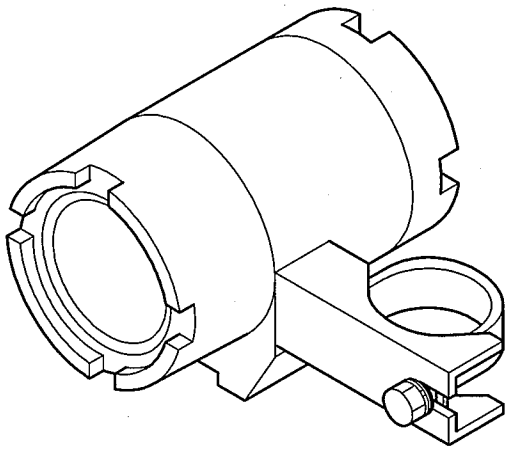
TOADKK

INSTRUCTION MANUAL

ELECTRODELESS CONCENTRATION ANALYZER

MODEL MDM-137A

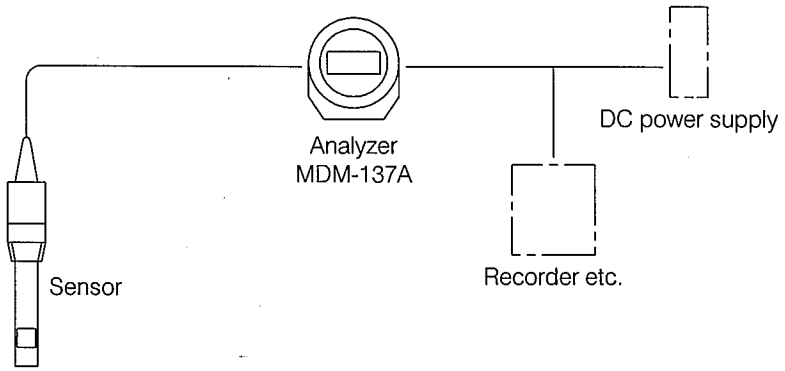


- Please keep this instruction manual close at hand of the persons who are in charge of the operation of this product.
- Before operating this product, please read this instruction manual carefully for its correct handling.

No. MDM-IB45201E

Introduction

(a) Thank you for your purchase of our product. The Model: MDM-137A Electrodeless Concentration Analyzer (hereafter called the analyzer or the product) is a two-wire, isolated type indicating analyzer in a measurement system that continuously measures the electrical conductivity of solution. This analyzer can be used for water quality control in processes using general water. This analyzer measures solution from which the correlation between conductivity and concentration can be obtained.



Example of a Measurement System

(b) In this product, concentration conversion data (linear approximate expression) is input according to the ordered specification. Concentration conversion data indicates the relationship between concentration, temperature and conductivity. In the standard specification, concentration conversion data is based on the international critical table (I.C.T) and DKK TOA analysis data.

(c) The entire concentration measuring range is 0.00 to 99.99% (possibly 0.000 to 4.000% depending on the setting), but the concentration measuring range of each individual product depends on the concentration conversion data that is set. According to the concentration conversion data setting, 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 concentration conversion data range.

(d) In this analyzer, a sensor with reference cell constant (design cell constant) 9.00 or 2.60/cm (depending on the ordered specification) can be incorporated. A sensor with any other reference cell constant cannot be incorporated in this product. The power supply is 24VDC ±10%. For other specifications, refer to 6.1 "Standard Specifications".

(e) 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

(f) Since important items are described in "Safety Information," read the contents carefully.

(g) 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 no 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 terminal plate in the analyzer while power is applied. Touching the terminal plate 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.

⚠ CAUTION

Disassembly and Modification

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

Warning Label Lost

- If any warning label affixed to this instrument 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 improper use of consumables, parts, optional equipment, software or other items.
- 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.

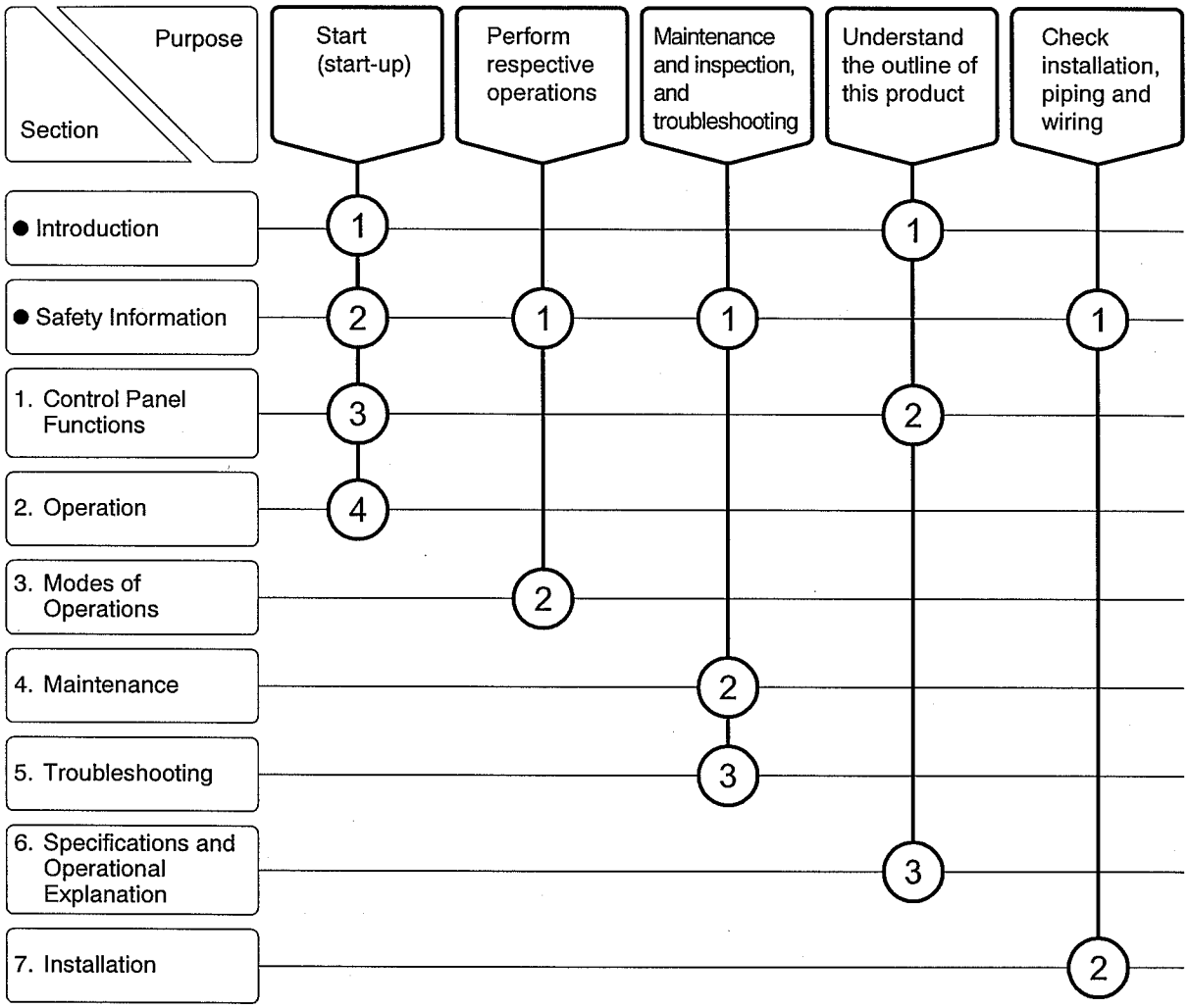
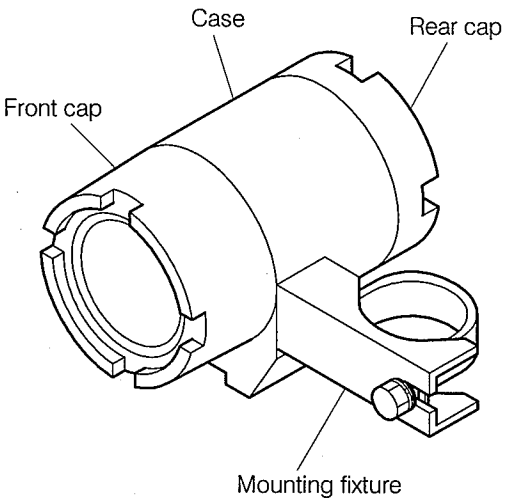


