmission 20mA value display (20mA)” screen are already checked in Steps ④ to ⑥.

Measurement Mode Screens and Factory Setting Values

Measurement mode screen	Factory settings	How to check and change the settings
[Alarm display screen group] <ul style="list-style-type: none"> • Alarm 1 display screen • Alarm 2 display screen 	Invalid (oFF) Invalid (oFF)	<ul style="list-style-type: none"> • Check 3.2(3) “Alarm display screen group” • Change 3.3(4) “Alarm setting”
[Transmission output range, etc. display screen group] <ul style="list-style-type: none"> • Transmission 4mA value display screen • Transmission 20mA value display screen • Transmission mode display in setting mode screen 	Depends on the ordered specification. Depends on the ordered specification. Hold (HoLd)	<ul style="list-style-type: none"> • Check 3.2(4) “Transmission output range, etc. display screen group” • Change 3.3(5) “Setting the transmission output range and transmission mode”
[Proper cell constant, etc. display screen group] <ul style="list-style-type: none"> • Proper cell constant display screen • Temperature slope display screen 	Depends on the sensor used. 2.000	<ul style="list-style-type: none"> • Check 3.2(5) “Proper cell constant, etc. display screen group” • Change 3.3(6) “Setting the proper cell constant” • Change 3.3(7) “Setting the temperature slope”
[Concentration conversion data, etc. display screen group] <ul style="list-style-type: none"> • Temperature 1 Concentration 1 screen to • Temperature 5 concentration 6 screen • Measurement mode auto return screen 	Depends on the ordered specification. to Depends on the ordered specification. Valid (on)	<ul style="list-style-type: none"> • Check 3.2(6) “Concentration conversion data, etc. display screen group” • Change Not changeable. The concentration conversion data can be changed using an application program for PC (option) if the product is equipped with RS-232C connector.

- ⑨ **Check the indication in measurement mode.** While “Concentration measured value” screen is displayed, press **[DISP]** repeatedly until the desired screen appears.

- Concentration measured value screen
- Concentration / correction value screen
- Temperature measured value screen
- Concentration / temperature measured value screen
- Concentration / conductivity screen

The measurement system is now placed in normal operation.

2.2 Stopping the Operation

- (a) To stop the operation, turn off power at the power source side that supplies power to the controller and alarm terminals for signal source.
- (b) If it is sure that the sensor will not be damaged or no possibility of the electrode section gets dirty, it is not necessary to remove the sensor
- (c) To restart the operation, refer to 2.1 “Operation Start Procedure”. To transfer the controller to other place, refer to 8. “Installation”.

3. Modes of Operations

3.1 Modes and Switching Method

(1) Checking the current mode

(a) Screens to check or set various items are separated into the following 3 modes:

- Measurement mode The screens needed for normal measurement are provided. These screens are used to check (only to watch) items such as an alarm screen and transmission output range screen.
- Setting mode The screens to change various settings such as the ones used for alarm are provided.
- Transmission adjustment mode The screens to adjust the transmission value are provided.

(b) The mode that the current screen belongs can be checked as shown in the table below. If the Standby indicator (ST-BY) is unlit, the mode is measurement mode and if it is lit, the mode is setting mode or transmission adjustment mode.

Standby indicator and Current Mode

	Standby indicator (ST-BY)
Measurement mode	—
Setting mode or transmission adjustment mode	○

○: Lit or blinks —: Unlit

[NOTE] • Key lock indicator when it is lit indicates that the key lock is on. Under this condition, all keys other than **[↑]** and **[ENT]** cannot be used. Pressing **[↑]** and **[ENT]** together longer (3 seconds or more) switches the key lock function to off (released). If the same operation is made when the key lock indicator is unlit, the key lock function turns on. Do not turn off the key lock condition unless it is necessary to do so.



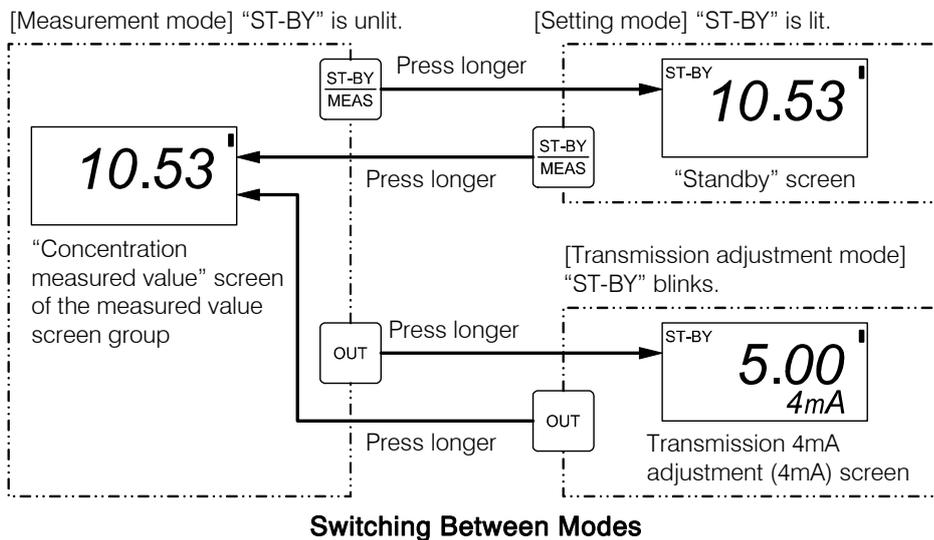
Condition when Key Lock is On

(2) Switching between modes

- (a) Measurement mode is the basic mode and when the power is applied to the controller, the controller goes to the measurement mode. If you exit from the setting mode or transmission adjustment mode, the mode goes to the measurement mode.
- (b) If you press **[ST-BY/MEAS]** longer (3 seconds or more) in measurement mode, the mode changes to the setting mode and if you press **[ST-BY/MEAS]** longer in the setting mode, the mode returns to the measurement mode.
- (c) If you press **[OUT]** longer in measurement mode, the mode changes to transmission adjustment mode, and if you press **[OUT]** longer in the transmission adjustment mode, the mode returns to the measurement mode.

(d) When the mode is switched, the transmission output changes as follows:

- Measurement mode The concentration value currently measured is output.
- Setting mode The concentration measured value is output according to the transmission mode set by the “Transmission mode setting in setting mode (S.OUT)” screen.
- Transmission adjustment mode An arbitrary current value is output set using the screen in this mode.



3.2 Measurement Mode Operation

(1) Measurement mode screen groups

(a) The screens of measurement mode are separated into the followings groups and pressing the assigned key for each group opens the screens of the group sequentially. Closing the last screen in the group brings you back to the “Concentration measured value” screen of the measurement mode.

- Measured value screen group DISP
- Alarm display screen group ALARM
- Transmission output range, etc. display screen group OUT
- Proper cell constant, etc. display screen RANGE/C.CON
- Concentration conversion data, etc. display screen group DATA →

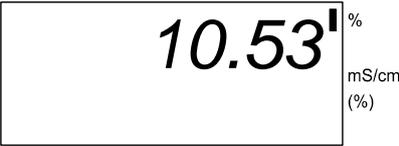
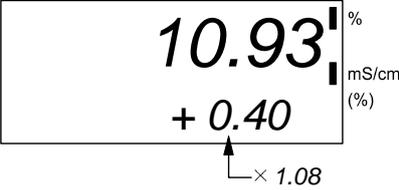
(b) Any screen other than those in the measured value screen group returns automatically to the “Concentration measured value” screen in 20 seconds after its screen is opened.

(2) Measured value screen group

(a) The screens shown in the table below are provided for measured value screen group and you can check the measured value, etc. You can open the screens sequentially by pressing DISP in the measurement mode.

(b) In normal measurement operation, select one of the screens from this group. However, “Temperature measured value” screen returns automatically to the “Concentration measured value” screen in 20 seconds after it is opened.

Sequence of Measured Value Screen Group

No.	Name	Screen example	Contents
(To switch screen: DISP)			
①	Concentration Measured Value Screen		<ul style="list-style-type: none"> • Main display The current concentration measured value (%). • Unit indicator The unit (mS/cm (%)) for the main display. • Sub display Not displayed.
②	Concentration and Compensation Value Screen (If the “Concentration Compensation On/Off Setting” (on/oFF) screen is “oFF”, this screen does not appear.)		<ul style="list-style-type: none"> • Main display The current concentration measured value (%). • Unit indicator The unit (mS/cm (%)) for the main display are shown. • Sub display Either of the following is shown. <ul style="list-style-type: none"> + or - Indicates the offset (conductivity) for concentration compensation. × Indicates the compensation coefficient by span compensation. In this case, the unit indicator “mS/cm” is unlit.

(To be continued)

(Continued from previous page)

No.	Name	Screen example	Contents
③	Temperature Measured Value Screen		<ul style="list-style-type: none"> • Main display ... The current temperature measured value (°C). • Sub display ... Shift value is displayed when “on” is set to the “Temperature Shift On/Off (SHFT)” screen. • Returns automatically to the “Concentration Measured Value” screen in 20 seconds after it is opened.
④	Concentration / Temperature Measured Value Screen		<ul style="list-style-type: none"> • Main display ... The current concentration measured value (%). • Unit indicator ... The unit (%) for the main display are shown. • Sub display ... The temperature measured value (°C).
⑤	Concentration /Conductivity Value Screen		<ul style="list-style-type: none"> • Main display ... The current concentration measured value (%). • Unit indicator ... The unit (%) for the main display are shown. • Sub display ... The current conductivity measured value of sample solution (mS/cm).

(3) Alarm display screen group

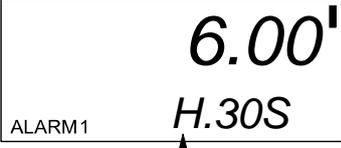
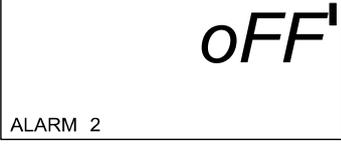
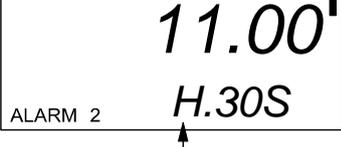
(a)The screens shown in the table below are provided for alarm screen group. You can check the alarm set-point values, etc. You can open the screens sequentially by pressing **ALARM** in the measurement mode. In addition, any screen in this group automatically returns to the “Concentration measured value” screen after it is opened.

(b)Two circuits are provided for alarm outputs.

- “Alarm 1 display” screen corresponds to the alarm 1 output.
- “Alarm 2 display” screen corresponds to the alarm 2 output.

(c)Alarm on/off, high/low limit (H, L), alarm set-point value and delay time settings can be changed using the screens of “Alarm screen group” in the setting mode. ▷ 3.3(4) “Alarm setting”

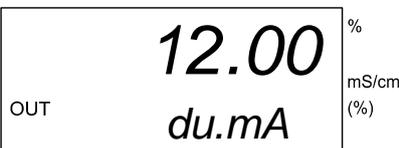
Sequence of Alarm Display Screen Group

No.	Name	Screen example	Contents
(To switch screen: ALARM)			
①	Alarm 1 display screen	 <p style="text-align: center;">< When Off is selected ></p>  <p style="text-align: center;">< When On is selected ></p>	<p><When Off is selected></p> <ul style="list-style-type: none"> • Sub display indicates that Alarm 1 is off. <p><When On is selected></p> <ul style="list-style-type: none"> • Main display shows the alarm set-point (%) of Alarm 1, and this indicates that Alarm 1 is on. • Unit indicator indicates the unit for main display value. • Sub display shows the high/low alarm distinction and its delay time (seconds). H (High) High alarm L (Low) Low alarm
②	Alarm 2 display screen	 <p style="text-align: center;">< When Off is selected ></p>  <p style="text-align: center;">< When On is selected ></p>	<ul style="list-style-type: none"> • In the same manner as in Alarm 1.
(Returns to “Concentration measured value” screen)			

(4) Transmission output range, etc. display screen group

- The screens shown in the table below are provided for transmission output range, etc. display screen group and you can check the transmission output range and the transmission mode in the setting mode. You can open the screens sequentially by pressing **OUT** in the measurement mode. In addition, any screen in this group automatically returns to the “Concentration measured value” screen in 20 seconds after it is opened.
- The items or values you can check in this screen group correspond to the transmission output value of 4 to 20mADC.
- You can change the setting values of this screen group using the screens of the “Transmission output range, etc. screen group” in the setting mode.

Sequence of Transmission Output Range, etc. Display Screen Group

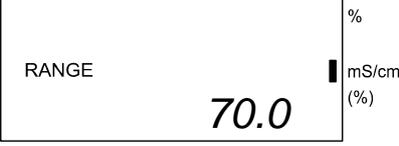
No.	Name	Screen example	Contents
(To switch screen: [OUT])			
①	Transmission 4mA value display screen		<ul style="list-style-type: none"> • Main display shows the concentration value (%) corresponding to 4mA value. • Unit indicator indicates the unit for main display value.
②	Transmission 20mA value display screen		<ul style="list-style-type: none"> • Main display shows the concentration value (%) corresponding to 20mA value. • Unit indicator indicates the unit for main display value.
③	Transmission mode display in maintenance mode screen	 <p style="text-align: center;">< Hold mode ></p>	<ul style="list-style-type: none"> • Main display shows the currently set symbol that indicates the transmission mode in the setting mode. One of the following can be selected. HoLd (Hold) The last transmission value before changing to the setting mode is output as a fixed value (factory setting) tH (Through) The measured value is output in the same way as in measurement mode. 12.00, etc. (Dummy) An arbitrarily set transmission value is output as a fixed value. The number shown is a dummy value (mA) • Sub display "S.OUT" indicates that the main display shows the symbol indicating the transmission mode. "du.mA" indicates that the transmission mode is in Dummy mode.
		 <p style="text-align: center;">< Through mode ></p>	
		 <p style="text-align: center;">< Dummy mode ></p>	
(Returns to "Concentration measured value" screen)			

(5) Proper cell constant, etc. display screen group

- (a) The screens shown in the table below are provided for proper cell constant, etc. display screen group and you can check the proper cell constant, conductivity range and temperature slope. You can open the screens sequentially by pressing **[RANGE/C.CON]** in the measurement mode. In addition, any screen in this group automatically returns to the "Concentration measured value" screen in 20 seconds after it is opened.
- (b) The proper cell constant is a cell constant that each sensor has and is a value a little more or less than the reference cell constant (designed cell constant). Normally if you enter the proper cell constant (described on the sensor) of the sensor combined to the analyzer, higher accuracy measurement can be obtained.
- (c) The conductivity measuring range is preset at factory according to the ordered specification. If the product is equipped with an RS-232C connector (option), by using an application program (option) for personal computer, the concentration conversion data can be changed to new one. This may result in the conductivity measuring range being changed.

(d) You can change the proper cell constant and temperature slope of this screen group using the screens of the proper cell constant, etc. setting screen group in the setting mode.

Sequence of Proper Cell Constant, etc. Display Screen Group

No.	Name	Screen example	Contents
(To switch screen: RANGE/C.CON)			
①	Proper Cell Constant Display Screen		<ul style="list-style-type: none"> • Main display ... Displays the set proper cell constant, a value of approx. 9.00/cm or 2.60/cm. Normally, the value described on the combined sensor is set. • Cell constant unit ... indicates that the unit for main display is /cm.
②	Conductivity Measuring Range Display Screen		<ul style="list-style-type: none"> • Sub display ... Maximum scale value (FS) (mS/cm) in the conductivity measuring range set at factory according to the ordered specification • Range display ... Indicates that the sub display shows a value within the conductivity measuring range.
	Temperature Slope Display Screen		<ul style="list-style-type: none"> • Main display ... Coefficient indicating the slope of the analytical curve for temperature measurement (factory setting: 2.000)
Returns to “Concentration Measured Value” screen.			

(6) Concentration conversion data, etc. display screen group

- (a) The screens shown in the table below are provided for concentration conversion data, etc. display screen group and you can check the concentration conversion data and the settings for measurement mode auto return. You can open the screens sequentially by pressing DATA → in the measurement mode. In addition, any screen of this group automatically returns to the “Concentration measured value” screen in 20 seconds after it is opened.
- (b) The setting values in these screens are preset at factory according to the ordered specification and cannot be changed. However, if the product is equipped with an RS-232C connector (option), the concentration conversion data can be changed by using an application program (option) for personal computer.
- (c) The concentration conversion data is a list of conductivity (mS/cm) of a sample solution of concentration X (%) and temperature T (°C). Conductivity for up to 30 points (X1T1 to X6T5) (conductivity for up to 6 points of concentration (X1 to X6) and up to 5 points of temperature (XT11 to 65)) is set. In this instruction manual, each data is referred to as the following symbol.

Temperature (°C)	T5	XT15	XT25	XT35	XT45	XT55	XT65
	T4	XT14	XT24	XT34	XT44	XT54	XT64
	T3	XT13	XT23	XT33	XT43	XT53	XT63
	T2	XT12	XT22	XT32	XT42	XT52	XT62
	T1	XT11	XT21	XT31	XT41	XT51	XT61
		X1	X2	X3	X4	X5	X6
Concentration (%)							

Symbols Indicating the Conductivity of Concentration Conversion Data

Sequence of Concentration Conversion Data, etc. Screen Group

No.	Name	Screen example	Contents
(To switch screen: DATA →)			
①	Concentration conversion XT11 screen		<ul style="list-style-type: none"> • Main display shows the conductivity value (mS/cm) of concentration conversion data when concentration is X1 and temperature is T1. • Sub display shows the concentration X1 (%) and temperature T1 (°C) alternately. The screen example shows 0.00% and 15.0°C.
②	Concentration conversion XT21 screen		<ul style="list-style-type: none"> • Main display shows the conductivity value (mS/cm) of concentration conversion data when concentration is X2 and temperature is T1. • Sub display shows the concentration X2 (%) and temperature T1 (°C) alternately. The screen example shows 3.00% and 15.0°C.
③	Concentration conversion XT31 screen to Concentration conversion XT65 screen	(Screen omitted)	<ul style="list-style-type: none"> • The contents are in the same manner as in ① and ②. The screens of up to 30 including the ones in ① and ② are provided. • The screens where concentration conversion data is not set will not be displayed. • If ST-BY/MEAS is pressed while concentration conversion data is displayed, the screen goes to the next "Measurement mode auto return" screen.
④	Measurement mode auto return display screen		<ul style="list-style-type: none"> • Main display shows the currently set measurement mode auto return on/off setting.
(Returns to "Concentration measured value" screen)			

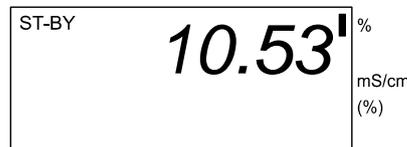
3.3 Setting Mode Operation

(1) Overview of standby screen and setting mode

(a) The setting values of setting mode screens are normally set in accordance with the ordered specification and shipped as such from the factory. Do not operate the screens of the setting mode unless it is really necessary. If it is necessary to change the setting values, proceed with operation after understanding this function thoroughly.

【IMPORTANT】 • Unless it is really necessary, do not operate the screens of the setting mode. If the setting values that are not needed to change are changed, correct measurement result cannot be obtained and the controller may not be returned to the measurement condition before the change is made.

(b) The “Standby” screen is the initial screen of the setting mode and it is an intermediary screen to go to each setting screen group.



Standby Screen

(c) If you press **[ST-BY/MEAS]** longer (3 seconds or more) in the measurement mode, the Standby indicator (ST-BY) lights and “Standby” screen appears. If you press the assigned key for each group, the screens of that group open. If you press **[ST-BY/MEAS]** longer in the setting mode, the screen returns to “Concentration measured value” screen, the initial screen of the measurement mode.

(d) Each screen group in the setting mode and their assigned keys are shown below. If any assigned key is pressed while the Standby screen is displayed, the initial screen of the corresponding group opens. If **[ENT]** is pressed (confirmed) while the last screen of each group is displayed, the screen returns to the “Standby” screen.

- Correction screen group **[CAL/SET]** **[DISP]**
- Alarm screen group **[CAL/SET]** **[ALARM]**
- Transmission output range, etc. screen group **[CAL/SET]** **[OUT]**
- Proper cell constant, etc. screen group **[CAL/SET]** **[RANGE/C.CON]**

(2) Concentration correction setting

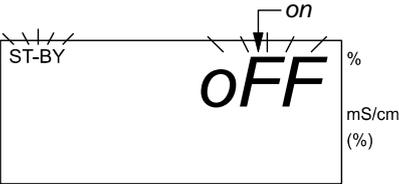
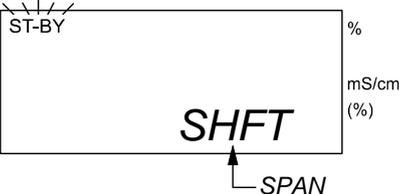
(a) It is possible to change the on/off setting of the concentration compensation function, the compensation method and the value after compensation. The concentration compensation function is set to “oFF” (do not perform compensation) at factory. Normally, this operation is not needed.

- Operation screen Correction screen group

(b) Concentration compensation is an operation that measures a solution of known compensation and changes the measured value on the screen to the value for the solution of known compensation by key operation. While this function is on, the measured value is compensated. If this function is turned off, the value before compensation is restored.

- (c) To perform this operation, it is necessary to prepare in advance a solution of known concentration that is kept constant (within a variance of 0.5°C for 5 minutes) within the temperature range of the concentration conversion data and immerse the sensor in it.
- (d) Either the concentration shift compensation (SHIFT) or concentration span compensation (SPAN) can be selected. Concentration shift compensation adds/subtracts an offset to/from the measured value and is suitable for compensation around the minimum value in the measuring range. On the other hand, concentration span compensation multiplies the measured value by the set compensation coefficient and is suitable for compensation around the maximum value.

Procedure for Concentration Correction Setting

Procedure and Screen Example	Contents
<p>① Select the “Standby” screen.</p>	<p>Press [ST-BY/MEAS] longer in the measurement mode.</p> <ul style="list-style-type: none"> • “ST-BY” lights.
<p>② Prepare a solution of known concentration.</p>	<p>Immerse the sensor in the solution of known compensation that is kept constant (within a variance of 0.5°C for 5 minutes) within the temperature range of the concentration conversion data and wait until the concentration is stabilized.</p> <ul style="list-style-type: none"> • If the concentration compensation function is turned off, this operation is not needed.
<p>③ Go to the correction screen group.</p>	<p>Press [CAL/SET] and then [DISP].</p> <ul style="list-style-type: none"> • “Concentration correction on/off” screen appears and “ST-BY” starts blinking. • The screen goes to the compensation screen group and this screen appears. • Main display ... The selected On/Off of the concentration compensation function on (On) ... The concentration compensation function is valid. oFF (Off) ... The concentration compensation function is invalid (factory setting).
<div style="text-align: center;">  </div> <p>Concentration Compensation On/Off Screen</p>	<p>④ Confirm the on/off selection of the..... Use [↑] or [↓] to show the desired choice and press [ENT].</p> <ul style="list-style-type: none"> • If you select “on”, the screen goes to the next screen after confirmation. • If you select “oFF”, proceed to the operation in ⑦ after confirmation.
<p>⑤ Set a concentration compensation method..... (If you select “oFF” in ④, this screen does not appear.)</p>	<p>Use [↑] or [↓] to display your desired choice on the sub display and press [ENT].</p> <ul style="list-style-type: none"> • SHFT (shift) ... Concentration shift compensation. • SPAN (span) ... Concentration span compensation. • After confirmation, the screen goes to the next screen.
<div style="text-align: center;">  </div> <p>Concentration Compensation Method Screen</p>	

(To be continued)

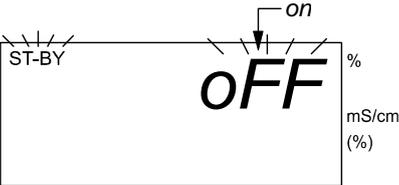
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Procedure and Screen Example	Contents
<p>⑥ Confirm the concentration compensation value..... (If you select “oFF” in ④, this screen does not appear.)</p>  <p style="text-align: center;">Concentration Compensation Value Screen</p>	<p>Change the blinking number on the main display to the concentration after compensation and press [ENT].</p> <ul style="list-style-type: none"> • Main display The set measured value (%) after compensation To increase/decrease number: [↑] [↓] • Sub display The selected concentration compensation method. • After confirmation, the screen goes to the next screen.
<p>⑦ Return to the “Concentration Measured Value” screen.</p>	<p>Press [ST-BY/MEAS] longer.</p>

(3) Setting the temperature shift

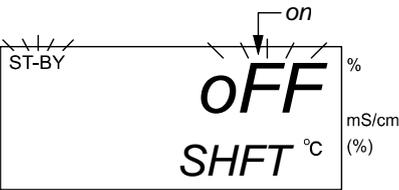
- (a) It is possible to change the on/off setting of the temperature shift function and the temperature measured value after shift. The temperature shift is set to “off” (do not shift) at factory. Normally, this operation is not needed.
- Operation screen Correction screen group
- (b) Temperature shift is a method that obtains the temperature of a sample solution by using another method (by using a precision thermometer, etc.) and shifts the indicated value of the analyzer by keying in the temperature measured value in the screen. While this function is on, the analytical curve of the temperature measurement system is moved in parallel (SHIFT). If this function is turned off, the value before shift is restored.
- (c) When the temperature shift is on, not only the temperature measured value but also the conductivity measured value and concentration measured value are calculated with the shifted temperature.

Procedure for Setting the Temperature Shift

Procedure and Screen Example	Contents
<p>① Select the “Standby” screen.</p>	<p>Press [ST-BY/MEAS] longer in the measurement mode.</p> <ul style="list-style-type: none"> • “ST-BY” lights.
<p>② Measure the temperature by another method.</p>	<p>Arrange so that the temperature of the solution in which the sensor is immersed can be measured by another method, and wait until the temperature is stabilized.</p> <ul style="list-style-type: none"> • If the temperature shift function is turned off, this operation is not needed.
<p>③ Go to the correction screen group.</p>  <p style="text-align: center;">Concentration Correction On/Off Screen</p>	<p>Press [CAL/SET] and then [DISP].</p> <ul style="list-style-type: none"> • “Concentration correction on/off” screen appears and “ST-BY” starts blinking.

(To be continued)

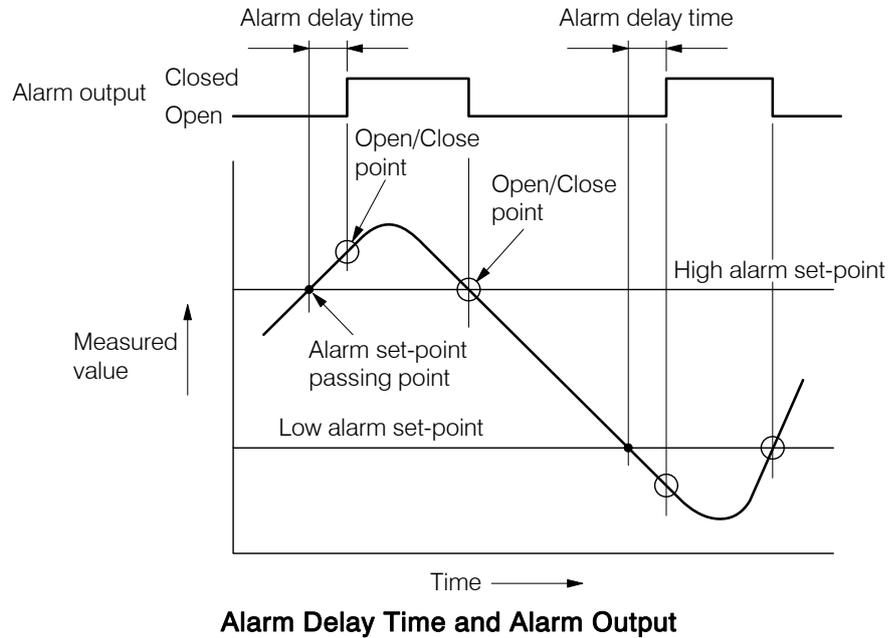
(Continued from previous page)

Procedure and Screen Example	Contents
<p>④ Select the temperature shift on/off screen. Press [ENT] three times.</p>  <p style="text-align: center;">Temperature Shift On/Off Screen</p>	<ul style="list-style-type: none"> • “Temperature shift on/off (SHFT)” screen appears. • Main display The on/off setting of temperature shift <ul style="list-style-type: none"> On (On) Temperature shift is valid. oFF (Off) Temperature shift is invalid (factory setting)
<p>⑤ Set the temperature shift on/off.</p>	<p>Select the desired symbol on the main display using [↑] or [↓] and then press [ENT].</p> <ul style="list-style-type: none"> • When On is selected, the next screen appears after the setting is confirmed. • When Off is selected, the screen goes to Step ⑦ after the setting is confirmed.
<p>⑥ Set the temperature shift value. (This screen is not displayed if Off is selected in Step ④.)</p>  <p style="text-align: center;">Temperature Shift Value Screen</p>	<p>Enter the temperature measured value after shift on the main display, which is obtained from other method, using [↑] or [↓] and then press [ENT].</p> <ul style="list-style-type: none"> • Unit indication °C • “Standby” screen appears after this operation.
<p>⑦ Return to “Concentration measured value” screen.</p>	<p>Press [ST-BY/MEAS] longer.</p>

(4) Alarm setting

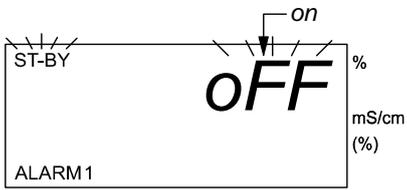
- (a) The settings related to alarm signals can be changed. The setting items are on/off setting of this function, distinction of high/low limit alarms, alarm set-points and delay time. The factory setting for this function is Off (alarm function is invalid).
- Operation screen Alarm screen group
- (b) Each alarm corresponds to its alarm output terminals. ▷ 8.3(1) “Wire connection diagram and terminal board”
- (c) When alarm function is On (valid), the alarm circuit works as shown below. If an alarm condition occurs, the contact signal of alarm output terminals changes from “Open” to “Closed” state and the alarm indicator (ALARM1, 2) blinks.
- High alarm (H) If the concentration measured value goes above the high alarm set-point and the alarm delay time elapses, the circuit goes to alarm status, and if the concentration measured value goes down below the high alarm set-point, the alarm status returns to normal.
 - Low alarm (L) If the concentration measured value goes below the low alarm set-point and the alarm delay time elapses, the circuit goes to alarm status and if the concentration measured value goes above the low alarm set-point, the alarm status returns to normal.
- (d) This function is valid under normal measurement condition and not valid in the following cases:
- The screen is in the setting mode or in the transmission adjustment mode

- At the time of power failure or when power supply is turned off
- (e) If the delay time (DLY.T) is set to other than zero, and when the concentration measured value passes the alarm set-point from the alarm signal “Open” to “closed” state, the contact signal can be delayed to start its alarm output. This delay time can be used to prevent “hunting” when an alarm condition occurs repeatedly in a short time. Obtain the appropriate point by increasing the delay time gradually.