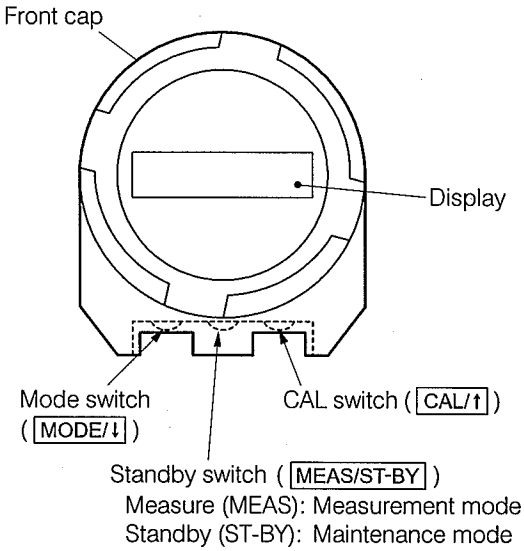
Table of Contents

1. Control Panel Functions

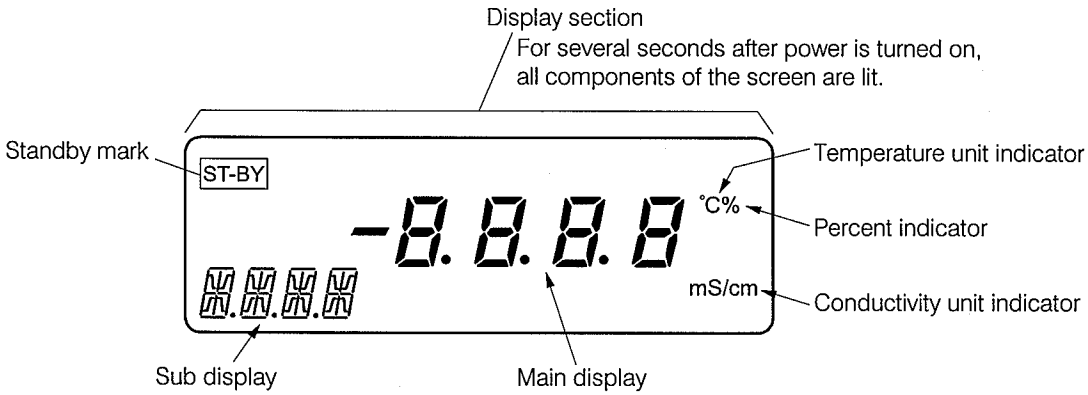
(1) Names of main components



External View of Analyzer



Front View



Display

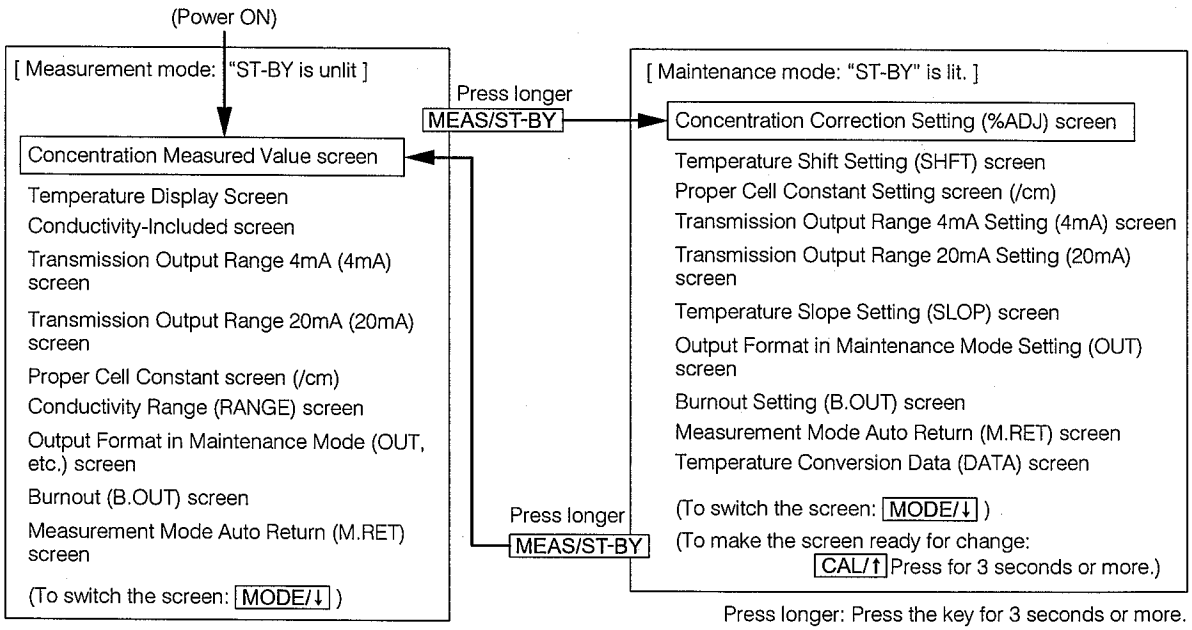
(2) Functions of switches

Name and Function of Each Switch

Name (appearing in the document)	Measurement mode	Maintenance mode	Function
Standby switch ([MEAS/ST-BY])	○	○	• Pressing this key for 3 seconds or more in the measurement mode (standby indicator "ST-BY" is unlit) switches the screen to the maintenance mode ("ST-BY" lights). • Pressing this key for 3 seconds or more in the maintenance mode returns the screen to the measurement mode. • Pressing this key once (for less than 3 seconds) after changing each item in the maintenance mode establishes the setting value.
Mode switch ([MODE/↓])	○	○	• Every time this key is pressed once (for less than 3 seconds) in the measurement mode and in the maintenance mode switches the screen. • Pressing this key for 3 seconds or more when the screen is ready for setting in the maintenance mode selects or decreases a setting value for each item.
CAL switch ([CAL/↑])	—	○	• Pressing this key for 3 seconds or more in the maintenance mode (standby indicator "ST-BY is lit) makes the screen ready for setting of each item. • Pressing this key when the screen is ready for setting in the maintenance mode selects or increases a setting value for each item.

○: Effective —: Ineffective

(3) Operation screen map



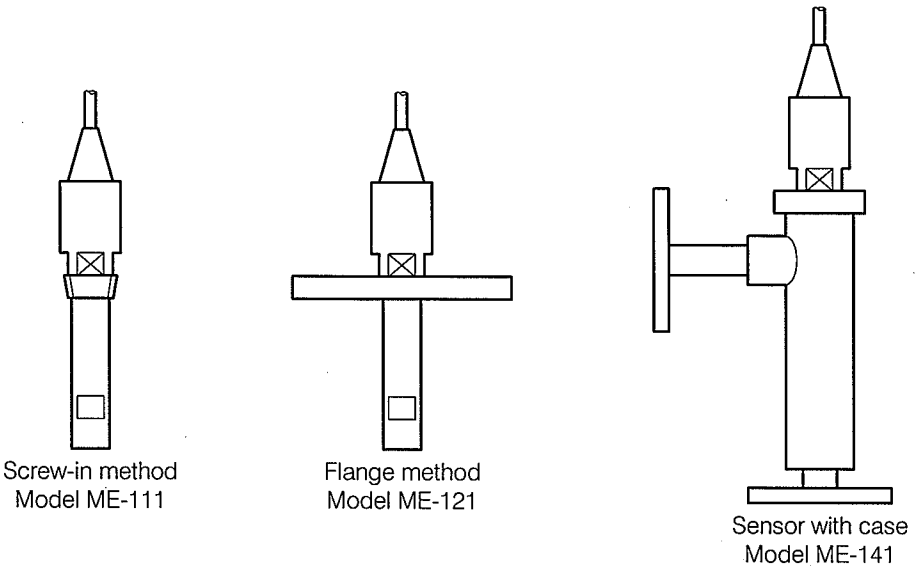
Press longer: Press the key for 3 seconds or more.

Note • For the "Transmission Output Adjustment" screen not shown here, see 3.4 "Adjustment of Transmission Output".

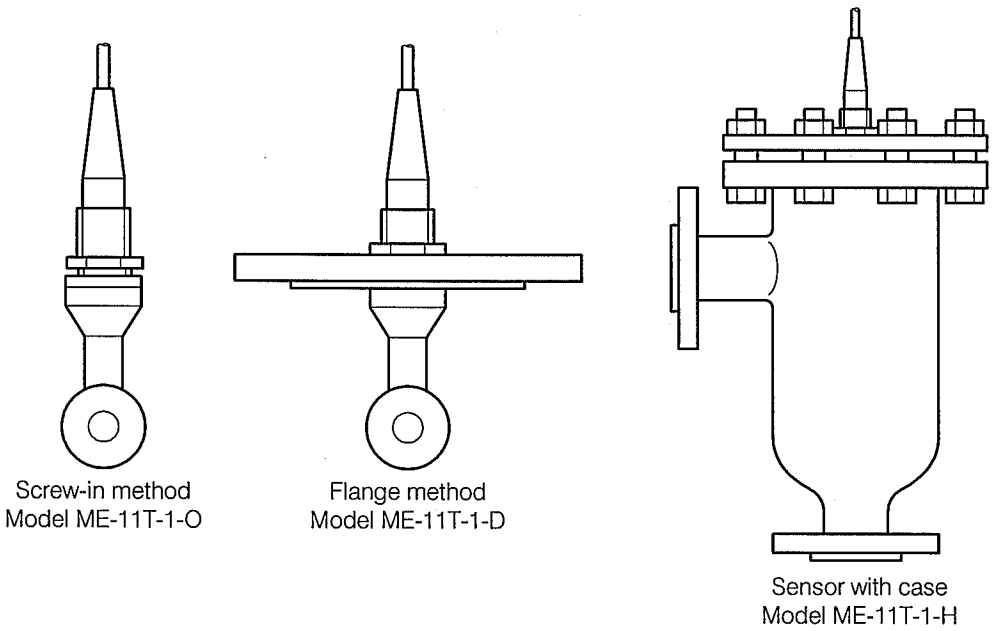
Operation Screen Map

(4) Main sensors

Sensor is selected according to the ordered specification. The shapes of main sensors are shown below. The reference cell constant is 9.00/cm or 2.6/cm.



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



ME-11T Series Sensors (Reference cell constant: 2.60/cm)

2. Operation

2.1 Operation Start Procedure

To make the analyzer ready for normal operation, operate it following the steps below:

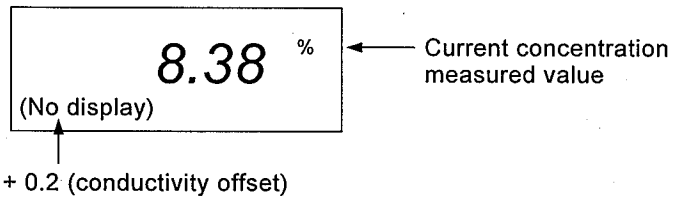
①**Check the installation.** ····· Check that the necessary installation work (mounting, piping and wiring) described in 7. "Installation" is completed.

②**Install the sensor.** ····· Check that the sensor is mounted properly. ▷ Check the procedure in 7.2 "Sensor Mounting". And make sure that the liquid contacting section of the sensor is immersed in a sample solution.

③**Turn on the power supply.** ····· Make sure that the power to be supplied to the analyzer complies with the specification. Then on the power supply (ON).

【IMPORTANT】
- Supplying voltage higher than the specification may damage the analyzer.
- Do not turn on the power supply for 10 seconds after turning it off.
- If the analyzer does not start normally when the power supply is turned on, stop power supply once then re-supply power after waiting for 10 seconds or more.

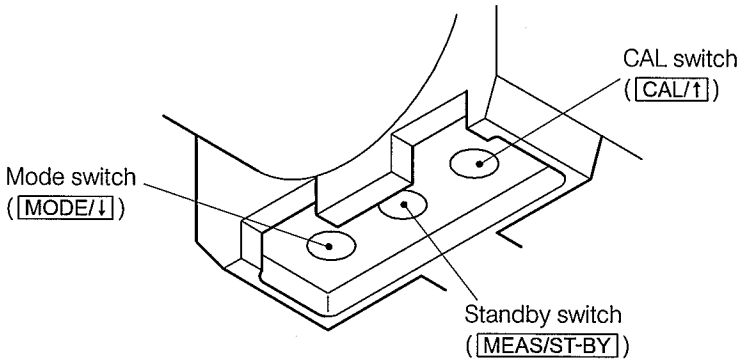
- When the power is supplied, the "Concentration Measured Value" screen (the initial screen of the measurement mode) appears and the concentration measured value is displayed on the main display. If the concentration correction function is on, conductivity offset is displayed.
  ▷ 3.3 (2) Changing the concentration correction



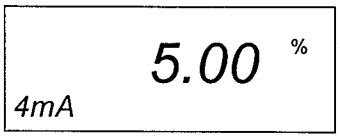
Concentration Measured Value Screen

- The unit of conductivity offset is centimeters (mS/cm).

④**Check the transmission range 4mA value.** ····· Press [MODE/↓] several times until "4mA" appears on the sub display and confirm that the main display of the appearing "Transmission Range 4mA" screen is the minimum scale value (%) of the transmission range.



Switches on the bottom face of the analyzer

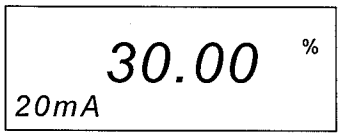


← The currently set transmission range 4mA value (Example of 5.00%)

Transmission Range 4mA Screen

- Normally, the transmission range is preset at factory according to the ordered specification.
- To change the transmission range: ▷ 3.3(5) "Changing the transmission output range"

⑤ **Check the transmission range 20mA value.** ····· Press [MODE/↓] once to display "2mA" on the sub display and confirm that the main display of the appearing "Transmission Range 20mA" screen is the maximum scale value (%) of the transmission range. Confirm that the transmission range specified by both the 2mA and 4mA values is suitable for the concentration of the sample solution.



← The currently set transmission range 20mA value (Example of 5.00 to 30.00 %)

Transmission Range 20mA Screen

⑥ **Set other values, if necessary.** ····· Change (or select) the setting, if necessary. The "Transmission Range 4mA" (4mA) screen and "Transmission Range 20mA" (20mA) screen shown in the table have been already checked in ④ and ⑤. ▷ 3.3 "Operation in the Maintenance Mode"

⑦ **Check the display of the measurement mode.** ····· Every time [MODE/↓] is pressed once in the "Concentration Measured Value" screen, the screen is switched to the "Sample Temperature Display" (TEMP) screen, etc.

- Each measurement mode screen other than the "Concentration Measured Value" screen automatically returns to the "Concentration Measured Value" screen 20 seconds after being displayed. ▷ 3.2 "Selecting a Measurement Mode Screen"

The measurement system is now ready for normal measurement.

2.2 Stopping the Operation

To stop operation for a short period of time (a few days), turn off (OFF) the power supply source that supplies power to the analyzer, at the supplying side. To stop operation for a long term, take action as follows:

(a) Turn off (OFF) the power source that supplies power to the analyzer at the supplying side.

(b) When you remove the sensor from sample, wash the sensing element before storing it. If there is no possibility that sensing element gets dirty with sample solution, it is not necessary to remove the sensor.

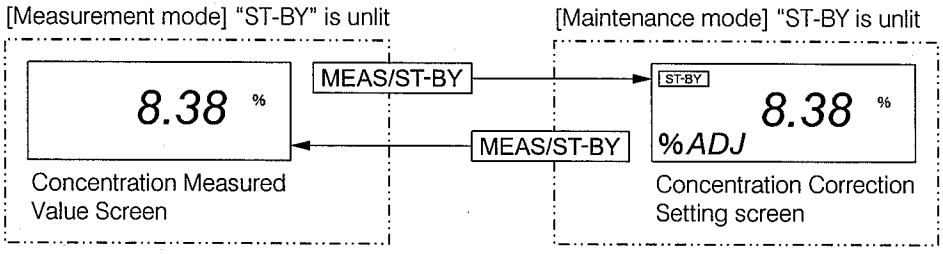
(c) When you remove the cable from the analyzer, attach a cap to prevent air from getting into the analyzer from the cable port. In addition, it is recommended to place desiccant such as silica gel inside.

(d) The end of the sensor cable (including the connector) removed from the analyzer should be waterproof enough by covering with a plastic bag or other means.

(e) To restart operation after relocation or storage, refer to 7. "Installation" and 2.1 "Operation Start Procedure."

3. Modes of Operations

3.1 Modes and Mode Switching



Modes and Mode Switching

(a) The mode of the current screen can be identified by whether the standby indicator (ST-BY) is lit.

Standby Indicator and Mode

	Measurement mode	Maintenance mode	
		Normal state	When the screen is ready for change
"ST-BY" is unlit	○		
"ST-BY" is lit		○	
"ST-BY" blinks			○

(b) When MEAS/ST-BY is pressed for 3 seconds or more in the measurement mode ("ST-BY" is unlit), the "Concentration Correction Setting" screen that is the initial screen of the maintenance mode appears ("ST-BY" is lit).

(c) When MEAS/ST-BY is pressed for 3 seconds or more in the maintenance mode ("ST-BY" is lit), the screen returns to the "Concentration Measured Value" screen that is the initial screen of the measurement mode.

3.2 Selecting a Measurement Mode Screen

(a) The measurement mode includes the "Concentration Measured Value" screen and other screens, as shown in the table below. Every time you press MODE/↓ (less than 3 seconds), the screen is switched.

(b) The transmission output range is specified by the values set in the "Transmission Output Range 4mA" screen and "Transmission Output 20mA" screen.

(c) Each measurement mode screen other than the "Concentration Measured Value" screen automatically returns to the "Concentration Measured Value" screen 20 seconds after being displayed.

Measurement Mode Screen Sequence

No.	Screen name	Screen example	Description
			(To switch screen: MODE/↓)
①	Concentration Measured Value screen	8.38 % (No display) e.g. +0.24., or × 1.06	• Main display ··· Concentration measured value (%) • Sub display ··· Conductivity offset, or conductivity correction coefficient. If the concentration correction function is off (oFF), nothing is displayed. + or -: Indicates an offset. ×: Indicates a correction coefficient.
②	Sample Temperature Display screen	27.5 °C (No display) e.g. −2.5	• Main display ··· Temperature of sample measured by the electrode. • Sub display ··· Sample temperature shift amount. If the sample temperature shift function is off (oFF), nothing is displayed.
③	Conductivity-Included screen	8.38 % 36.1 mS/cm	• Main display ··· Concentration measured value (%) • Sub display ··· Conductivity measured value (mS/cm)
④	Transmission Output Range 4mA screen	5.00 % 4mA	• Main display ··· The minimum scale concentration of the currently set transmission output range (%)
⑤	Transmission Output Range 20mA screen	30.00 % 20mA	• Main display ··· The maximum scale concentration of the currently set transmission output range (%). The screen examples in ④ and ⑤ indicate a transmission output range of 5.00 to 30.00%.
⑥	Proper Cell Constant screen	9.03 /cm e.g. 2.61	• Main display ··· The currently set proper cell constant (/cm). A proper cell constant is set for each individual sensor.

(To be continued)

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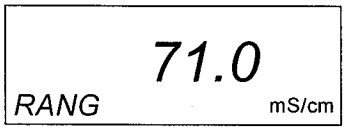
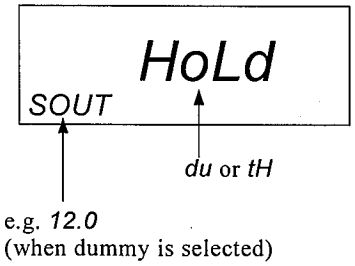
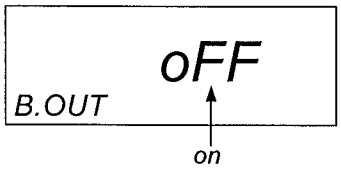
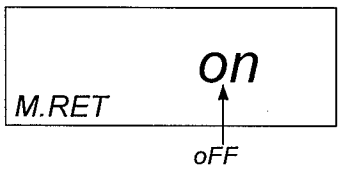
No.	Screen name	Screen example	Description
⑦	Conductivity Range screen		• Main display ··· The maximum scale value of the conductivity measuring range that is automatically selected in accordance with the setting value in the "Concentration Conversion Data Setting" (DATA) screen (mS/cm)
⑧	Output Format in Maintenance Mode screen		• Main display ··· The currently set output format in the maintenance mode HoLd (hold) ··· The transmission output value immediately before the screen is switched to the maintenance mode is output (fixed) (factory setting). du (dummy) ··· Any transmission output value (fixed) that is set is output. (Sub display: e.g. 12.0) tH (through) ··· As in the measurement mode, the conductivity measured value is output.
⑨	Burnout screen		• Main display ··· The currently set burnout mode on.H (on high) ··· At normal time, the transmission output becomes 21mA. On.L (on low) ··· At abnormal time, the transmission output becomes 3.8mA. oFF (off) ··· No burnout (factory setting)
⑩	Measurement Mode Auto Return screen		• Main display ··· The currently set measurement mode auto return on/off. on (on) ··· The screen automatically returns to the measurement mode approx. 2 hours after being switched to the maintenance mode (factory setting). oFF (off) ··· The screen does not automatically return to the measurement mode.
	(Returns to ①.)		

3.3 Operation in the Maintenance Mode

(1) Maintenance mode screen sequence

(a) The maintenance mode includes the screens shown in the table below.

(b) Pressing [MEAS/ST-BY] in the measurement screen for 3 seconds or more, the "Concentration Correction Setting" (%ADJ) screen (the initial screen of the maintenance mode) appears. "ST-BY" is lit in the lower left of the screen.