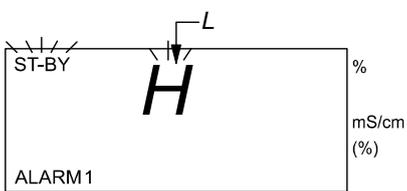
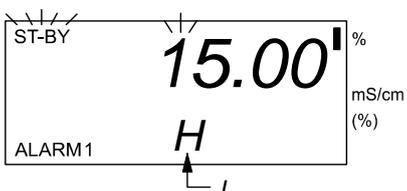
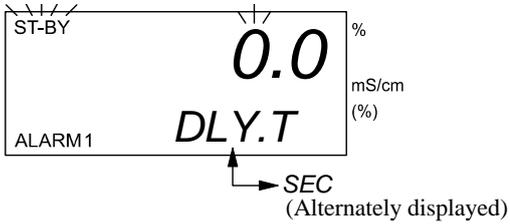
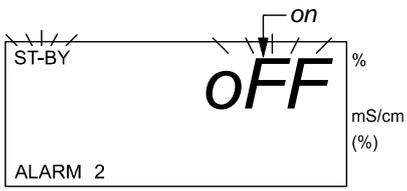
[IMPORTANT] • If the “Transmission output range” is changed, check these alarm settings again.

Procedure for Alarm Setting

Procedure and Screen Example	Contents
① Select “Standby” screen.....	Press [ST-BY/MEAS] longer in the measurement mode. • “ST-BY” lights.
② Go to the alarm screen group.....	Press [CAL/SET] and then [ALARM] . • “Alarm 1 on/off” screen appears and “ST-BY” starts blinking. • Main display Alarm 1 on/off setting on (On) Alarm 1 is valid. oFF(Off) Alarm 1 is invalid (factory setting)
 <p>Alarm 1 On/Off Screen</p>	
③ Set the Alarm 1 on/off.....	Select the desired symbol on the main display using [↑] or [↓] and then press [ENT] . • When On is selected, the screen goes to “Alarm 1 high/low limit” screen after this operation. • When Off is selected, the screen goes to Step ⑦ after this operation.

(To be continued)

(Continued from previous page)

Procedure and Screen Example	Contents
<p>④ Set the Alarm 1 high/low selection. (This screen is not displayed if Off is selected in Step ③.)</p>  <p>Alarm 1 High/Low Limit Screen</p>	<p>Select the desired symbol on the main display using ↑ or ↓ and then press ENT.</p> <ul style="list-style-type: none"> • Main display ... Alarm 1 high/low alarm distinction L (Low) ... Low limit alarm H (High) ... High limit alarm (factory setting) • The next screen appears after the setting is confirmed.
<p>⑤ Set the Alarm set-point 1 value. (This screen is not displayed if Off is selected in Step ③.)</p>  <p>Alarm 1 Set Point Screen</p>	<p>Enter the new alarm set-point 1 value on the main display and then press ENT.</p> <ul style="list-style-type: none"> • Main display ... Alarm set-point 1 value (concentration) To increase/decrease ... ↑ ↓ To move digit ... DATA → Setting range ... Depends on the set measuring range. • Unit indicator ... Unit for alarm set-point value • Sub display ... Alarm 1 high/low distinction • The next screen appears after the setting is confirmed.
<p>⑥ Set the Delay time 1. (This screen is not displayed if Off is selected in Step ③.)</p>  <p>Delay Time 1 Screen</p>	<p>Enter the new delay time 1 on the main display and then press ENT.</p> <ul style="list-style-type: none"> • Main display ... Delay time 1 (second) To increase/decrease ... ↑ ↓ To move digit ... DATA → Setting range ... 0 to 99 s (factory setting: 0) • The next screen appears after the setting is confirmed.
<p>⑦ Confirm the Alarm 2 on/off setting.</p>  <p>Alarm 2 On/Off Screen</p>	<p>In the same manner as in Step ③.</p>
<p>⑧ Set the Alarm 2 high/low selection. (This screen is not displayed if Off is selected in Step ⑦.)</p>	<p>In the same manner as in Step ④.</p>
<p>⑨ Set the Alarm 2 set-point value. (This screen is not displayed if Off is selected in Step ⑦.)</p>	<p>In the same manner as in Step ⑤.</p>
<p>⑩ Set the Delay time 2. (This screen is not displayed if Off is selected in Step ⑦.)</p>	<p>In the same manner as in Step ⑥.</p> <ul style="list-style-type: none"> • “Standby” screen appears after this operation.
<p>⑪ Return to “Concentration measured value” screen</p>	<p>Press ST-BY/MEAS longer.</p>

(5) Setting the transmission output range and transmission mode

(a) The transmission output range and transmission mode can be changed. The factory setting depends on the ordered specification. Normally this operation is not needed.

- Operation screenTransmission output range, etc. screen group

(b) The transmission output range is the range from the concentration measured value corresponding to the 4mA value of transmission output to the concentration measured value corresponding to that of 20mA value.

(c) The transmission output range can be set within -30 to 130% of the concentration range set by the “Concentration conversion data screen group” screens.

(Example) Minimum concentration (X1) of concentration conversion data: 8%, maximum concentration (X6): 26%

$$\text{Minimum value of settable transmission output range} = 8 - (26-8) \times 0.3 = 2.6 (\%)$$

$$\text{Maximum value of settable transmission output range} = 26 + (26-8) \times 0.3 = 31.5 (\%)$$

(d) The transmission mode in the setting mode can be selected from the following:

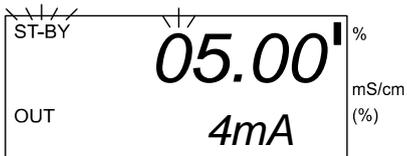
Hold (HoLd) mode.....The last transmission output value before cahnging to the setting mode is output as a fixed value (factory setting).

Dummy (dU) mode An arbitrarily set transmission value is output as a fixed value.

Through (tH) mode The measured value is output in the same way as in measurement mode.

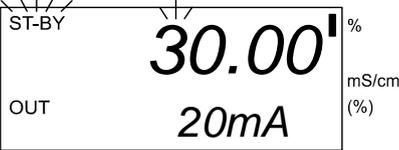
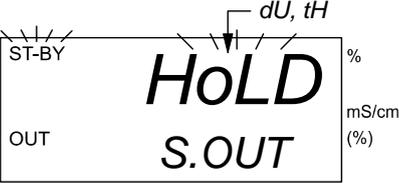
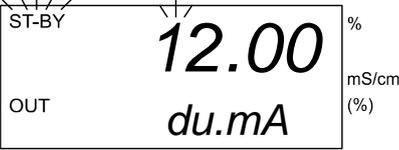
(e) When Dummy is selected, it is necessary to set an arbitrary dummy value (transmission output value) subsequently.

Procedure for Setting the Transmission Output Range and Transmission Mode Setting

Procedure and Screen Example	Contents
① Select “Standby” screen.....	Press [ST-BY/MEAS] longer in the measurement mode. <ul style="list-style-type: none"> • “ST-BY” lights.
② Go to the transmission output range, etc. screen group.	Press [CAL/SET] and then [OUT] . <ul style="list-style-type: none"> • “Transmission 4mA value” screen appears and “ST-BY” starts blinking. • Main display The concentration value corresponding to the transmission 4mA value. • Unit indicator Unit for main display
	
Transmission 4mA Value Screen	
③ Enter the concentration value corresponding to 4mA transmission value.	Enter the desired concentration value corresponding to the 4mA transmission value and then press [ENT] . <ul style="list-style-type: none"> • To increase/decrease number [↑] [↓] To move digit [DATA →] Setting range From “Concentration minimum value (%) – (Concentration minimum value (%) × 0.7)” to Concentration maximum value of concentration conversion data • “Transmission output range 20mA value” screen appears after this operation.

(To be continued)

(Continued from previous page)

Procedure and Screen Example	Contents
<p>④ Enter the concentration value corresponding to 20mA transmission value.</p>  <p>Transmission 20mA Value Screen</p>	<p>Enter the desired concentration value corresponding to the 20mA transmission value and then press [ENT].</p> <ul style="list-style-type: none"> To increase/decrease number ... [↑] [↓] To move digit ... [DATA→] Setting range ... From Concentration minimum value to “Concentration maximum value(%) × 1.3” of concentration conversion data “Transmission mode setting in setting mode” screen appears after this operation.
<p>⑤ Set the transmission mode in setting mode screen.</p>  <p>Transmission Mode in Setting Mode Screen</p>	<p>Select the desired output mode on the main display using [↑] or [↓] and then press [ENT].</p> <ul style="list-style-type: none"> Main display ... Transmission mode in setting mode HoLd ... Hold (factory setting) dU ... Dummy tH ... Through Since “Standby” screen appears after this operation when Hold or Through is selected, go to Step ⑦.
<p>⑥ Enter the dummy value. (This screen is not displayed if “HoLd” or “tH” is selected in Step ⑤.)</p>  <p>Dummy Value Screen</p>	<p>Enter the desired dummy value on the main display and then press [ENT].</p> <ul style="list-style-type: none"> Main display ... Dummy value (mA) being set. To increase/decrease number ... [↑] [↓] To move digit ... [DATA→] Setting range ... 4.00 to 20.0mA (factory setting: 12.0) “Standby” screen appears after the set value is confirmed.
<p>⑦ Return to “Concentration measured value” screen.</p>	<p>Press [ST-BY/MEAS] longer.</p>

(6) Setting the proper cell constant

- (a) The proper cell constant can be changed. It is necessary to change the proper cell constant when the sensor combined is replaced. Factory setting depends on the ordered specification. Normally, this operation is not needed.
- Operation screen ... Proper cell constant, etc. screen group
- (b) This analyzer must be combined with a sensor whose reference cell constant is 9.00/cm or 2.60/cm. The proper cell constant of each sensor is a little more or a little less of the reference cell constant and it is described on the plate or tag of the sensor. Setting this value for the analyzer enables more accurate measurement.
- (c) It is necessary to install the sensor where no shielding (conductors or insulator) exists within 50mm in radius from the center of the sensor. If it is necessary to install the sensor in a location where a shielding object exists, refer to 8.2(3) “Adjustment of proper cell constant when shielding exists”.

Procedure for Setting the Proper Cell Constant

Procedure and Screen Example	Contents
① Select “Standby” screen.....	Press [ST-BY/MEAS] longer in the measurement mode. <ul style="list-style-type: none"> • “ST-BY” lights.
② Goes to the proper cell constant, etc. screen..... group.	Press [CAL/SET] and then [RANGE/C.CON] . <ul style="list-style-type: none"> • “Proper cell constant, etc. setting” screen appears and “ST-BY” starts blinking. • Main display The currently set proper cell constant (/cm).
 <p>Measuring Range Screen</p>	
③ Set the proper cell constant.....	Check the proper cell constant (approx. 9.00/cm or 2.60/cm) described on the sensor combined and change the blinking number so that the proper cell constant appears on the main display and then press [ENT] . <ul style="list-style-type: none"> • To increase/decrease number [↑] [↓] To move the digit [DATA→] • The screen goes to the next screen, after confirmation.
④ Return to “concentration Measured Value” screen	Press [ST-BY/MEAS] longer.

(7) Setting the temperature slope

(a) The slope value for temperature measurement can be changed. Normally, this operation is not needed.

- Operation screen Proper cell constant, etc. screen group

(b) By changing the coefficient for temperature measurement, it can be used to change the indicated temperature value to the temperature measured by using another method (by using a precision thermometer, etc.). This is a concept of changing the slope of the analytical curve of the temperature measurement system.

(c) When the slope value is changed, not only the temperature measured value but also the conductivity measured value and concentration measured value are calculated with the shifted temperature.

(d) The slope value is preset to “2,000” at factory. If the slope value is changed to a numeric value greater than “2,000”, the temperature changes to the plus side at high temperature section. If the slope value is changed to a smaller value, the temperature changes to the minus side. Repeat changing until the desired temperature measured value is obtained.

Procedure for Setting the Temperature Slope

Procedure and Screen Example	Contents
① Select “Standby” screen.....	Press [ST-BY/MEAS] longer in the measurement mode. <ul style="list-style-type: none"> • “ST-BY” lights.

(To be continued)

(Continued from previous page)

Procedure and Screen Example	Contents
<p>② Go to the proper cell, etc. screen group.</p>  <p>Proper Cell Constant Screen</p>	<p>Press [CAL/SET] and then [RANGE/C.CON].</p> <ul style="list-style-type: none"> • “Proper cell constant” screen appears and “ST-BY” starts blinking.
<p>③ Select the “Temperature Slope” screen.</p>  <p>Temperature Slope Screen</p>	<p>Press [ENT] once.</p> <ul style="list-style-type: none"> • The screen goes to the “Temperature Slope” screen. • Main display The set temperature slope value.
<p>④ Set a temperature slope value.</p>	<p>Change the main display to show your desired temperature slope value and press [ENT].</p> <ul style="list-style-type: none"> • To increase/decrease number: [↑] [↓] • To move the digit: [DATA →] • “Standby” screen appears after this operation.
<p>⑤ Return to the “Concentration Measured Value” screen.</p>	<p>Press [ST-BY/MEAS] longer.</p>
<p>⑥ Check the temperature measured value.</p>	<p>In the “Temperature Measured Value” screen, check the temperature after the temperature slope value is changed and repeat operations in ① to ⑤, if necessary.</p>

4. Maintenance

4.1 Maintenance List

(a) To operate the product correctly at all times and maintain its specified performance, it is necessary for you to thoroughly understand its function and perform maintenance periodically.

[IMPORTANT] • Operating the product without performing maintenance periodically can result in a failure.

(b) The “Maintenance cycle” described in the following table is based on the standard installation condition (condition that satisfies the items in 8.1(1) “Controller installation location” and 8.2(2) “Examples of sensor installation”. Depending on the condition, the maintenance cycle may differ. Modify the maintenance cycle based on the operating condition carried out more than several months.

(c) For the controller system, the maintenance for sensor is especially important. Refer to the Instruction Manual provided for the sensor.

(d) For technical services such as repairs, please call a sales representative in your area or directly contact our company. A specialist who is qualified for the technical certification system in our company or a person who has technical skills equivalent to that certification system must perform technical services.

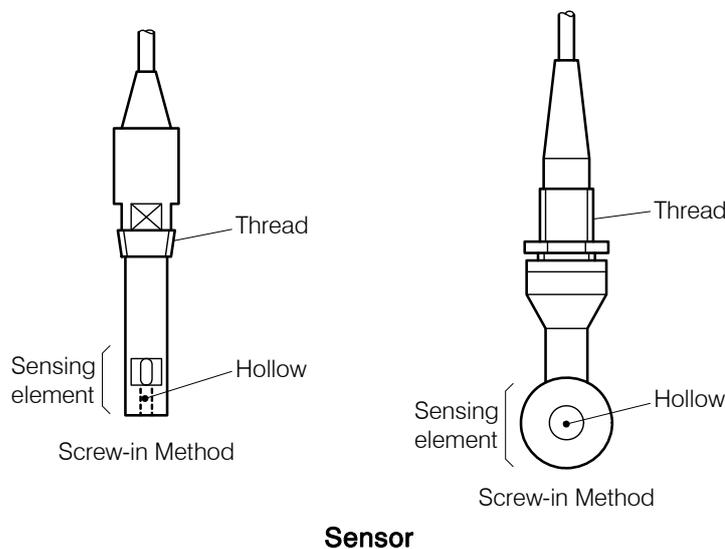
Standard Maintenance List

No.	Subject	Contents	Start	Maintenance Cycle						Execution method, etc.
				1 week	1 month	3 months	6 months	1 year	When needed	
1	Sensor	(1) Wash				○				▷ 4.2 “Washing the Sensor”
			In the case of city water with up to several hundred μS/cm, etc.							
			In the case of a sample solution containing dirt, metal powder, etc.			○				
		(2) Inspection of temperature element						○		▷ 4.3 “Inspection of Temperature Element”
2	Measurement system	Adjustment using a solution of known conductivity							○	▷ 4.4 “Adjustment Using a Solution of Known Concentration”

[NOTE] • Generally, it is not necessary for a electrodeless concentration analyzer to prepare spare parts.

4.2 Washing the Sensor

(a) The electrode section of the sensor is used to measure concentration. If the electrode section gets dirty, correct measurement cannot be made. Remove the dirt especially from the hollow section.



Sensor

(b) Select appropriate cleaning agent to wash the sensor depending on the condition of sample solution.

Washing the Sensor

Condition of sample solution	Cleaning agent	Washing method
<ul style="list-style-type: none"> When dirt is not much, such as general process, boiler, etc. 	Alcohol	Wipe off dirt from the electrode section using gauze, etc. soaked with ethyl alcohol.
	Neutral detergent	Wash the sensor with neutral detergent, etc. and rinse it off thoroughly with city water, etc.
<ul style="list-style-type: none"> When dirt is tough, such as process waste water with plenty of rust. 	Cleanser	Applying cleanser to a cloth and polish the electrode section lightly with that cloth and rinse it off thoroughly with city water, etc.
	Other agents	Soak the electrode section in a cleaning agent suitable for the components of dirt such as a low concentration hydrochloric acid solution and then rinse it off thoroughly with city water, etc.

WARNING

Toxic Substances

- For chemical substances to be used, ask the manufacturer from which you bought the product to send the Material Safety Data Sheet (MSDS) on the product and handle it safely according to the explanation.

(c) When concentration of about the same value is measured, if the measured value obtained after the wash is higher than the value obtained before, it indicates that the measured value had been affected very much by dirt. Therefore, shorten the wash interval. On the contrary, if the measured value obtained after the wash is about the same as before, it indicates that the measured value is almost not affected by dirt. Therefore, you can make the wash interval longer.

- (d) Take necessary measures to prevent sample solution from leaking out when you remove the sensor. In the case of a flange type sensor, remove the flange section first instead of thread section. This can prevent liquid leak from the thread section.
- (e) When you assemble a screw-in type sensor after the wash, remove the old sealing material (such as tape) from the thread section and then wind new sealing material.

-
- 【IMPORTANT】**
- To reassemble a screw-in type sensor, use new sealing material to the thread section. This is used to prevent liquid leak.
 - When you assemble a sensor, make sure that the thread of the sensor mates correctly.
-

4.3 Inspection of Temperature Element

A temperature element is built in the electrode section of the sensor and used to automatically compensate for a change in concentration of sample solution due to temperature.

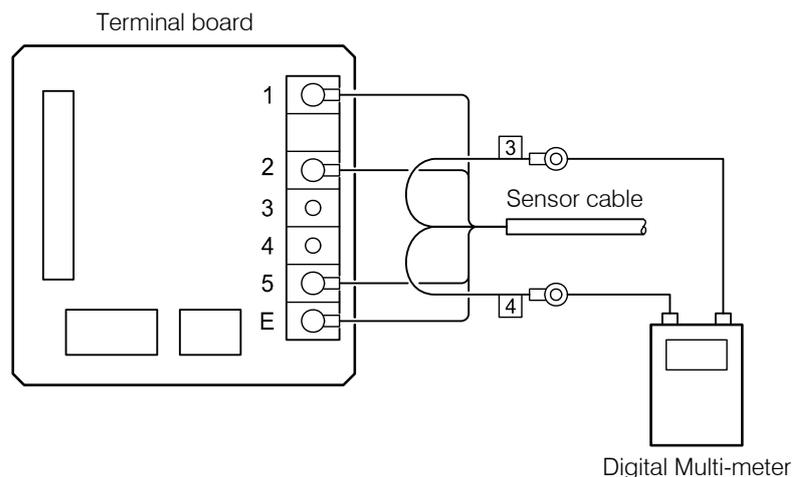
- ① **Turn off the power source.** Turn off the power source that supplies power to the analyzer.



Electric Shock

- Do not touch the terminals in the analyzer while power is applied. Touching the terminals may cause electric shock.

-
- ② **Remove the lead wires of temperature element.** Remove the wires 3 and 4 of the sensor cable lead wires from the analyzer terminal board.



Inspection of Temperature Element

③ **Measure the resistance value.** Measure the resistance value between the lead wires 3 and 4 of the sensor cable using a digital multimeter, etc. and write down its value.

[IMPORTANT] • Measure the temperature element in a short time. This is to prevent measurement current from causing self-heat and changing its resistance value.

④ **Check the temperature.** Check the temperature of sample solution using a bar thermometer, etc.

⑤ **Compare the resistance value.** Obtain the guideline resistance value of the temperature element corresponding to the temperature of sample solution measured in Step ④ and compare the value with the resistance value written down in Step ③ and check that there is no extremely large error.

Guideline Resistance Value of Temperature Compensation Element

Temperature [°C]	Guideline resistance value [kΩ]	Temperature [°C]	Guideline resistance value [kΩ]
10	60.0	60	7.4
20	37.5	70	5.2
25	30.0	80	3.7
30	24.1	90	2.7
40	15.9	100	2.0
50	10.7		

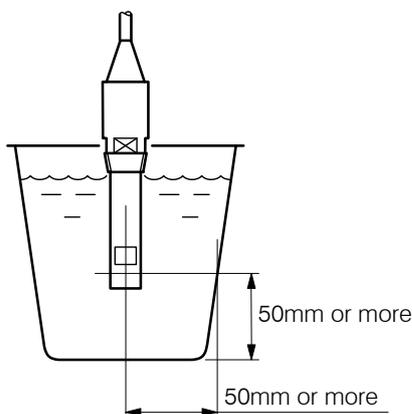
If an extreme large error exists, there is a possibility of broken wires or short-circuits. It is necessary to replace the sensor. Contact DKK-TOA.

⑥ **Reinstallation** Connect the sensor cable in the same way as before and turn on power to the analyzer.

4.4 Adjustment Using a Solution of Known Concentration

The indication of the analyzer can be checked and, if necessary, the indicated value can be adjusted using a solution of known concentration.

- ① **Wash the sensor.** Take out the sensor and wash it thoroughly. This is needed because if the sensor is dirty, an error occurs. ▷ 4.2 “Washing the Sensor”
- ② **Confirm that the conductivity is zero.** Place the sensor in the air and confirm that the conductivity shown on the sub display of the “Concentration and Conductivity” screen is approx. 0.
- ③ **Immerse the sensor in the solution.** Immerse the sensor in a solution of known concentration (or the reference solution) and waits until the indication is stabilized.
 - If the sensor is provided with a case, fill the case with a solution of known concentration to immerse the sensor. This is needed not to change the condition such as the distance between the electrode section and the perimeter.
 - If the sensor is not provided with a case, isolate the electrode section of the sensor from the inner wall and the bottom of the vessel by 50mm or more.



Isolating Electrode Section from Inner Wall and Bottom of the Vessel by 50mm or more

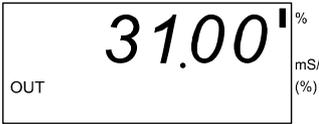
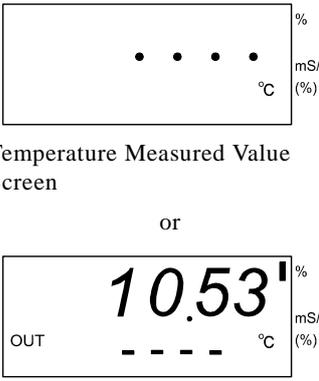
- ④ **Check the concentration indication.** Check the difference between the indicated value in the “Concentration Measured Value” screen and the concentration of the solution of known concentration.
 - If the difference is within the range of the specified “temperature compensation accuracy” adjustment is not required. In this case, proceed to ⑥.
- ⑤ **Adjust the concentration indication.** Set “on” in the “Concentration Compensation On/Off” screen in the setting mode and perform concentration shift compensation or concentration span compensation. ▷ 3.3(2) “Changing the concentration compensation”
- ⑥ **Rinse off the sensor.** Rinse off the sensor with clean water, etc.
- ⑦ **Reinstall the sensor.** Replace the sealing tape of the thread section with new one and install the sensor in the same way as before.

5. Troubleshooting

5.1 Error Messages

The indicated conditions in the table below are error messages. Take necessary actions.

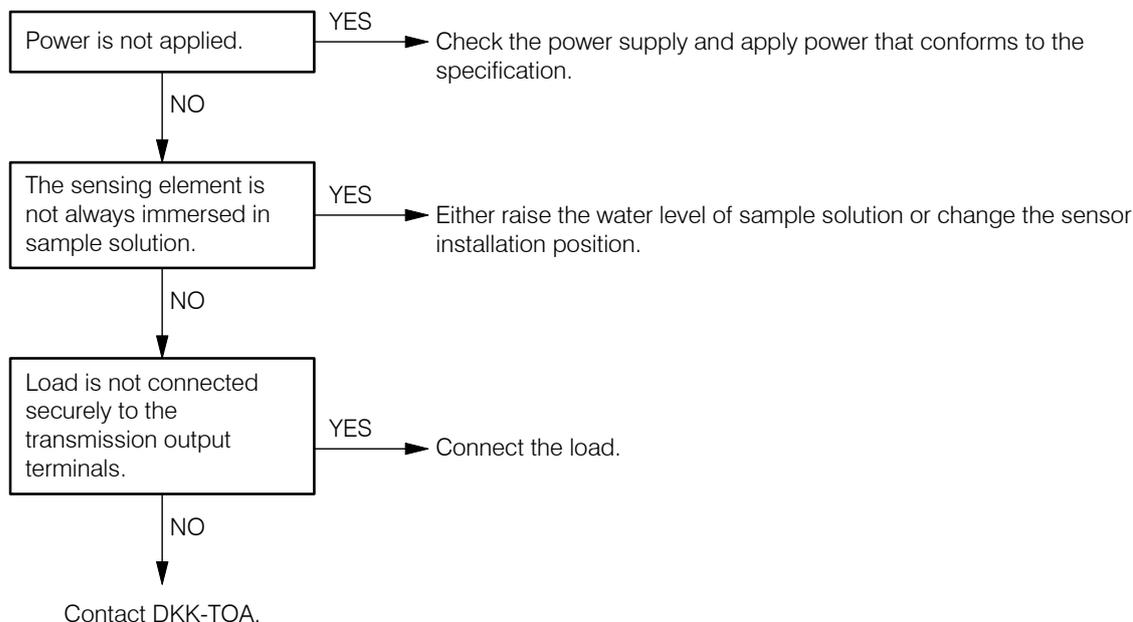
Error Messages and Necessary Actions

No.	Display	Message name and contents	Actions
1	 <p>(The entire display blinks)</p>	<p>[Concentration measured value is off the scale] (Indication swings off)</p> <ul style="list-style-type: none"> • Indication is off the scale. 	<ul style="list-style-type: none"> • Remove the abnormal sample solution. • ≧ 5.2(2) “Concentration value is off the scale”
2	 <p>Temperature Measured Value Screen</p> <p style="text-align: center;">or</p> <p>Concentration / Temperature Measured Value Screen (The entire display blinks)</p>	<p>[Temperature measured value is off the scale]</p> <ul style="list-style-type: none"> • Liquid temperature went out of the -5 to 120°C range. • Temperature compensation element or sensor cable is short-circuited or broken. 	<ul style="list-style-type: none"> • Connect the sensor cable correctly. • Replace the sensor.
3		<p>[Memory element error]</p> <ul style="list-style-type: none"> • Soon after power is supplied, the setting data could not be called and judged that it was an error. • Indication is off the scale. 	<ul style="list-style-type: none"> • Even if power is supplied and if it does not return to normal, contact DKK-TOA.
4		<p>[Setting data error]</p> <ul style="list-style-type: none"> • Soon after power is supplied, the setting data was checked and judged that it was an error. • Indication is off the scale. 	<ul style="list-style-type: none"> • Even if power is supplied and if it does not return to normal, contact DKK-TOA.

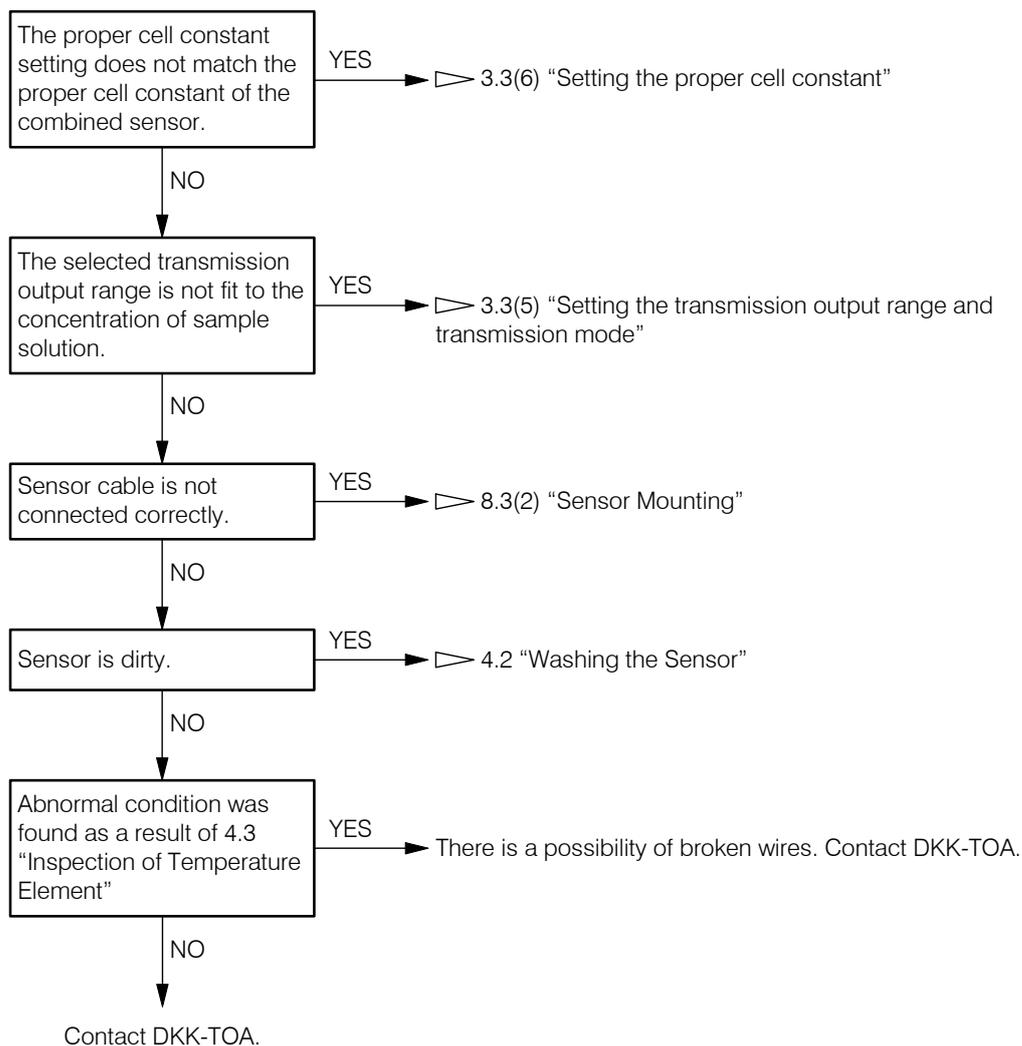
5.2 Troubleshooting

“Indication” here means the indicated values such as the indication of the analyzer, indication of a recorder and indication of a digital multimeter.