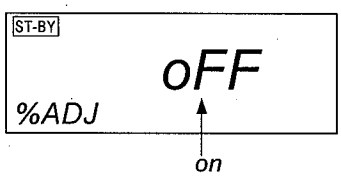
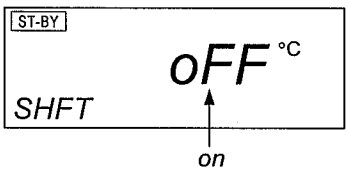
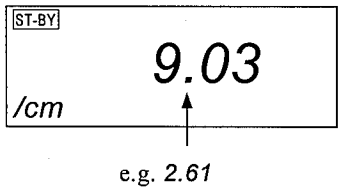
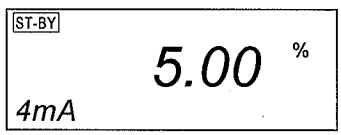
(c) In the measurement mode, every time you press [MODE/↓], the screen is switched. By pressing [MEAS/ST-BY] for 3 seconds or more in the maintenance mode, you can return to the measurement mode.

【IMPORTANT】 • When you press [MEAS/ST-BY] to establish the setting value in each screen, be sure to press it for less than 3 seconds. If you press MEAS/ST-BY for 3 seconds or more, the ongoing setting operation is aborted and the screen returns to the measurement mode.

(d) To change the setting value in each screen, refer to 3.3.(2) "Changing the concentration correction" and after.

(e) When the screen enters into the maintenance mode, the transmission output is displayed in the format set in the "Output Format in Maintenance Mode Setting" (OUT) screen (e.g. hold).

Maintenance Mode Screen Sequence

No.	Screen name	Screen example	Description
			(To switch screen: [MODE/↓])
①	Concentration Correction Setting screen		• Main display ···The currently set concentration correction on/off on (on) ··· The corrected value is used as the concentration measured value. oFF (off) ··· The value that is not corrected is used as the concentration measured value (factory setting).
②	Sample Temperature Shift Setting screen		• Main display ···The currently set sample temperature shift on/off on (on) ··· The shifted value is used as the sample temperature measured value. oFF (off) ··· The value that is not shifted is used as the sample temperature measured value (factory setting).
③	Proper Cell Constant Setting screen	 e.g. *2.61*	• Main display ··· The currently set proper cell constant (/cm) The proper cell constant of the incorporated sensor is set. (Factory setting: Depends on the ordered specification.)
④	Transmission Output Range 4mA Setting screen		• Main display ··· The minimum scale concentration of the currently set transmission output range (%)

(To be continued)

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No.	Screen name	Screen example	Description
⑤	Transmission Output Range 20mA Setting screen	ST-BY 30.00 % 20mA	• Main display ··· The maximum scale concentration of the currently set transmission output range (%). The screen examples in ④ and ⑤ indicate a transmission range of 5.00 to 30.00%.
⑥	Sample Temperature Slope Setting screen	ST-BY 2.000 SLOP	• Main display ··· The currently set sample temperature slope coefficient. The slope coefficient of analytical curve with zero point 25°C for sample temperature measurement. • Setting range ··· 1.900 to 2.100 (factory setting: 2.000)
⑦	Output Format in Maintenance Mode Setting screen	HoLd SOUT du or tH 12.0 (when dummy is selected)	• Main display ··· The currently set output format in the maintenance mode. HoLd (hold) ··· The transmission output value immediately before the screen is switched to the maintenance mode is output (factory setting). du (dummy) ··· Any transmission output value (fixed) that is set is output. (Sub display: e.g. 12.0) tH (through) ··· As in the measurement mode, the conductivity measured value is output.
⑧	Burnout screen	ST-BY oFF °C B.OUT on.H or on.L	• Main display ··· The currently set burnout format. on.H (on high) ··· At abnormal time, the transmission output becomes 21mA. on.L (on low) ··· At abnormal time, the transmission output becomes 3.8mA. oFF (off) ··· No burnout (factory setting)
⑨	Measurement Mode Auto Return screen	ST-BY on M.RET oFF	• Main display ··· The currently set measurement mode auto return on/off. on (on) ··· The screen automatically returns to the measurement mode approx. 2 hours after being switched to the maintenance mode (factory setting). oFF (off) ··· The screen does not automatically return to the measurement mode.
⑩	Concentration Conversion Data Setting screen	ST-BY DATA	• Sub display ··· Indicates that this screen is the Concentration Conversion Data Setting screen.
	(Returns to ①.)		

(2) Changing the concentration correction

(a) The concentration correction function on/off, the correction method and the concentration measured value after correction can be changed. Normally, this operation is not needed.

- Operation screen ··· "Concentration Correction Setting" screen

(b) If this function is turned on, the corrected value is used as the concentration measured value. If this function is turned off, the value that is not corrected is used as the concentration measured value. The conductivity in the "Conductivity-Included" screen is also used as the measured value after correction.

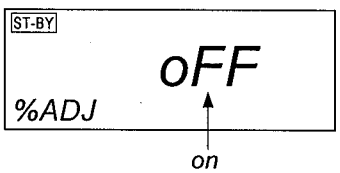
(c) The change operation of concentration correction measures a concentration-known solution and adjusts the measured value displayed on the screen to the value of the concentration-known solution. To perform this operation, it is necessary to prepare a concentration-known solution that is kept constant within a temperature range based on the concentration conversion data (fluctuation within 0.5°C for 5 minutes) and immerse the detector in this solution.

(d) Concentration can be corrected in two ways; concentration shift correction (SHIFT) and concentration span correction (SPAN), either one of which you can select. The concentration shift correction adds or subtracts an offset to/from the measured value. This method is suitable for correction around the minimum scale concentration of the measuring range. On the other hand, concentration span correction multiplies the measured value by a correction coefficient. This method is suitable for correction around the maximum scale concentration of the measuring range.

(e) The offset and correction coefficient are automatically changed when the concentration measured value after correction is changed, as shown in the table below. If the concentration correction function is on, you can check the offset or correction coefficient on the sub display of the "Concentration Measured Value" screen.

Procedure to Change Concentration Correction

Procedure and display example	Description
① Switch to the maintenance mode. ·····	Press [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Check the "Concentration Correction Setting" screen. ·····	Confirm that "%AD" appears on the sub display. If not displayed, press [MODE/↓] repeatedly until it is displayed. • Main display ··· Concentration correction on/off on (on) ··· The corrected value is used as the concentration measured value. oFF (off) ··· The value that is not corrected is used as the concentration measured value (factory setting).
③ Make the screen ready for change. ·····	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Select on/off. ·····	Press [MODE/↓] or [CAL/↑] to display either "on" or "oFF" you want to select.



(To be continued)

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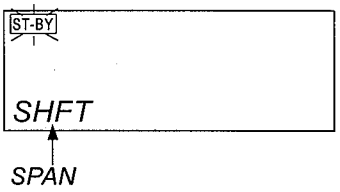
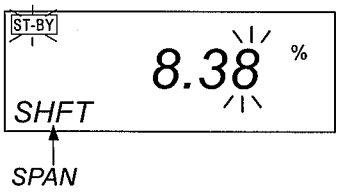
Procedure and display example	Description
⑤ Establish the setting.	Press MEAS/ST-BY.
	• When "on" is selected ··· "on" is established and the screen is ready for changing the concentration correction method. SHIFT (shift) ··· Correct the measured value by adding/subtracting an offset (factory setting). SPAN (span) ··· Correct the measured value by multiplying a correction coefficient • When "oFF" is selected ··· "oFF" is established and the screen becomes the state after "⑨" is operated. Proceed with the operation in Step ⑩.
⑥ Select a correction method.	Press MODE/↓ or CAL/↑ to display either one you want.
⑦ Establish the setting.	Press the MEAS/ST-BY.
	• The correction method is established and the screen is now ready for changing the offset or correction coefficient. • Main display ··· The measured value (before correction is changed) of the concentration-known solution currently being measured. • Sub display ··· The correction method established by this operation.
⑧ Enter the measured value after correction.	Press MODE/↓ or CAL/↑ to display the concentration of the concentration-known solution on the main display. • Setting range ··· Measured value before correction ± 20%
⑨ Establish the setting.	Press MEAS/ST-BY. • The measured value of the correction efficient is established and the screen becomes the state after "②" is operated. • When MODE/↓ is pressed here, the next item screen appears.
⑩ Return to the measurement mode.	Press MEAS/ST-BY for 3 seconds or more.

(3) Changing the sample temperature shift

(a) The sample temperature shift function on/off and the sample temperature after shift can be changed. Normally, this operation is not needed.

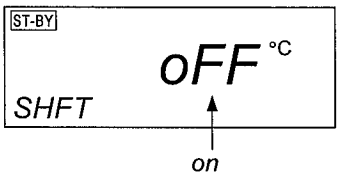
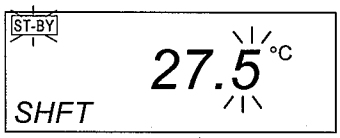
- Operation screen ··· "Sample Temperature Shift Setting" screen

(b) If this function is turned on, the shifted sample temperature measured value is used as the temperature measured value. If this function is turned off, the value that is not shifted is used as the sample temperature measured value. Because the sample temperature after shift also applies to the concentration conversion formula, it affects the concentration measured value, as well.

(c) The change operation of sample temperature after shift adjusts the indication of the analyzer by key operation to the temperature measured value that was measured by another means (e.g. by a precision thermometer). To perform this operation, it is necessary to prepare so that the sample temperature around the sensor can be measured by another means (e.g. by a precision thermometer).

(d)The sample temperature shift amount is automatically changed when the sample temperature after shift is changed. If temperature shift is on, you can check the sample temperature shift amount on the sub display of the "Temperature Display" screen.