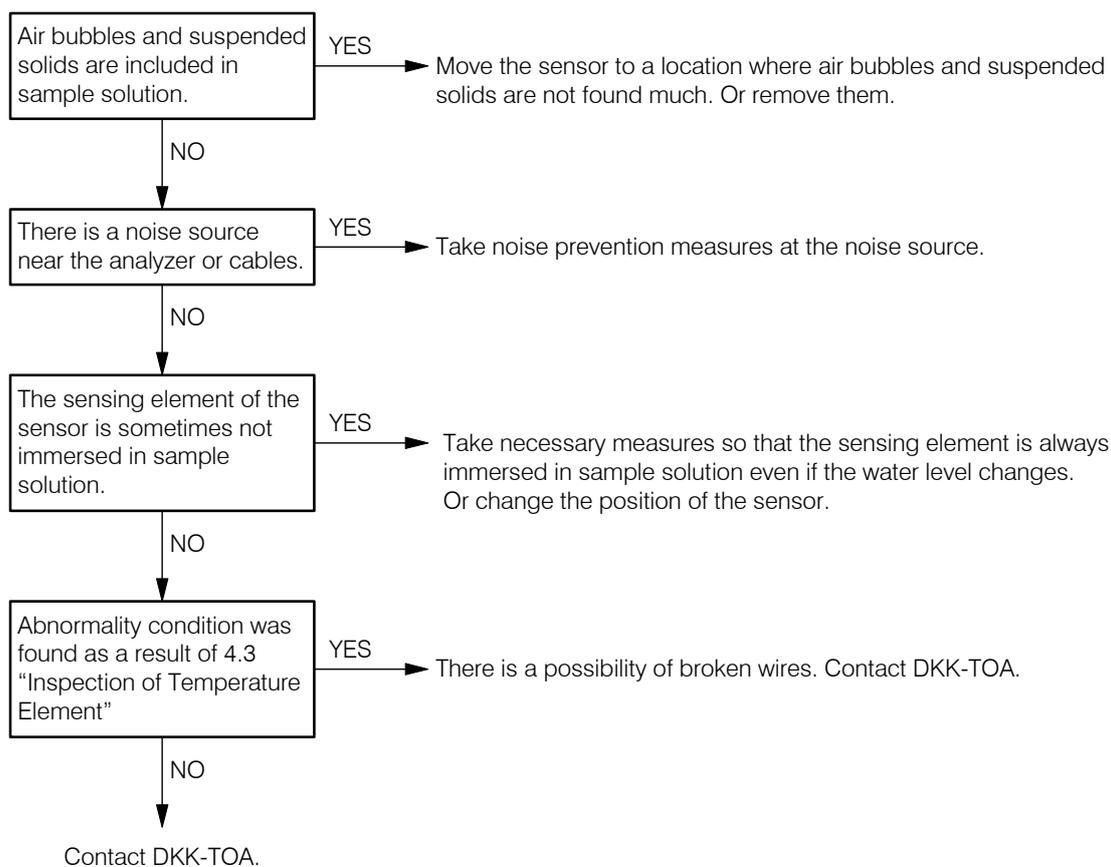
(1) No indication or indication does not change



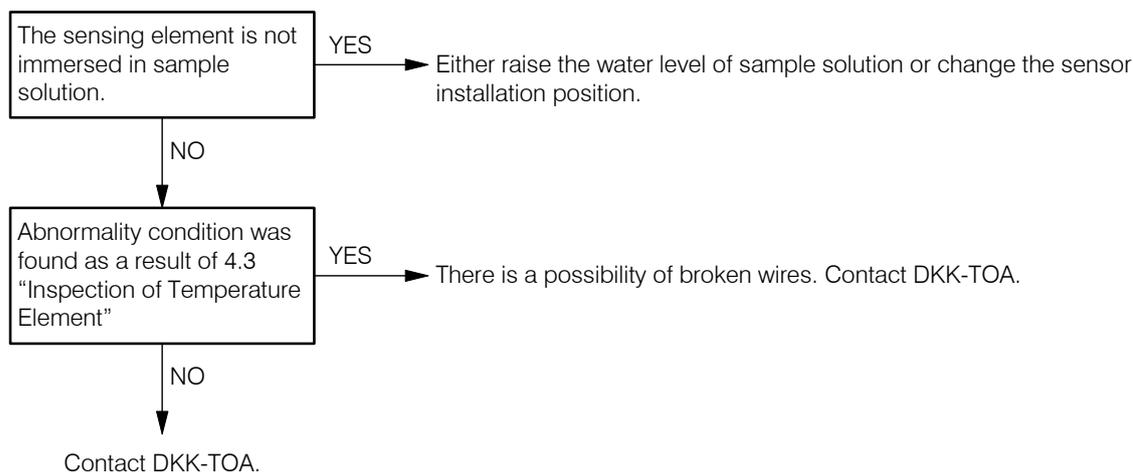
(2) Concentration value is off the scale



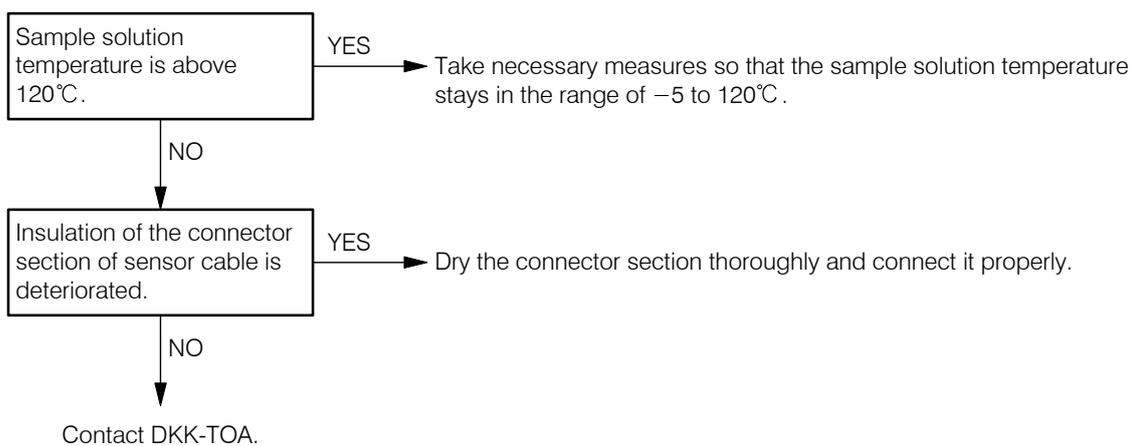
(3) Fluctuation of conductivity value



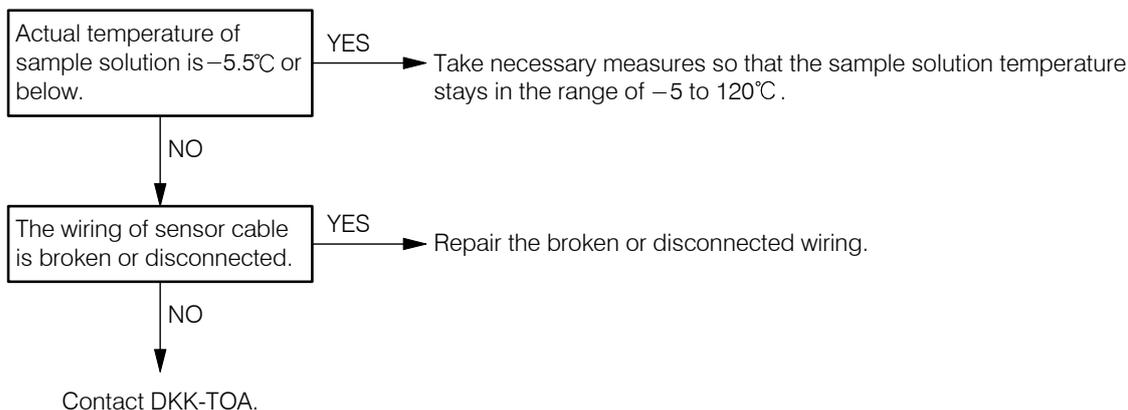
(4) A large deviation of concentration measured value



(5) Temperature measured value is off the scale



(6) Temperature measured value is below the minimum indication value



5.3 Checking the Analyzer Operation with Equivalent Input

- (a) Using an equivalent resistance, the entire measurement system including the sensor can be checked whether it is working correctly or not. If the measured value is improper even if the system is working correctly, it is probable that there is other cause for the problem other than the measurement system. This operation requires a 6-decade resistance box, digital multimeter, etc.
- (b) In this operation, the lead wires of the 6-decade resistance box are wound to the hollow section of the sensor to give a simulation signal (equivalent resistance value) to the analyzer and a simulation resistance instead of a resistance value of the temperature element is connected to the terminals 3 and 4 of the analyzer to create the condition of sample solution under stable temperature and check that the concentration indicated value and the transmission output value are appropriate.
- (c) The inspection record is made under the condition of factory setting values. If the product is equipped with an RS-232 connector (option) and the concentration conversion data is drastically changed by the application program (option), then the numeric values in the inspection record differs and this operation check cannot be performed.

① Preparation

- Digital multimeter (internal resistance of 10Ω or less)..... 1 unit
- 6-decade resistance box A..... 1 unit
- 6-decade resistance box B (or a fixed resistor) 1 unit (piece)
- Inspection record (attached to the product)..... 1

[IMPORTANT] • Do not use an inductance type decade resistance box. If the inductance type resistance box is used, an indication error of the controller may occur.

< Recommended devices >

- Decade resistance box Model 2786 (Yokogawa Electric Corporation)
 - 6-decade standard resistance box ADR Series (Alpha Electronics Inc.)
-

WARNING

Electric Shock

- Do not touch the terminals in the analyzer while power is applied. Touching the terminals may cause electric shock.
-

② **Write down the proper cell constant and the transmission output range.** Open the screens shown below in the measurement mode and write down the setting values.

- “Proper Cell Constant Display (C.CON)” screen
- “Transmission Range 4mA Value Display (4mA)” screen
- “Transmission Range 20mA Value Display (20mA)” screen

[NOTE] • If the transmission output range does not match the values described in the inspection record, adjust the range. ▷ 3.3(5) “Setting the transmission output range and transmission mode”

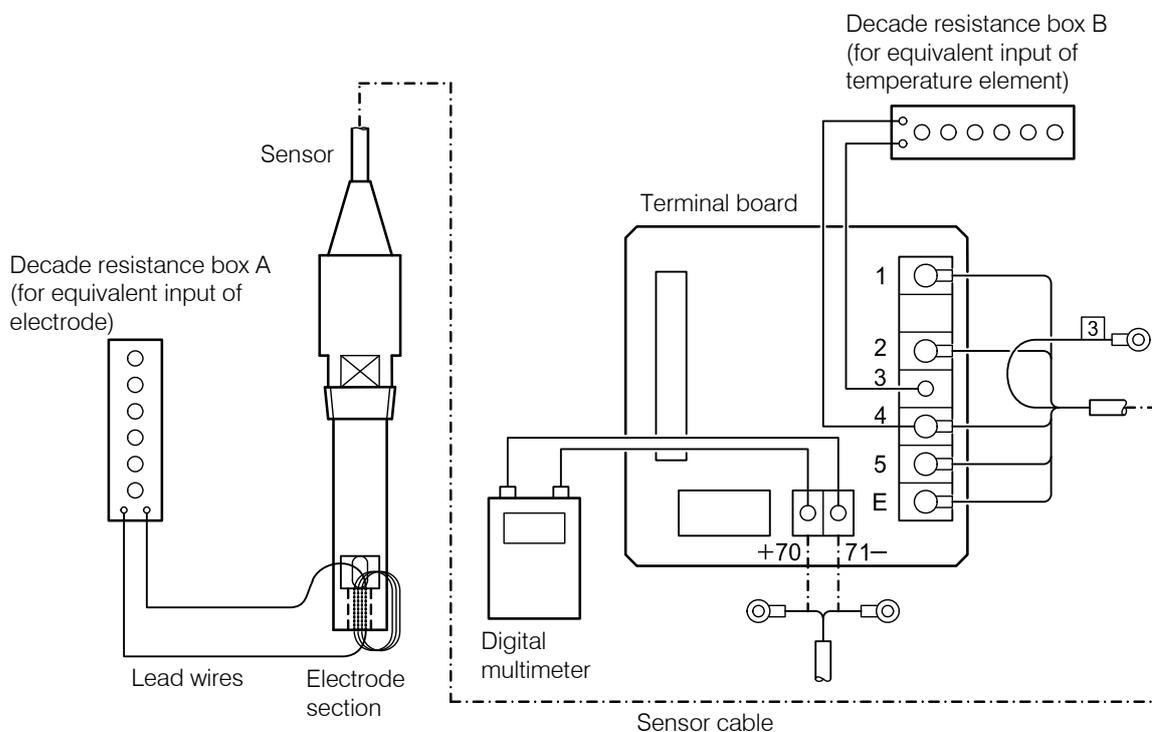
③ **Set “oFF” to the concentration compensation and temperature shift settings.** ▷ 3.3(2) “Concentration correction setting”, 3.3(3) “Setting the temperature shift”

④ **Turn off power and remove the lead wires.** Turn off the power source that supplies power to the analyzer and remove the wire of the sensor cable connected to the terminal 3 of the terminal board and also remove the wires of another cable connected to the terminals 70 (+) and 71 (-).

⑤ **Remove the sensor.** Take necessary measures to prevent sample solution from leaking out and remove the sensor.

⑥ **Connect the prepared devices.** Connect the following devices to the terminals of each as shown below. “N” as in “(N) turns” in the column of “Equivalent resistance value” means the number of turns of lead wires to the electrode section. Wind the lead wires of a 6-decade resistance box N times to the hollow section of the electrode section. If nothing is described, use “1 turn” (the lead wire is put through the tip end of the sensor without being wound up).

- Electrode section hollow section 6-decade resistance box A (for equivalent input of sensor)
- Between the terminals 3 and 4 6-decade resistance box B (for equivalent input of temperature element)
- Between the terminals 70 (+) and 71 (-) Digital multimeter



Connecting the Devices for Operation Check

⑦ **Set the reference cell constant to “Proper Cell Constant” screen.** Turn on the power source that supplies power to the analyzer and enter the reference cell constant (designed cell constant, which is the “Cell constant” described in the inspection record) to “Proper Cell Constant (C.CON)” screen in the setting mode. ▷ 3.3(6) “Setting the proper cell constant”

- When the constant is near 9.00/cm Set 9.00/cm
- When the constant is near 2.60/cm Set 2.60/cm

⑧ **Select “Concentration Measured Value” screen.** If the analyzer is in the setting mode (“ST-BY” is lit), press **[ST-BY/MEAS]** longer. If the analyzer is in the measurement mode (“ST-BY” is unlit), press **[DISP]** several times to select “Concentration Measured Value” screen.

- ⑨ **Enter an equivalent resistance value of temperature element.** Check the “Thermistor resistance value” (with reference temperature) in the inspection record and set that resistance value to the 6-decade resistance box B.
- ⑩ **Enter an equivalent resistance value of 4mA.** Check the “Equivalent resistance value (Ω)” corresponding to 4mA of “Transmission output value” in the inspection record and set that resistance value to the 6-decade resistance box A.
- ⑪ **Check the indication of 4mA and transmission output.** Check that the value (mS/cm at 25°C) corresponding to 4mA appears on the “Concentration Measured Value” screen and “4mA” is indicated on the multimeter.
- ⑫ **Enter an equivalent resistance value of 20mA.** Check the “Equivalent resistance value (Ω)” corresponding to 20mA of “Transmission output value” in the inspection record and set that resistance value to the 6-decade resistance box A.

[NOTE] • The equivalence resistance value of “Inspection record” is calculated as follows:

$$\text{Equivalent resistance } (\Omega) = \frac{\text{Reference cell constant } (/cm)}{\text{Conductivity } (mS/cm)} \times 10^3 \times (\text{Number of turns})^2$$

Example: Reference cell constant: 9.00/cm (same with 9.00cm⁻¹)
 Conductivity for 20mA value: 876mS/cm
 Number of turns: 4 turn

$$\text{Equivalent resistance value } (\Omega) = \frac{9.00}{876} \times 10^3 \times (4)^2 = 164.4 (\Omega)$$

- ⑬ **Check the indication of 20mA and transmission output.** Check that the value corresponding to 20mA in the inspection record appears on the “Concentration Measured Value” screen and “20mA” is indicated on the digital multimeter.
- If a large error occurs, the analyzer, sensor cable or sensor is probably not working correctly. refer to 5.2 “Troubleshooting”.
- ⑭ **Restore the proper cell constant and the transmission output range.** Put these value back to the ones written down in Step ②. 3.3(5) “Setting the transmission output range and transmission mode”, 3.3(6) “Setting the proper cell constant”
- ⑮ **Restore concentration compensation and the temperature shift.** Restore the setting if “on” was changed to “oFF” in Step ③. ▷ 3.3(2) “Concentration correction setting”, 3.3(3) “Setting the temperature shift”
- ⑯ **Remove the devices.** Turn off the power source and disconnect the digital multimeter, 6-decade resistance box, etc. and connect the sensor cable to the terminal 3 and another cable to the terminals 70 (+) and 71 (–).
- ⑰ **Reinstall the sensor.** Reinstall the sensor in the same way as before.

[IMPORTANT] • To reassemble a screw-in type sensor, use new sealing material to the thread section. This is used to prevent liquid leak.

- ⑱ **Install the terminal block cover.** Install the terminal block cover and turn on power.

5.4 Measures against Noise

(1) Error symptom due to noise

If a strong noise source exists near this analyzer, the following symptoms may occur.

This analyzer has an effective anti-noise characteristic for $\pm 1500\text{Vp-p}$ (peak-to-peak voltage) but if a peripheral device exists that generates strong noise exceeding this level, any of the following symptoms occurs.

- (a) Alarm operating point changes.
- (b) Indication flickers erroneously.
- (c) Indication stays unmoved.

(2) Noise source

If an error symptom caused by noise occurs, check that any of the following devices is not found in the vicinity and take necessary actions. \triangleright 5.4(3) "Protective measures using a surge absorber"

These inductive control devices generate pulsed surge voltages of 4000V or more when some of the circuits used there turn on and off. These may be the source of noise.

- (a) Electromagnetic switch
- (b) Solenoid valve
- (c) Pump
- (d) Motor

(3) Protective measures using a surge absorber

If there is a device that is considered as a noise source described above, install a surge absorber as follows:

- (a) Use a CR filter type surge absorber. The life of a semiconductor absorber such as a varistor is relatively short.
- (b) Use a surge absorber with its rating exceeding the drive voltage of the target device.
- (c) DKK-TOA sells the following type of a surge absorber.
Spark killer 2S1201 (part code No. 112Z009)
- (d) Install a surge absorber between the drive terminals nearest to the noise generating source.

●Repair contact

If a repair is required, please contact your sales representative or directly our sales office, or our service department. In this case, let us know the following information:

- Model name (MODEL)
- Serial number (SER. No.)
- Manufacturing date (DATE)

6. Specifications and Operating Description

6.1 Standard Specifications

(1) Controller specifications

(a) Basic items

Product name	: Electrodeless Concentration Analyzer / Controller
Model name	: MBM-102A
Measuring object	: Converting the conductivity of a solution to concentration value
Unit	: % and mS/cm
Measurement method	: Linear approximation concentration conversion by conductivity measurement using electromagnetic induction method.
Measured value display method	: 4-digit digital liquid crystal display provided with sub display and unit indicator
Reference cell constant	: 9.00/cm or 2.60/cm Sensors with other cell constants cannot be combined.
Entire measuring range (display)	: Concentration..... 0.000 to 4.000% or 0.00 to 99.99% Conductivity 0 to 2100mS/cm, one of the following is selected in accordance with ordered specification 0.000 to 2.100, 0.00 to 7.00, 0.00 to 21.00, 0.0 to 70.0, 0.0 to 210.0, 0 to 700, 0 to 2100mS/cm Temperature -5 to 120°C (depending on the heat resistance of display and sensor)
Measuring range	: In accordance with ordered specification (depends on the concentration conversion data)
Transmission output signal	: Analog signal and corresponds to the concentration measured value Type..... Input/output and ground isolation type Output type 4 to 20mADC Load resistance 650Ω maximum Ripple Peak value 0.3% FS maximum
Temperature compensation method	: Linear approximation microcomputer calculation method
Temperature compensation element	: 30kΩ (at 25°C) thermistor
Temperature compensation range	: In accordance with ordered specification (depends on the concentration conversion data)
Temperature compensation coefficient	: In accordance with ordered specification (depends on the concentration conversion data)
Alarm output	: Contact capacity 250VAC, 3A, 2-circuits with one set of NO and NC contact each (output can be delayed up to 99s), Depending on the concentration input (0.000 to 4.000% or 0.00 to 99.00%)
Power supply voltage and maximum load resistance	: 90 to 264VAC, 50/60Hz, maximum load resistance 650Ω, power consumption 3VA

Allowable ambient temperature and humidity : (1) Performance guaranteed range..... –10 to 50°C, 0 to 90% RH
 (2) Operation guaranteed range..... –20 to 60°C, 0 to 90% RH
 (3) Transportation and storage guaranteed range –30 to 70°C, 0 to 90% RH

(b) Performance

Linearity : Differs depending on the solution of a measuring object
 Concentration..... Within $\pm 3\%$ FS (tested with equivalent resistance input)
 Conductivity Within $\pm 0.5\%$ FS (tested with equivalent resistance input)
 Temperature Within $\pm 0.3^\circ\text{C}$ (tested with equivalent resistance input)

Repeatability : Concentration..... Within $\pm 0.5\%$ FS (tested with equivalent resistance input, but depends on the concentration conversion data)
 Conductivity Within $\pm 0.2\%$ FS (tested with equivalent resistance input)
 Temperature Within $\pm 0.1^\circ\text{C}$ (tested with equivalent resistance input)

Temperature compensation accuracy : Concentration..... Within $\pm 3.0\%$ FS (tested with equivalent resistance input, but depends on the concentration conversion data)
 Stability Within $\pm 0.2\%$ FS/24h (tested with equivalent resistance input, depends on the conductivity)
 Fluctuation Within $\pm 0.2\%$ FS + 1 digit/min (tested with equivalent resistance input)
 Transmission ripple Within $\pm 0.3\%$ FS (tested with equivalent resistance input, but depends on the concentration conversion data)

Response : Conductivity 0 to 90% FS, FA: within 10 seconds, SL: within 60 seconds (tested with equivalent resistance input)

(c) Function

Cell constant adjustment : –10 to 50% with respect to reference value, changeable with key operation

Conductivity measured value adjustment : –10 to 50% with respect to reference value, changeable with key operation, however, within the range of cell constant adjustment

Temperature measured value adjustment : $\pm 5^\circ\text{C}$, changeable with key operation

Transmission output : 4 to 20mA adjustable with key operation

Transmission output in maintenance : Hold, Dummy and Through, changeable with key operation

(d) Structure, etc.

Sensor	: (Option) ME-1□1 Series (reference cell constant: 9.00/cm) ME-11T Series (reference cell constant: 2.60/cm), etc.
Connector box	: (Option) Model FC-4
Sensor cable	: (Option) sensor cable Model EC-11 (up to 10m is possible when a connector box is used)
Connection terminal	: M3
Structure	: Indoor installation
Dimensions and mounting method	: 96mm × 96mm × 90mm (main body), panel cut-out 92mm × 92mm
Mass	: Approx. 0.5kg
Material	: Main body..... Aluminum Window Resin
Surface color	: Blue, metallic silver

(2) Specifications of main sensors

The specifications of the sensor differ depending on the ordered specification. Check the actual specifications using delivery specifications, etc. The following specifications are just examples.

(a) Model ME-111 sensor specifications

Product name and model name	: Electrodeless concentration sensor Model ME-111
Reference cell constant	: 9.00/cm
Temperature element	: Thermistor
Conditions of sample solution	: Temperature ... 0 to 100°C (Liquid contacting material: PFA) 0 to 65°C (Liquid contacting material: Heat resistant PVC) Pressure 0.5MPa or less (Liquid contacting material: PFA) 0.3MPa or less (Liquid contacting material: Heat resistant PVC) Flow rate..... 2m/s or less
Ambient temperature	: -10 to 60°C
Mounting	: R3/4 screw-in method
Sensor cable	: 5m
Mass	: Approx. 0.5kg

(b) Model ME-11T sensor specifications

Product name and model name	: Electrodeless concentration sensor Model ME-11T-1-0 (when used independently as a detector)
Measurement object	: Electric concentration of general water, acid, alkali, salt solution, etc.
Measurement method	: Electric concentration measurement using electromagnetic induction.
Reference cell constant	: 2.60/cm
Sample solution temperature	: -5 to 150°C
Sample solution pressure	: Maximum 2.0MPa (1.0MPa when sample temperature is 150°C)
Sample solution flow rate	: 5m/s or less
Ambient temperature	: - 10 to 60°C
Response of built-in temperature element	: 4 to 10 minutes for 90% response (depends on the flow rate condition)
Liquid contacting material	: PTFE, PFA
Mounting	: G3/4 screw-in method
Sensor cable	: 5m
Mass	: Approx. 0.5kg

(c) Model ME-61 sensor (Model ME-61TTH) specifications

Reference cell constant	: 2.60/cm (vertical-hole type)
Liquid contacting material	: PFA
Temperature element	: External thermistor
Condition of sample solution:	Temperature: 0 to 120°C
Mounting	: Equipped with a case
Connection flange	: 25A JIS 10K RF equivalent

(d) Model ME-62 sensor (Model ME-62TTH) specifications

Reference cell constant	: 2.60/cm (horizontal-hole type)
Liquid contacting material	: PFA
Temperature element	: External thermistor
Condition of sample solution:	Temperature: 0 to 120°C
Mounting	: Equipped with a case
Connection flange	: 25A JIS 10K RF equivalent

(e) Model ME-63 sensor (Model ME-63EGH) specifications

Reference cell constant	: 2.60/cm (slanted-hole type)
Liquid contacting material	: PVC, glass
Temperature element	: External thermistor
Condition of sample solution:	Temperature: 0 to 60°C
Mounting	: Equipped with a case
Connection flange	: 25A JIS 10K FF

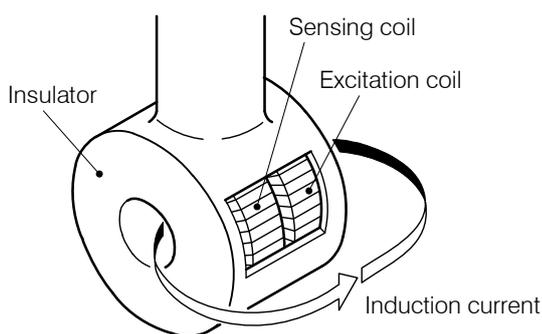
(f) Model ME-73 sensor (Model ME-73E) specifications

Reference cell constant	: 2.60/cm (slanted-hole type)
Liquid contacting material	: PVC, glass
Temperature element	: Built-in thermistor
Condition of sample solution:	Temperature: 0 to 60°C
Mounting	: Without a case
Connection flange	: 100A JIS 10K FF

6.2 Principle of Operation

(1) Principle of sensor

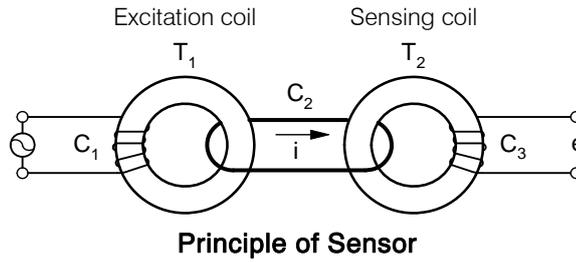
The sensor is structured with two transformers placed one on top of another in a insulator case and this structure is immersed in a sample solution to measure the concentration (conductivity) of the sample using electromagnetic induction.



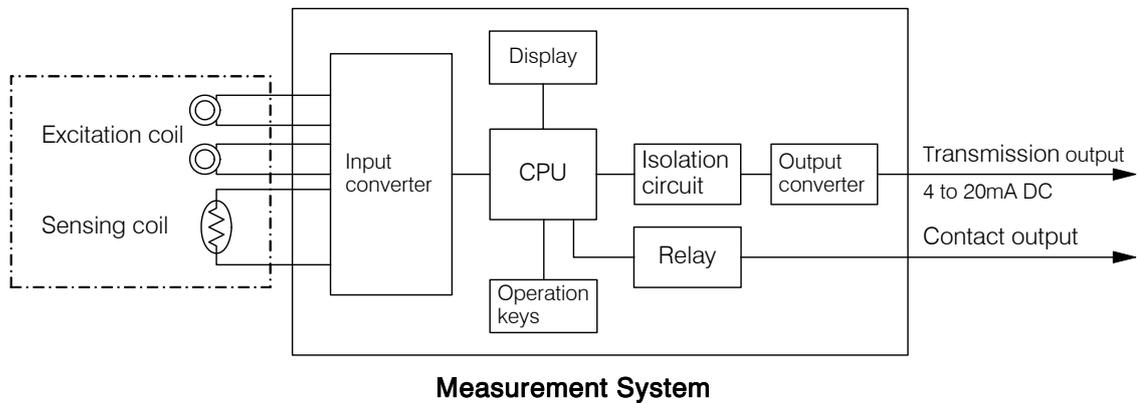
Structure of Sensor

If T_1 and T_2 coils are placed as transformers in a sample solution as shown in the diagram “Principle of Sensor”, the sample solution, in equivalent circuit, forms a 1-turn circuit intercrossing T_1 and T_2 . If an AC current is made to flow in the primary circuit C_1 , an induced current i flows in C_2 , which is proportional to the concentration of the solution. On the other hand, in the secondary coil C_3 of the transformer T_2 with primary coil C_2 , a voltage e is generated, which is proportional to the current that

flows in C_2 . Therefore, this voltage conforms to the concentration of the solution and by measuring the voltage e , the concentration of the sample solution can be obtained.



(2) Analyzer operation



The controller calculates as follows. The input transmitter receives a signal from the concentration sensor consisting of an excitation coil and a detection coil, and a signal from a temperature element and the transmitter converts these signals. The CPU (central processing unit) reads these signals, calculates and obtains the conductivity value at conversion temperature (normally 25°C), and then converts the conductivity value to concentration value using the concentration conversion data, and indicates the value on the display. At the same time, the output from the CPU goes through an isolation circuit and enters the output transmitter and the output transmitter sends out a 4 to 20mA transmission signal.