Procedure to Change Sample Temperature Shift

Procedure and display example	Description
① Switch to the maintenance mode.	Press [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Sample Temperature Shift Setting" screen. 	Press [MODE/↓] once. • Main display ···The currently set sample temperature shift on/off on (on) ··· The shifted value is used as the sample temperature measured value. oFF (off) ··· The value that is not shifted is used as the sample temperature measured value (factory setting).
③ Make the screen ready for change.	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Select on/off.	Press [MODE/↓] or [CAL/↑] to display either "on" or "oFF" you want to select.
⑤ Establish the setting. 	Press [MEAS/ST-BY]. • When "on" is selected ··· Sample temperature shift "on" is established and the screen is ready for changing the sample temperature after shift. • When "oFF" is selected ··· Sample temperature shift "oFF" is established and the screen becomes the state after "⑦" is operated. Proceed with the operation in Step ⑧.
⑥ Enter the sample temperature after temperature shift.	Press [MODE/↓] or [CAL/↑] to display the sample temperature after shift on the main display. • Setting range ··· Measured value before shift ±5.0°C
⑦ Establish the setting.	Press [MEAS/ST-BY]. • The temperature after shift is established and the screen becomes the state after "②" is operated. • When [MODE/↓] is pressed here, the next item screen appears.
⑧ Return to the measurement mode.	Press [MEAS/ST-BY] for 3 seconds or more.

(4) Changing the proper cell constant

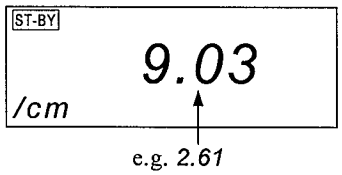
(a)The setting of the proper cell constant can be changed. Since the proper cell constant is preset according to the ordered specification, this operation is not needed normally. This function can be used when the sensor is replaced with another one.

- Operation screen ··· "Proper Cell Constant Setting (/cm)" screen

(b)The proper cell constant is a value that is assigned to each individual sensor. This value is described on a tag, etc. of each sensor. This is a numeric value that differs slightly from the reference cell constant (design cell constant). This function is useful for more accurate measurement.

(c) If a shielding such as a conductor or insulator exists within 50mm radius from the center of the sensing element of the sensor, the direction of the induction current changes and the measured value will be affected. In this case, measure the conductivity-known solution and adjust the setting value of the proper cell constant to indicate a proper measured value.

Procedure to Change Proper Cell Constant

Procedure and display example	Description
① Switch to the maintenance mode.	Press [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Proper Cell Constant Setting" screen.	Press [MODE/↓] several times until "/cm" appears on the sub display. • Main display ···The currently set proper cell constant (/cm) (Depends on the sensor).
 e.g. 2.61	
③ Make the screen ready for change.	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Enter the proper cell constant.	Check the proper cell constant of the incorporated sensor then use [MODE/↓] or [CAL/↑] to display the proper cell constant.
⑤ Establish the setting.	Press [MEAS/ST-BY]. • The proper cell constant is established and the screen becomes the state after "②" is operated. • When [MODE/↓] is pressed here, the next item screen appears.
⑥ Return to the measurement mode.	Press [MEAS/ST-BY] for 3 seconds or more.

(5) Changing the transmission output range

(a) The transmission output range of the concentrated measured value can be changed. Since the transmission output range is preset according to the ordered specification, this operation is not needed normally.

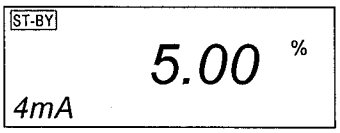
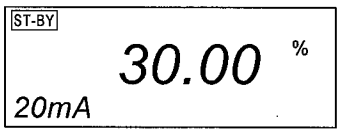
- Operation screen ····· "Transmission Output Range 4mA Setting" (4mA) screen
  "Transmission Output Range 20mA Setting" (20mA) screen

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

(c) The transmission output range can be arbitrarily set within an area to which the concentration range set in the "Concentration Conversion Data Setting" (DATA) screen is expanded by adding approx. 30% of the range to the minimum and maximum values of the range.

Example) Concentration conversion data range: 8%(X1) to 26%(X6)
The minimum value of the settable transmission output range = $8 - (26 - 8) \times 0.3 = 2.6$ (%)
The maximum value of the settable transmission output range = $26 + (26 - 8) \times 0.3 = 31.5$ (%)

Procedure to Change the Transmission Output Range

Procedure and display example	Description
① Switch to the maintenance mode.	Press [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Transmission Output Range 4mA Setting" screen. 	Press [MODE/↓] several times until "4mA" appears on the sub display. • Main display ··· The minimum value of the currently set concentration transmission output range. Concentration (%) corresponding to the transmission output 4mA. The display example is 5.00%.
③ Make the screen ready for change.	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Enter the minimum value of the transmission output range.	Press [MODE/↓] or [CAL/↑] to display the minimum scale value of the transmission range you want to set. • Setting range ··· Area to which the concentration range set in the "Concentration Conversion Data Setting" (DATA) screen is expanded by adding 30% of the range to the minimum and maximum scale values of the range.
⑤ Establish the setting.	Press [MEAS/ST-BY]. • The value corresponding to 4mA of the transmission output range is established and the screen becomes the state after "②" is operated.
⑥ Select the "Transmission Output Range 20mA Setting" screen 	Press [MODE/↓]. • Main display ··· The maximum value of the currently set concentration transmission output range. Concentration (%) corresponding to the transmission output 20mA. The display example is 30.00%.
⑦ Make the screen ready for change.	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
⑧ Enter the maximum value of the transmission output range.	Press [MODE/↓] or [CAL/↑] to display the maximum scale value of the transmission range you want to set. • Setting range ··· Area to which the concentration range set in the "Concentration Conversion Data Setting" (DATA) screen is expanded by adding 30% of the range to the minimum and maximum scale values of the range.
⑨ Establish the setting.	Press [MEAS/ST-BY]. • The value corresponding to 20mA of the transmission output range is established and the screen becomes the state after "⑥" is operated. • When [MODE/↓] is pressed here, the next item screen appears.
⑩ Return to the measurement mode.	Press [MEAS/ST-BY] for 3 seconds or more.

(6) Changing the sample temperature slope

(a) The sample temperature slope can be changed. Normally, this operation is not needed. This function can be used to measure the concentration an temperature more accurately when a temperature is 10°C or more different from 25°C.

- Operation screen ··· "Sample Temperature Slope Setting" (SLOP) screen

(b) If temperature adjustment is needed, normally, it is recommended to shift the sample temperature. (▷ 3.3(3) "Changing the sample temperature shift")

(c) In this operation, you change the sample temperature slop coefficient after change that is previously obtained. By changing the slope coefficient of the sample temperature measurement analytical curve with zero point 25°C, the sample temperature measured value is corrected. To cancel the correction, reset the coefficient to "2.000."

(d) Before this operation, it is necessary to obtain the coefficient after change as follows:

① Adjust the temperature to 25°C. ····· By sample temperature shift (▷ 3.3 (3) "Changing the sample temperature shift"), adjust the temperature to 25°C as accurately as possible.

② Immerse the sensor in the solution that is kept at a temperature you want to measure, that is, the solution whose temperature is 10°C or more different from 25°C and read the indication of the analyzer (temperature before correction). Measure the sample temperature (temperature after correction) around the sensor by another means (e.g. precision thermometer).

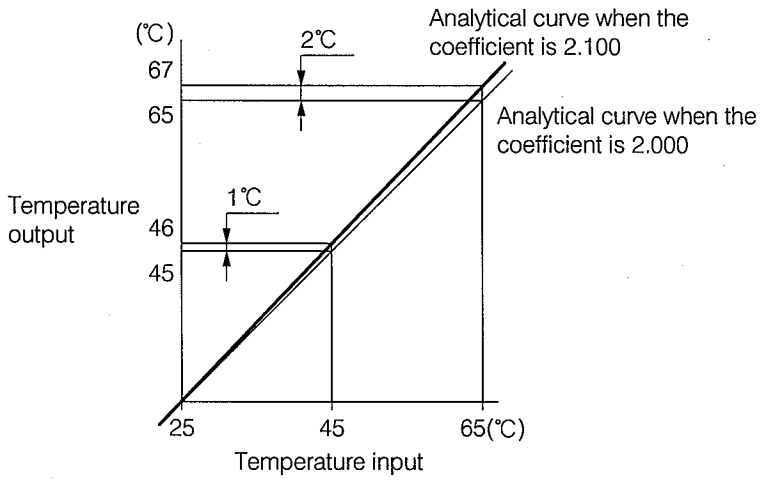
③ Calculate the coefficient. ····· Using the following formula, calculate the slope coefficient.

$$\text{Coefficient} = \frac{\text{Temperature after correction} - 25}{\text{Temperature before correction} - 25} \times 2$$

Example) When the indication of the analyzer (temperature before correction) is 45.0°C and the sample temperature measured by another means (temperature after correction) is 46.0°C

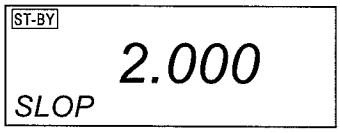
$$\text{Coefficient} = \frac{46.0 - 25}{45.0 - 25} \times 2 = 2.100$$

As in this example, assuming that the slope coefficient is 2.100, 45°C is corrected to 46°C (corrected 1°C to the plus side) and 65°C is corrected to 67°C (corrected 2°C to the plus side).



Slope Coefficient and Temperature Input/Output

Procedure to Change the Sample Temperature Slope

Procedure and display example	Description
① Switch to the maintenance mode.	Press the [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Sample Temperature Slope Setting" screen. 	Press [MODE/↓] several times until "SLOP" appears on the sub display. • Main display ···The currently set sample temperature slope coefficient.
③ Make the screen ready for change.	Press [CAL/↑] for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Enter a sample temperature slope coefficient.	Press [MODE/↓] or [CAL/↑] to display a new sample temperature slope coefficient on the main display. Setting range ··· 1.900 to 2.100 (factory setting: 2.000)
⑤ Establish the setting.	Press [MEAS/ST-BY]. • The temperature slope coefficient is established and the screen becomes the state after "②" is operated. • When [MODE/↓] is pressed here, the next item screen appears.
⑥ Return to the measurement mode.	Press [MEAS/ST-BY] for 3 seconds or more.

(7) Changing the output format in the maintenance mode

(a) The setting of the transmission output format in the maintenance mode can be changed.

- Operation screen ··· "Output Format in Maintenance Mode Setting" (OUT) screen

(b) One of the following can be selected for the output format in the maintenance mode.

Hold (HoLd) format ··· The transmission output value immediately before the screen is switched to the maintenance mode is output (fixed) (factory setting).

Dummy (du) format ··· Any transmission output value that is set (fixed) is output.

Through (tH) format ··· As in the measurement mode, the measured value is output.

(c) If dummy is selected, it is necessary to set any transmission output value (dummy value) immediately after.

Procedure to Change the Output Format in the Maintenance Mode

Procedure and display example	Description
① Switch to the maintenance mode.	Press the [MEAS/ST-BY] for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.

(To be continued)

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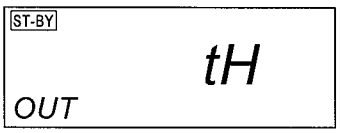
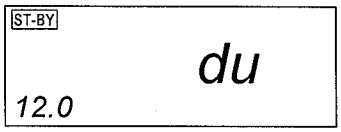
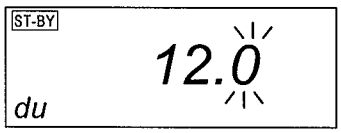
Procedure and display example	Description
② Select the "Output Format in Maintenance Mode Setting" screen.	Press MODE/↓ several times until "OUT" appears on the sub display. • Main display ···The currently set output format in the maintenance mode. HoLd ··· Hold format (factory setting). tH ··· Through format du ··· Dummy format (Sub display: Dummy value: mA)
 Hold format	 Through format
 Dummy format	
③ Make the screen ready for change.	Press CAL/↑ for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Select an output format.	Press MODE/↓ or CAL/↑ to display any one you want to select. • Setting range ··· HoLd, tH, du
⑤ Establish the output format you have set.	Press MEAS/ST-BY. • If the hold format or through format is set, after the setting is established, the screen becomes the state after "②" is operated. When MODE/↓ is pressed here, the next screen appears. Proceed with operation "⑧".
 Dummy Value Setting Screen	• If the dummy format is set, the dummy value blinks on the main display.
⑥ Enter a dummy value.	Press MODE/↓ or CAL/↑ and enter a dummy value. • Setting range ··· 4 to 20mA (factory setting: 12.0mA)
⑦ Establish the setting.	Press MEAS/ST-BY. • The dummy value is established and the screen becomes the state after "②" is operated. • When MODE/↓ is pressed here, the next item screen appears.
⑧ Return to the measurement mode.	Press MEAS/ST-BY for 3 seconds or more.

(8) Changing the burnout

(a) The setting of burnout can be changed.

- Operation screen ··· "Burnout Setting" (B.OUT) screen

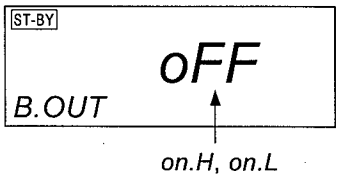
(b) The burnout function notifies of an error upon its occurrence, by letting the indicator of the transmission output value swing off-scale. You can select one from the following choices:

- On high (on.H) ··· When an error occurs, the transmission output becomes 21mA.
- On low (on.L) ··· When an error occurs, the transmission output becomes 3.8mA.
- Off (oFF) ··· No burnout (factory setting)

(c) The burnout function operates when any of the following alarm messages is displayed.

- Storage element error (E-20)
- Setting data error (E-21)
- Temperature measured value error (when the value exceeds the range –5 to 120°C)

Procedure to Change the Burnout

Procedure and display example	Description
① Switch to the maintenance mode.	Press MEAS/ST-BY for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Burnout Setting" screen. 	Press MODE/↓ several times until "B.OUT" appears on the sub display. • Main display ···The currently set burnout mode (/cm) on.H ··· On high on.L ··· On low oFF ··· Off (factory setting)
③ Make the screen ready for change.	Press CAL/↑ for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.
④ Select a burnout mode.	Press MODE/↓ or CAL/↑ to display the burnout mode you want to select. •
⑤ Establish the setting.	Press MEAS/ST-BY. • The setting is established and the screen becomes the state after "②" is operated. • When MODE/↓ is pressed here, the next item screen appears.
⑥ Return to the measurement mode.	Press MEAS/ST-BY for 3 seconds or more.

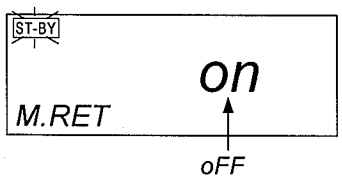
(9) Changing the measurement mode auto return

(a) The setting (on/off) of the measurement mode auto return function can be changed.

- Operation screen ··· "Measurement Mode Auto Return Setting" (M.RET) screen

(b) If "on" is set, the screen automatically returns to the measurement mode ("Concentration Measured Value Setting" screen) approx. 2 hours after it goes to the maintenance mode.

Procedure to Change the Measurement Mode Auto Return

Procedure and display example	Description
① Switch to the maintenance mode.	Press MEAS/ST-BY for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Measurement Mode Auto Return Setting" screen. 	Press MODE/↓ several times until "M.RET" appears on the sub display. • Main display ···The currently setting (on/off) of the measurement mode auto return function. on (on) ··· The measurement mode auto return function is enabled. oFF (off) ··· The measurement mode auto return function is disabled.
③ Make the screen ready for change.	Press CAL/↑ for 3 seconds or more. • "ST-BY" and the main display change from "lit" to "blinking" state.

(To be continued)

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Procedure and display example	Description
④ Select auto return on/off. ·····	Press [MODE/↓] or [CAL/↑] to display either one you want to select. • Setting range ··· on, oFF
⑤ Establish the setting. ·····	Press [MEAS/ST-BY]. • The measurement mode auto return is established and the screen becomes the state after "②" is operated. • When [MODE/↓] is pressed here, the screen returns to the initial screen, "Concentration Correction Setting" (%ADJ) screen.
⑥ Return to the measurement mode. ·····	Press [MEAS/ST-BY] for 3 seconds or more.

(10) Changing the concentration conversion data

(a) Concentration conversion data is preset at factory according to the ordered specification. Normally, you need not change this setting. If the currently set data is evidently unsuitable for the characteristics of the sample, the data can be changed within a range where "digit" shift will not happen.

• Operation screen ··· "Concentration Conversion Data Setting" (DATA) screen

(b) On the screen, each concentration conversion data is represented by the following symbols. For example, solution of concentration X1(%) has a conductivity of XT11 (mS/cm) at temperature T1 (°C). Concentration can be set at 6 points max. (X1 to 6). Sample temperatures can be set at 5 points max. (T1 to 5). Conductivity can be sets at 30 points max. (XT11 to 65).

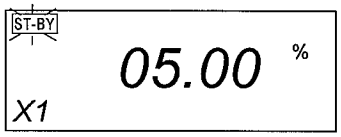
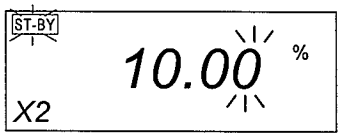
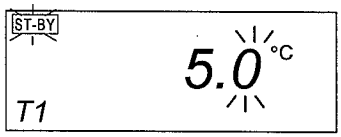
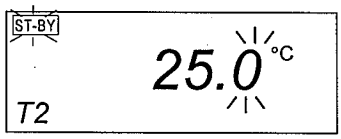
Temperature (°C)	T5	XT15	XT25	XT35	XT45	XT55	XT65
	T4	XT14	XT24	XT34	XT44	XT54	XT64
	T3	XT13	XT23	XT33	XT43	XT53	XT63
	T2	XT12	XT22	XT32	XT42	XT52	XT62
	T1	XT11	XT21	XT31	XT41	XT51	XT61
		X1	X2	X3	X4	X5	X6
		Concentration (%)					

Symbols for Concentration Conversion Data

(c) Before changing data, be sure to carefully confirm the new concentration conversion data is suitable. In addition, write down all data (X1 to 6, T1 to 5, XT11 to 65) beforehand so that they can be restored.

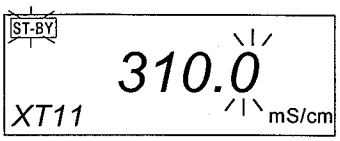
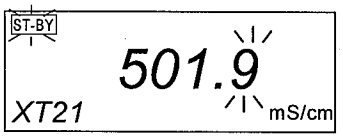
【IMPORTANT】
- Do not change the concentration conversion data, unless otherwise necessary.
- Be sure to write down the concentration conversion data before change. Once it is changed, the old data is erased.
- If the original concentration conversion data is unable to be restored, proper measurement will be impossible. Furthermore, 5.3 "Operation Check of Analyzer Using Equivalent Resistance" cannot be performed.

Procedure to Change the Concentration Conversion Data

Procedure and display example	Description
① Switch to the maintenance mode.	Press MEAS/ST-BY for 3 seconds or more in the measurement mode. • "ST-BY" lights and the "Concentration Correction Setting" (%ADJ) screen appears.
② Select the "Concentration Conversion Data Setting" screen. 	Press MODE/↓ several times until "DATA" appears on the sub display.
③ Make the screen ready for change.  Concentration X1 Setting Screen	Press CAL/↑ for 3 seconds or more. • "X1" appears on the sub display.
④ Enter a value for concentration X1.	Press MODE/↓ or CAL/↑ to display a new value for concentration X1. • Setting range ··· 0.00 to 99.99% • If you do not change the X1 value, this operation is not needed.
⑤ Establish the setting. 	Press MEAS/ST-BY. • Concentration X1 is established and the "Concentration X2 Setting" screen appears.
⑥ Change concentrations X2 to 6.  Temperature T1 Setting Screen	In the same manner as in ④ and ⑤, repeat input and establishment until concentration X6 has been changed. • When you have established the "Concentration X6 Setting" screen, the "Temperature T1 Setting" screen appears.
⑦ Enter a value for temperature T1.	Press MODE/↓ or CAL/↑ to display a new value for temperature T1. • Setting range ··· –5 to 120°C • If you do not change the T1 value, this operation is not needed.
⑧ Establish the setting. 	Press MEAS/ST-BY. • Temperature T1 is established and the "Temperature T2 Setting" screen appears.