In addition, if the measured value exceeds the alarm set-point, the CPU drives a relay to send a contact signal.

7. RS-232C Connector (Option)

(1) RS-232C connector function

(a) When the transmitter is provided with an optional RS-232C connector, the following can be made by connecting a communication cable (cross cable) between this connector and a personal computer (PC).

- PC takes in digital data of the measured value (concentration, conductivity and temperature)
- Changes the concentration conversion data stored in the controller (using an optional dedicated software program)

(b) Communication specification is as follows:

Standard: Conforms to JIS X5103

Transmission method: Asynchronous, semi-duplex communication

Baud rate: 9600 BPS

Character configuration: Data length 8 bits

Parity check Non-parity

Stop bit 1 bits

Connector: D-sub 9 pin

(2) Pin arrangement and communication cable (cross cable)

(a) Pin arrangement of RS-232C connector is shown below. Pins 4 and 6 are connected internally.

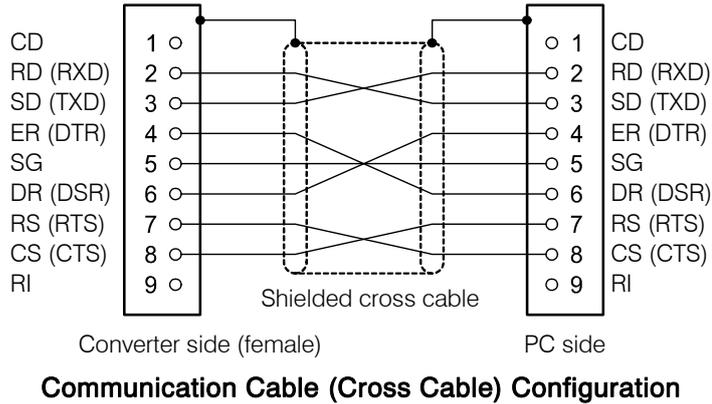
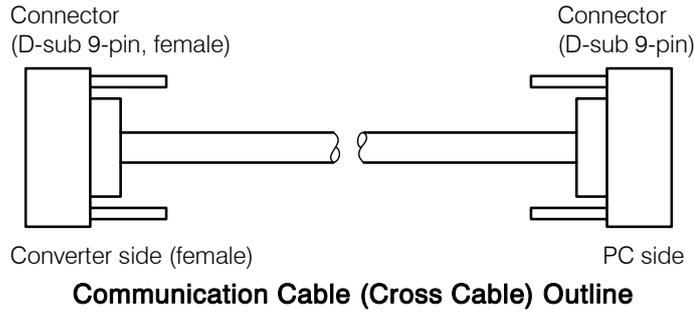
Pin Arrangement and Signal Names

Pin No.	Signal symbol	Signal name	Direction	Remarks
1	—	—	—	Not used
2	RD (RXD)	Received Data	Input	—
3	SD (TXD)	Transmitted data	Output	—
4	ER (DTR)	Data Terminal Ready	—	Not used
5	SG	Signal Ground	—	—
6	DR (DSR)	Data Set Ready	—	Not used
7	RS (RTS)	Request to Send	Output	Not used
8	CS (CTS)	Clear to Send	Input	Not used
9	—	—	—	Not used

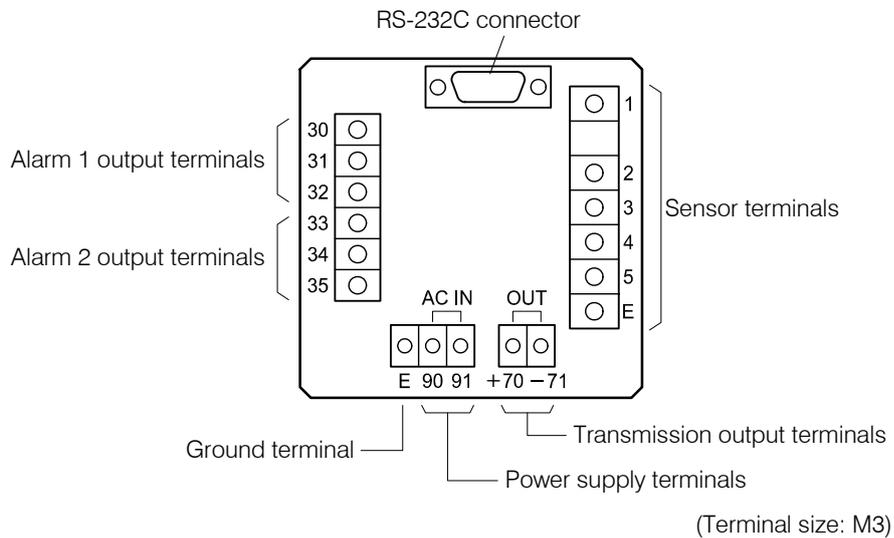
(b) Prepare a communication cable (cross cable) shown in the following diagram to connect between the controller and PC. The connector of the communication cable (cross cable) on the transmitter side is a D-sub female connector and the connector on the PC side shall be the one that matches the PC.

(c) The length of the communication cable (cross cable) must be 10m max.

【IMPORTANT】 • If a communication cross cable is longer than 10m, the dedicated software program may not work properly.



(3) Wiring



- (a) Make sure to turn off the power source to the transmitter and turn off the power of PC before you connect a communication cable (cross cable). When the cable is connected, turn on the power source and turn on the power of PC. This is intended to prevent electric shock caused by touching the terminal board and prevent an erroneous operation of the application software.
- (b) Install the communication cable (cross cable) separated from the power input cable and alarm output cable

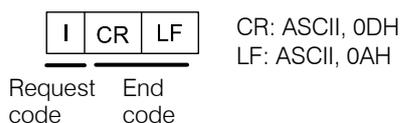
【IMPORTANT】 • If the communication cable (cross cable) is installed together with the power cable or alarm output cable, a communication error may occur caused by noise.

(c) Make sure to ground the ground terminal. This is one of the measures to prevent noise.

(4) Command format

(a) PC command

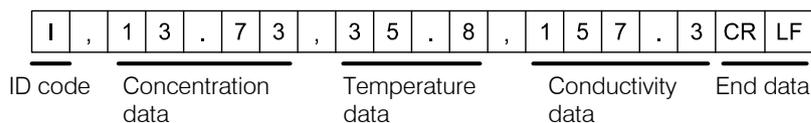
The command format from PC to the transmitter to request the measured data is shown below.



Command Format from PC

(b) Transmitter response

(i) The following format is used to send data from the transmitter when requested from PC.



Command Format from Controller

(ii) Concentration data is 4-digit data as shown below.

(Example) Concentration 13.73%: 13.73
 3.731%: 3.731
 99.99%: 99.99

(iii) Temperature data is 3-digit data as shown below.

(Example) Temperature 35.8°C: 35.8
 99.9°C: 99.9
 0.0°C: 0.0

(iv) Conductivity data is 4-digit data as shown below.

(Example) Conductivity 157.3mS/cm: 157.3
 2100mS/cm: 2100

8. Installation

8.1 Analyzer Mounting

(1) Controller installation location

Install the analyzer in a location which conforms to the specifications and satisfies the following conditions.

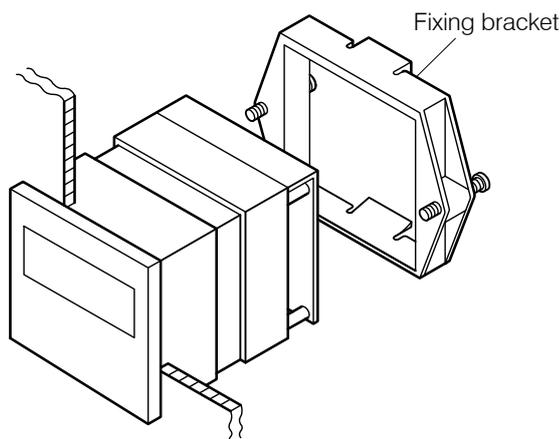
- (a) A location where the lead wires of the sensor, etc. can reach.
- (b) A location where installation and maintenance work can be performed easily.
- (c) A location where not exposed to direct sunshine and where temperature does not change quickly and temperature change does not occur locally.
- (d) A location where no equipment is nearby that generates electric noise. ▷ 5.4 “Measures against Noise”
- (e) A location where sea water or chemicals are not sprayed.
- (f) A location without vibration.
- (g) A location where drops of water are not sprinkled.
- (h) A location without corrosive gasses.

⚠ WARNING

Hazardous Gasses

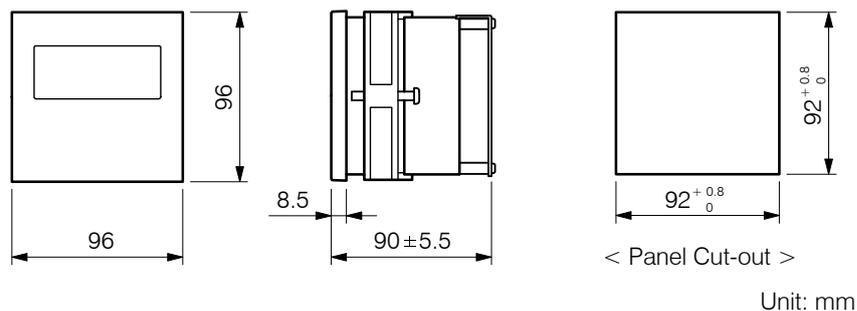
- Do not use the product in an area where explosive gas, flammable gas exists. Using the product in any of these areas can cause explosion or fire.
-

(2) How to mount the controller



How to Mount the Controller to the Panel Cut-out

- (a) Prepare a panel cut-out and insert the controller from the front and fix the controller from the rear using a fixing bracket. The dimensions and panel cut-out drawing is shown below.



Dimensions and Panel Cut-out Drawing

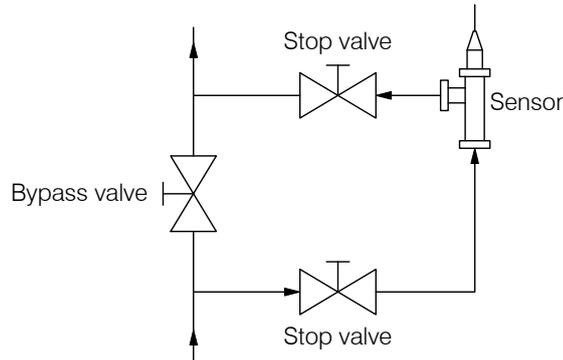
- (b) If the controller is installed at a position 1.3 to 1.5m from the floor, maintenance work and operation can be easily performed.
- (c) Mount the controller so that the top surface of the controller becomes level.

8.2 Sensor Mounting

(1) Key points of sensor mounting

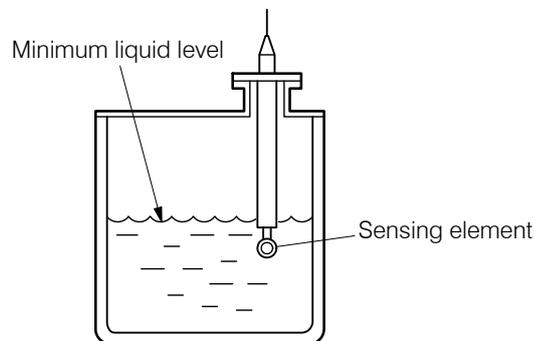
Install the transmitter in a location which conforms to the specifications and satisfies the following conditions.

- (a) A location where installation and maintenance work can be performed easily.
- (b) A location where not exposed to direct sunshine and where temperature does not change quickly and temperature change does not occur locally.
- (c) A location where no equipment is nearby that generates electric noise
- (d) A location where sea water or chemicals are not sprayed.
- (e) A location without vibration
- (f) A location without corrosive gasses
- (g) A location where the temperature of the sample is maintained within the operating temperature range of the electrode regardless of whether the sensor is in operation or not.
- (h) If the sensor is provided with a case, use the specified types of bolts and packing.
- (i) When you install the sensor to a pipeline, provide a bypass line and stop valves so that the sensor can be removed.



Installation to a Pipeline

(j) Even if the liquid level varies, the sensor must always be immersed in sample solution.



Tip End of Sensor and Minimum Liquid Level

- (k) If a noise current flows through the sample solution or piping, an error may occur. Therefore, sample solution must be grounded in some way.
- (l) If air bubbles or suspended solids exist in sample solution, this causes fluctuation of the indication or a measurement error. Either remove air bubbles and suspended solids or move the sensor to other location.
- (m) For a sensor provided with a case, maintain the flow rate near the sensor within the specification limits. Even if the indication is not affected by flow rate, if the flow rate is large, air bubbles tend to occur and if it is small, the indication becomes slow.
- (n) Do not allow solids to flow into sample solution, which may scratch or damage the tip end of the sensor.

! WARNING

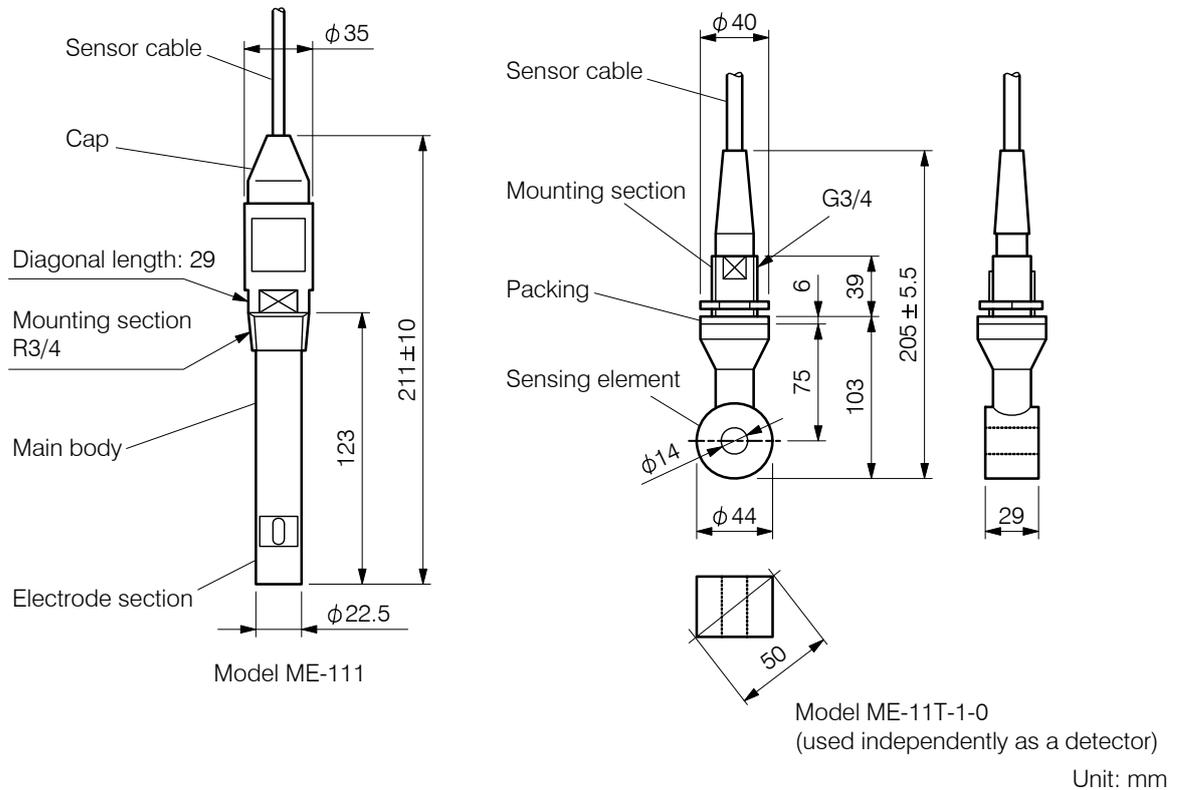
Hazardous Gasses

- Do not use the product in an area where explosive gas, flammable gas exists. Using the product in any of these areas can cause explosion or fire.
-

(2) Examples of sensor installation

- (a) For this analyzer, combine a sensor with a reference cell constant of 9.00/cm or 2.60/cm. Even if the analyzer is combined with a sensor of other reference cell constants, the analyzer does not work correctly.