(To be continued)

(Continued from previous page)

Procedure and display example	Description
⑨ Change temperatures T2 to 5. ·····	In the same manner as in ⑦ and ⑧, repeat input and establishment until temperature T5 has been changed. • When you have established the "Temperature T5 Setting" screen, the "Conductivity XT11 Setting" screen appears.
 Conductivity XT11 Setting Screen	
⑩ Enter a value for conductivity XT11. ·····	Press MODE/↓ or CAL/↑ to enter a new value for conductivity XT11. • If you do not change the XT11 value, this operation is not needed.
⑪ Establish the setting. ·····	Press MEAS/ST-BY. • Conductivity XT11 is established and the "Conductivity XT21 Setting" screen appears.
	
⑫ Change conductivities XT21 to 65. ·····	In the same manner as in ⑩ and ⑪, repeat input and establishment until conductivity XT65 has been changed. • When you have established the "Conductivity XT65 Setting" screen, the screen becomes the state after "②" is operated. • When MODE/↓ is pressed here, the next item screen appears.
⑬ Return to the measurement mode. ·····	Press MEAS/ST-BY for 3 seconds or more.

3.4 Adjustment of Transmission Output

(a) By fine-tuning the analyzer, the transmission output can be adjusted to the indication of the receiving device (recorder, etc.). Normally, this operation is not needed. This function can be used when indication adjustment cannot be performed at the receiving device side.

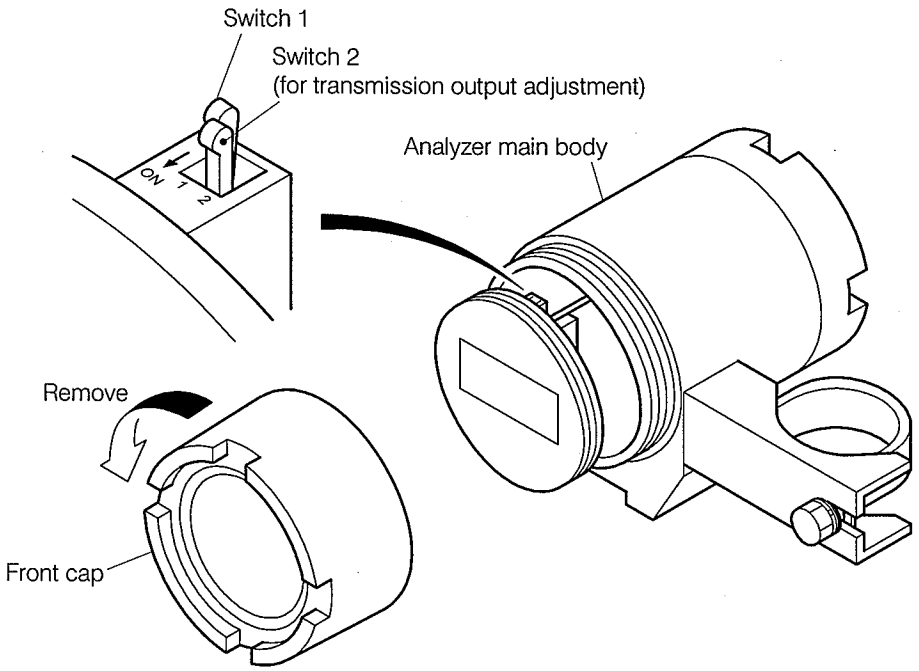
- Operation screen ····· "Transmission Output Adjustment 4mA" (4mA) screen
  "Transmission Output Adjustment 20mA" (20mA) screen

(b) This operation screen appears when Switch 2 in the front cap is switched to "ON". When you have finished this adjustment operation, be sure to reset Switch 2 to the "OFF" side (the opposite side of "ON").

Switch Positions

	ON	OFF
Switch 1 (spare)	—	Anytime
Switch 2 (for transmission output adjustment)	When transmission output adjustment is performed	When transmission output adjustment is not adjusted

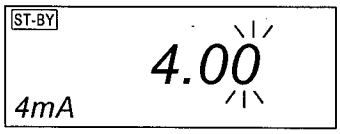
(c) By this operation, the transmission output changes to around 4mA and around 20mA. If this affects the control system, take measures in advance.



Adjustment of Transmission Output

①Turn on the switch. ····· Remove the front cap of the analyzer and set the switch to the "ON" side.

【IMPORTANT】
- While the front cap is removed, be careful so that raindrops and moisture will not get into the analyzer. This is for preventing insulation failure.
- Do not change the position of Switch 1. Switch 1 must always be set to the OFF side (the opposite side of ON).
- "ST-BY" lights and the "Transmission Output Adjustment 4mA" (4mA) screen appears.

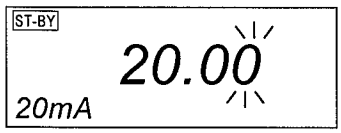


Transmission Output Adjustment 4mA Screen

②Adjust the 4mA side. ····· Press [MODE/↓] or [CAL/↑] to increase/decrease the value around 4mA on the display until the minimum scale value (zero) of the receiving device is met.

③Establish the 4mA side. ····· Press [MEAS/ST-BY] once.

- The transmission output value of the 4mA side entered in ② is established. Then the "Transmission Output Adjustment 20mA" (20mA)" screen appears.



Transmission Output Adjustment 20mA Screen

④Adjust the 20mA side. ····· Press [MODE/↓] or [CAL/↑] to increase/decrease the value around 20mA until the maximum scale value (span) of the receiving device is met.

⑤Establish the 4mA side. ····· Press [MEAS/ST-BY] once. The transmission output value of the 4mA side entered in ④ is established. Then the screen returns to the "Transmission Output Adjustment 4mA" (4mA) screen.

⑥Reset the switch to the original position. ····· Reset Switch 2 to the off (OFF) side and put back the front cap.

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 7.1(1) "Analyzer Installation location"). 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 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

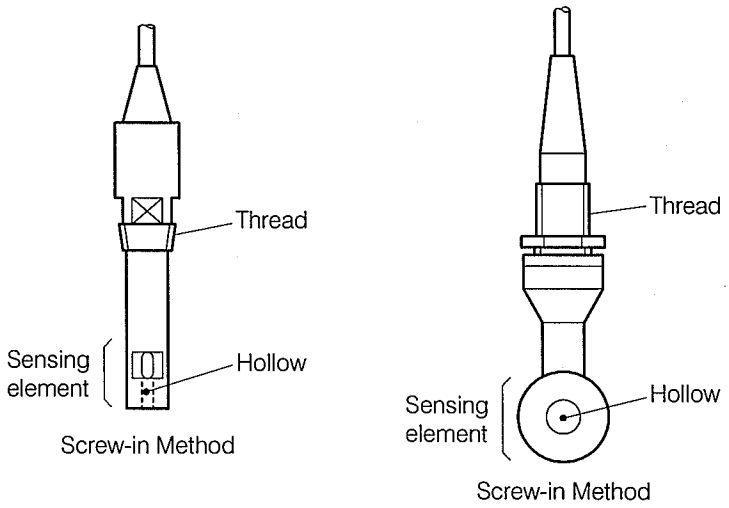
No.	Subject	Contents	Maintenance Cycle						Execution method, etc.
			1 week	1 month	3 months	6 months	1 years	When needed	
1	Sensor	Wash	○						▷ 4.2 "Washing the Sensor"
2	Sensor	Inspection of temperature element					○		▷ 4.3 "Inspection of Temperature Element"
3	Measurement system	Adjustment Using a Solution of Known Conductivity						○	▷ 4.4 "Adjustment Using a Solution of Known Concentration"

○ ····· Maintenance cycle to apply to

【NOTE】 • Normally, this analyzer does not require supplies.

4.2 Washing the Sensor

(a) The sensing element of the sensor detects conductivity that is the base of the concentration measured value. If the sensing element 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
• When dirt is not much, such as general process, boiler, etc.	Alcohol	Wipe off dirt from the sensing element using gauze, etc. soaked with ethyl alcohol.
	Neutral detergent	Wash the sensor with neutral detergent, etc. and rinse it off thoroughly with city water.
• When dirt is tough, such as process waste water with plenty of rust.	Cleanser	Apply cleanser to a cloth and polish the sensing element lightly with the cloth and rinse it off thoroughly with city water.
	Nitric acid solution	After immersing the sensing element in a cleaning solution for 5 to 10 minutes, wash it with city water thoroughly.
	Cleaning solution (diluted)	Soak the sensing element in a cleaning solution suitable for the dirt component, for 5 to 10 minutes and rinse it off thoroughly with city water.

(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.

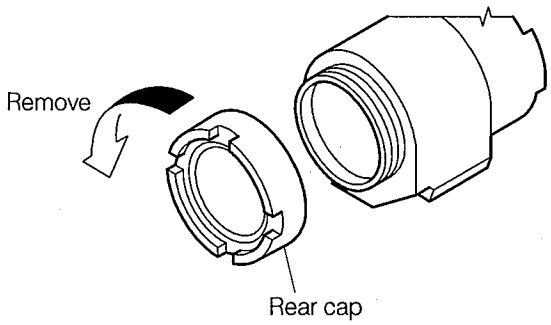
【IMPORTANT】
- To reassemble a screw-in type sensor, use new sealing material to the thread section. This is used to prevent liquid leak.
- When you assemble a sensor, make sure that the thread of the sensor mates correctly.