(b) For the type of sensor, screw-in type, flange type and a sensor with a case are provided and liquid contacting materials differ. Mount the sensor referring to the delivery specification, etc.



Dimensions Examples of Screw-in Type Sensors

- [IMPORTANT]**
- Do not apply strong shock to the extent the sensor deforms or gets scratched.
 - Be careful that the sensor cable will not be twisted when you screw in the sensor. The sensor cable is directly connected and it cannot be removed from the sensor.

(c) If the mounting section is made of resin, the opposite side must also be made of resin. If it is made of metal, select the opposite side which is made of metal. This is needed to prevent liquid leak.

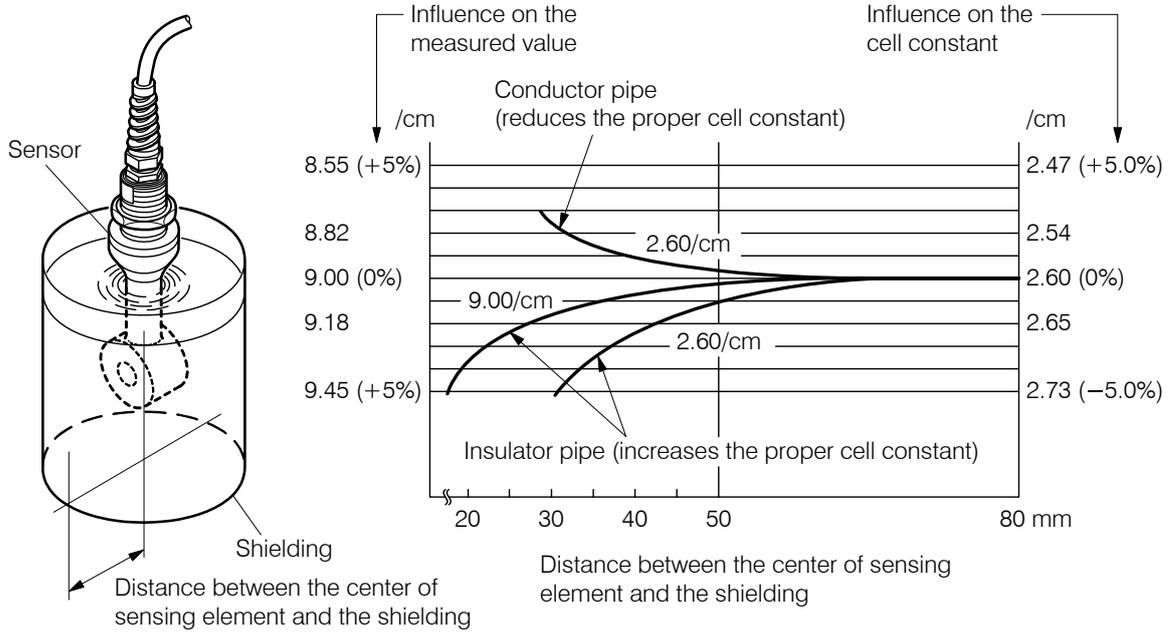
(d) For the thread of the mounting section, wind sealing material and mount the sensor correctly so that the thread of the sensor mates correctly.

(3) Adjustment of proper cell constant when shielding exists

(a) If the distance between the center of the electrode section and a shielding object (conductor or insulator) is 50mm (inner diameter $\phi 100$ mm) or less, the direction of induction current changes and the measurement value will be affected. The effect is shown in the diagram below. However, if a sensor with reference cell constant of 9.00/cm is installed in a conductor pipe (metal), almost no effect occurs. This is not described in the diagram.

(b) If it is necessary to install the sensor where a shielding object exists, the effect can be almost corrected by adjusting the setting value of the proper cell constant soon after the operation started. However, if the sensor is provided with a case when it is shipped from the factory, the proper cell

constant described on the sensor is the one adjusted in the combined condition and thus it is not necessary to adjust the setting value again.



Effect of Sensor Cell Constant by Shielding Object

(c) Adjust the proper cell constant as shown below after the operation starts.

(Example) Sensor reference cell constant: 2.60/cm
 Type of shielding: Conductor pipe (metal)
 Distance between the center and the shielding: 50mm (inner diameter ϕ 100mm)

- ① **Check the cell constant affected by shielding.** Read the cell constant (approx. 2.59/cm) when the distance between the center of the electrode section and the shielding is 50mm referring to the diagram “Effect of Sensor Cell Constant by Shielding Object.”
- ② **Adjust the proper cell constant.** Open the “Proper Cell Constant Setting (C.CON)” screen in the setting mode and set the cell constant affected by shielding. \triangleright 3.3(6) “Changing the proper cell constant”

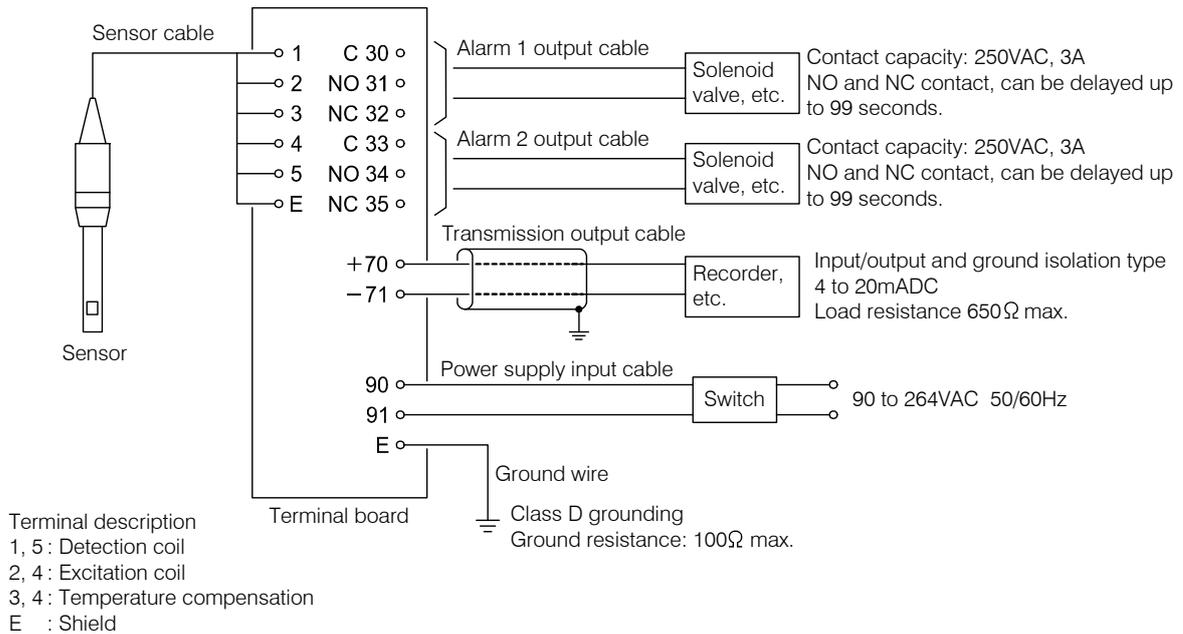
8.3 Wire Connection

(1) Wire connection diagram and terminal board



Electric Shock

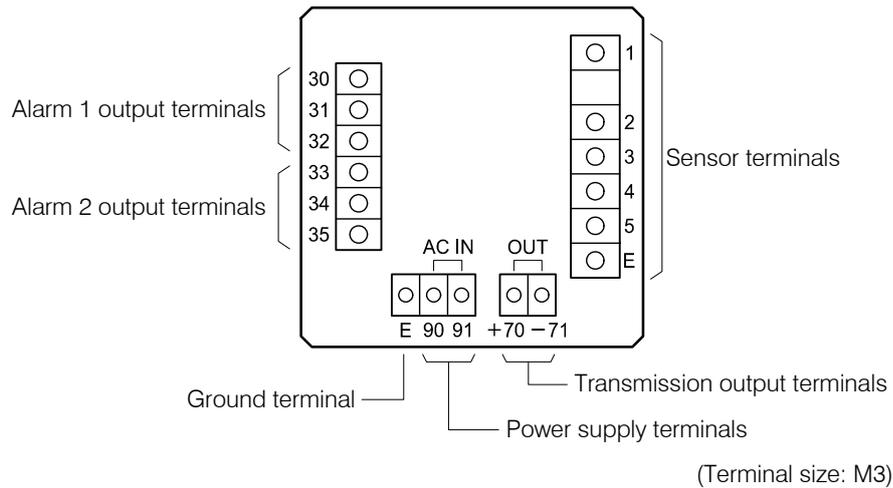
- Do not touch the terminals in the analyzer while power is applied. Touching the terminals may cause electric shock.



Wire Connection Diagram

- [IMPORTANT]** • If you use conduit wiring, use flexible metal conduit in the vicinity of controller and sensor about 1m from each because the sensor may be removed such as to perform maintenance work.

- After checking that power supply is turned off, remove the terminal block cover from the rear of the controller and connect each cable by referring to 8.3(2) "Sensor terminals" and subsequent items. When wiring is completed, install the terminal block cover in the same way as before.
- Attach a M3 crimping terminal to each end of cable wires and connect them to the terminals of their corresponding numbers.



Terminal Board

(c) If you want to use RS-232C connector (option), refer to the explanation sections.

▷ 6. “RS-232C Connector” and the instruction manual of the dedicated software.

(2) Sensor terminals

(a) Terminal numbers (wire markings) are provided for lead wires of sensor cable. Connect the lead wires to their corresponding terminals of controller terminal board.

-
- 【IMPORTANT】**
- If the terminals of the sensor cable are soiled by dirty hand, or moistened by water drops or oil, it causes unstable display. Keep them always dry and clean. In case they get dirty or moistened, wipe them with clean alcohol and dry them thoroughly.
 - Since the sensor cable cannot be extended by splicing more than one cable, make sure to use one long cable.
-

(b) Do not cut the sensor cable to make it short. If the cable is cut, terminal processing for the cable is required again. If it is necessary to cut it short, ask a technical servicing company to do this work. This is because the work is relatively complex and requires preparation of a crimping tool and insulation tubes. In case it is necessary, ask the company to do the same as the actually delivered sensor cable. In addition, if the length of the sensor cable is changed, it may be necessary to adjust the controller again.

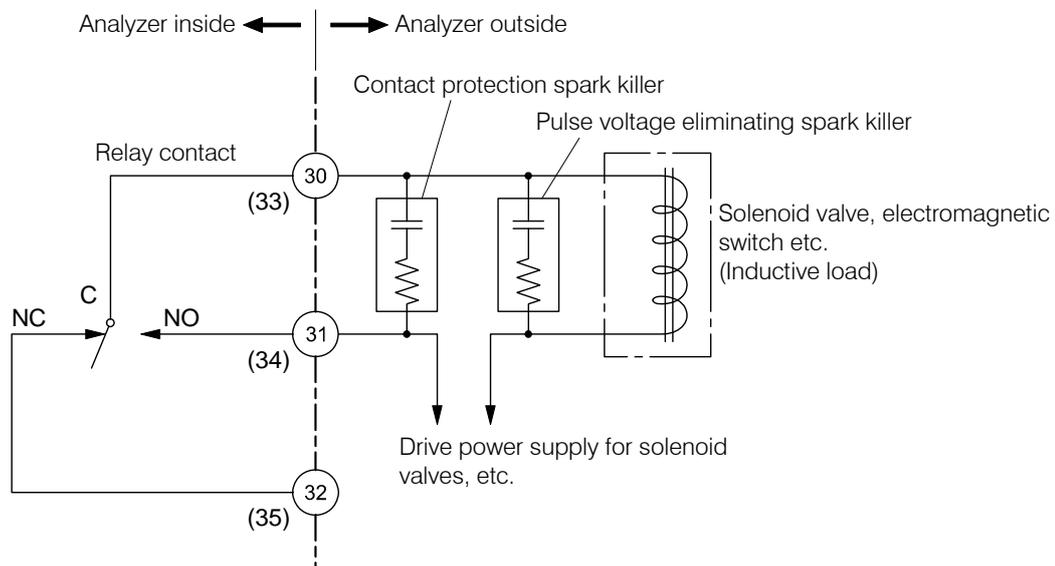
-
- 【IMPORTANT】**
- For terminal processing of the sensor cable, ask a technical servicing company to do the work. If the terminal processing work fails, correct measurement cannot be maintained.
-

(3) Transmission output terminals

The transmission output described in the specification can be taken from the transmission output terminals [70(+)] and [71(-)] of the terminal board. Use a 2-core shielded cable to connect between the terminals and a receiving device (such as a recorder).

(4) Alarm output terminals

- (a) Provide a contact protecting spark killer and a pulse voltage eliminating spark killer near the solenoid valve.



Example of Protection against Noise for Alarm Circuits

- (b) If the indicated value exceeds the alarm set-point and the alarm delay time elapses, the contacts “C–NO” shown in the diagram close. If it is necessary to turn on/off current larger than the contact capacity, provide a power relay and use the alarm output signal to turn on/off its amplifier circuit.

(5) Power supply input terminals and ground terminal

- (a) Connect power supply defined in the specification to the power supply input terminals of the terminal board.

-
- [IMPORTANT]**
- Connect wires only here and when you apply power, follow the procedure in 2.1 “Operation Start Procedure”.
 - Do not connect voltage higher than the power voltage defined in the specification. In addition, do not accidentally connect power to other terminals. The controller may be damaged.
-

- (b) A power switch is not provided in this controller. Provide a switch so that power can be switched on or off at the power supply side.
- (c) The ground terminal (E) of the terminal board must be grounded with Class D grounding work (ground resistance 100Ω max). Do not share the ground with other power equipment to prevent noise.
- (d) If it is not possible to ground the controller at a place near the installation site, the controller can be grounded at the power supply side. Use a 3-core shielded instrumentation cable and connect the core for grounding to the ground terminal (E).

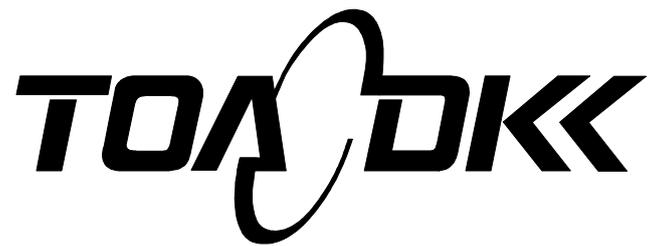
 **WARNING**

Electric Shock

- The ground terminal must be grounded. If the terminal is not grounded and a problem occurs in the power supply system, electric shock may result.
-

Revision History

Instruction Manual No. MBM-IB42405E	30/09/2007/ (NC)	New Version in English
MBM-IB43405E	19/02/2015/ (DEC)	(DEC Shimada)



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