4.3 Inspection of Temperature Element

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

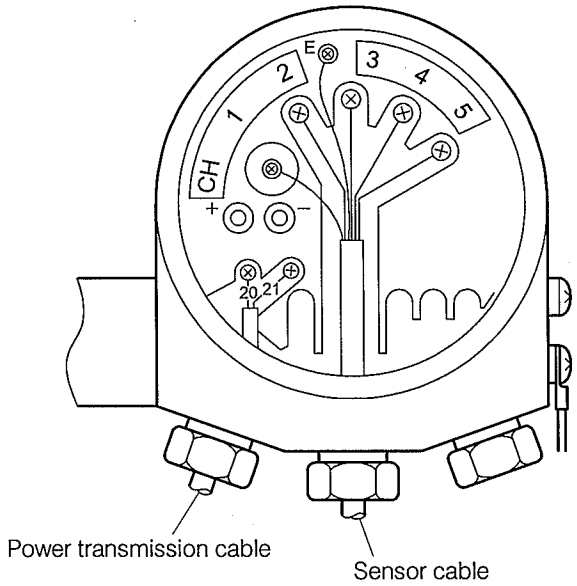
①Turn off the power source. ····· Turn off the power source that supplies power to the analyzer.

②Remove the rear cap. ····· Remove the rear cap of the analyzer by turning it counterclockwise.



Remove the Rear Cap

③Remove the temperature element lead wires ····· From the analyzer terminal board, remove sensor cable lead wires "3, 4".



Terminal board of Analyzer

④ **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.

⑤ **Check the temperature.** ····· Check the temperature of sample solution using a bar thermometer, etc.

⑥ **Compare the resistance value.** ····· Obtain the guideline resistance value of the temperature element corresponding to the temperature of sample solution measured in Step ⑤ and compare the value with the resistance value written down in Step ④ 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.

⑦ **Reinstallation** ····· Connect the sensor cable as it was before and re-install the rear cap, and supply 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. Both the concentration and temperature must be within the set concentration conversion data (linear approximate expression) range. ⇨ 3.3(10) "Changing the concentration conversion data"

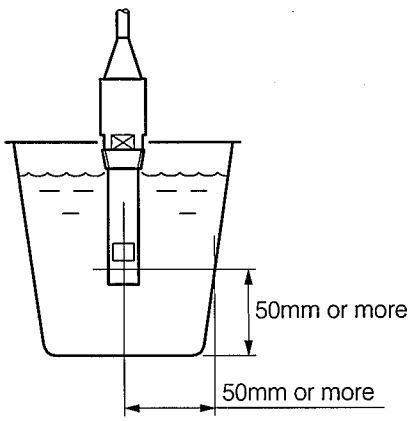
①Wash the sensor. ····· Take out the sensor and wash it thoroughly. This is needed because if the sensor is dirty, an error occurs. ⇨ 4.2 "Washing the Sensor"

②Check that the indicated value is zero. ····· Place the sensor in the open air and check that the indicated value is nearly "0".

【IMPORTANT】
- During calibration, keep the temperature to the temperature used to obtain the temperature of concentration-known solution.
- The concentration of the solution changes by absorbing the components in the air. Especially when its concentration is weak, the conductivity changes fast. Therefore, it is necessary to perform calibration quickly.

③Immerse the sensor in the solution. ····· Immerse the sensor in a solution of known concentration.

- In the case of a sensor with case, place the sensor in the case in the same manner as when measurement is performed and fill the case with water. At factory, the sensor is adjusted in this manner.
- Keep the center of the sensing element of the sensor with no case, at least 50mm away from the inside wall and bottom of the container.



Isolating Sensing Element from Inner Wall and Bottom of the Vessel by 50mm or more

④Adjust the indicated value. ····· ⇨ 3.3(2) "Changing the concentration correction"

⑤Rinse off the sensor. ····· Rinse off the sensor with clean water, etc.

⑥Reinstall 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 burnout function is enabled when "on.L" or "on.H" is set in 3.3 (8) "Changing the burnout."

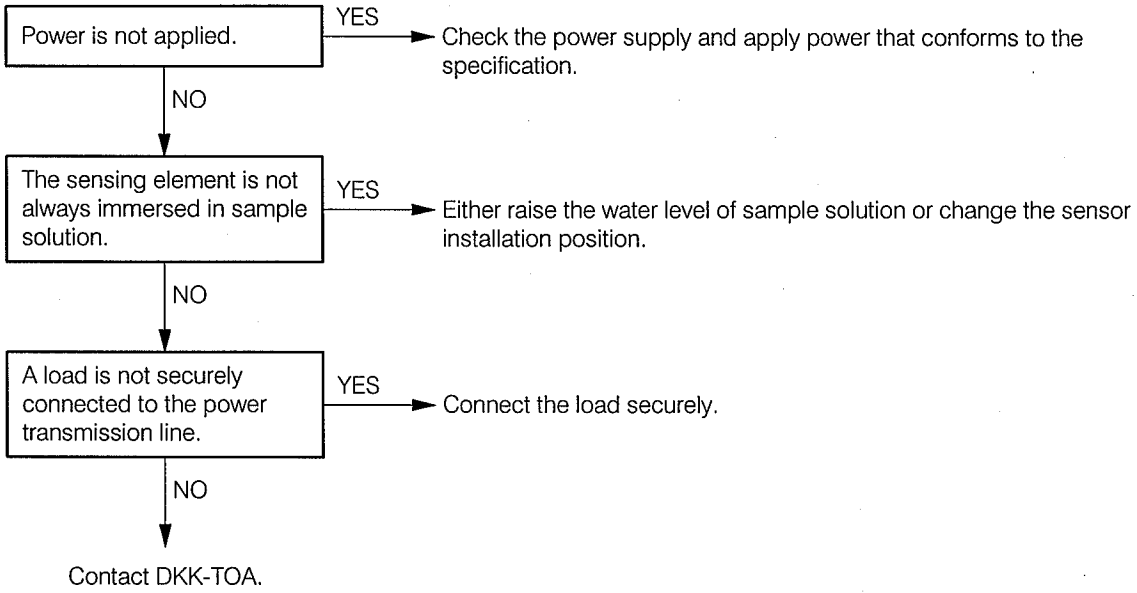
Error Messages and Corrective Action

No.	Display	Message name and contents	Corrective action, etc.
1	32.5	[Concentration scale-over] (Indication off-scale) • The analyzer enters in the scale-over state.	• Remove the abnormal sample. • 5.2(2) "Concentration is off the scale"
2	TEMP ⁂ ⁂ ⁂ ℃ (On the temperature measured value display, 3 decimal points blink.)	• The temperature compensation element or the sensor cable was short-circuited or disconnected. • The burnout function operates.	• Connect the sensor cable correctly. • Replace the sensor.
3	ROM E-20	[Storage element error] • Setting data calling failed immediately after the power supply is turned on, and this situation was judged as an error. • The burnout function operates.	• If the normal state cannot be restored when the power supply is turned on, contact DKK-TOA
4	DATA E-21	[Setting data error] • The setting data was checked immediately after the power supply is turned on, and the status was judged as an error. • The burnout function operates.	• If the normal state cannot be restored when the power supply is turned on, contact DKK-TOA.

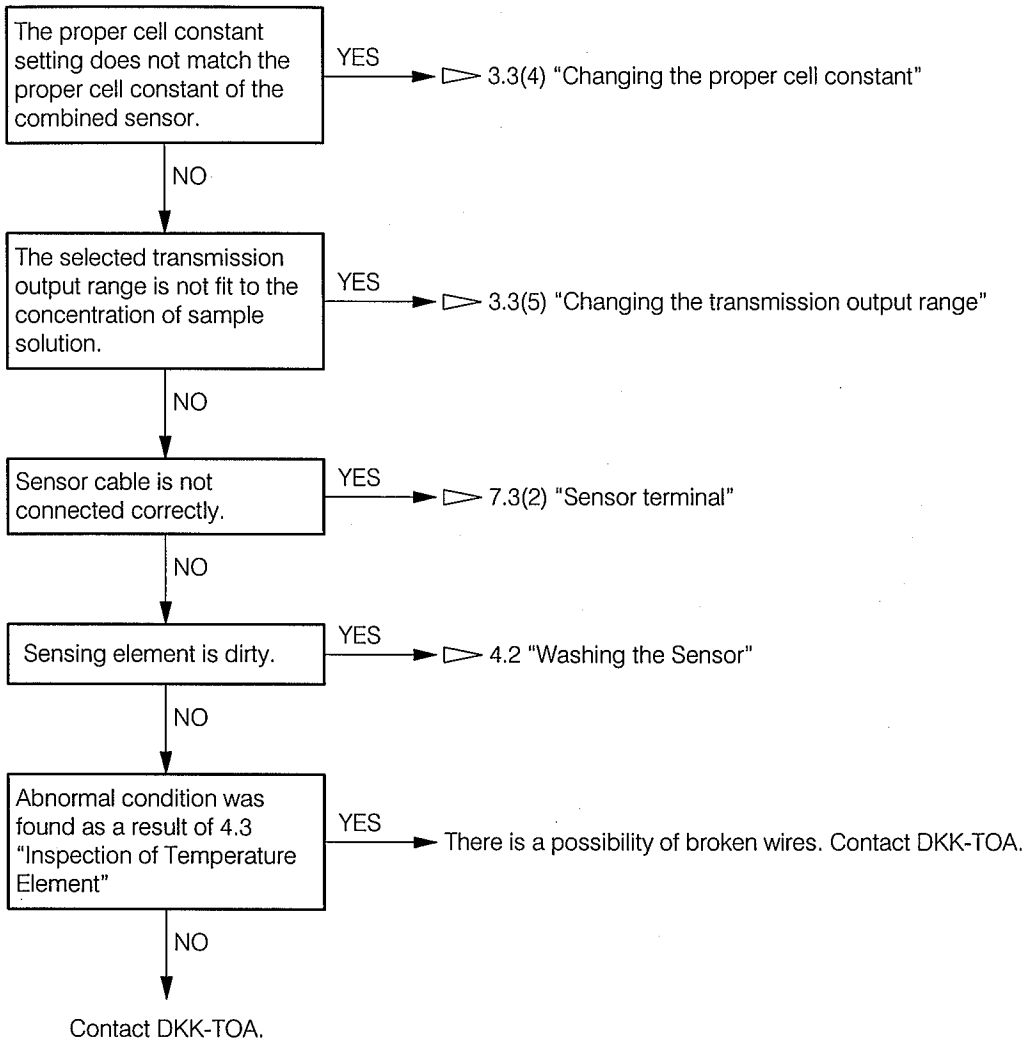
5.2 Troubleshooting

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

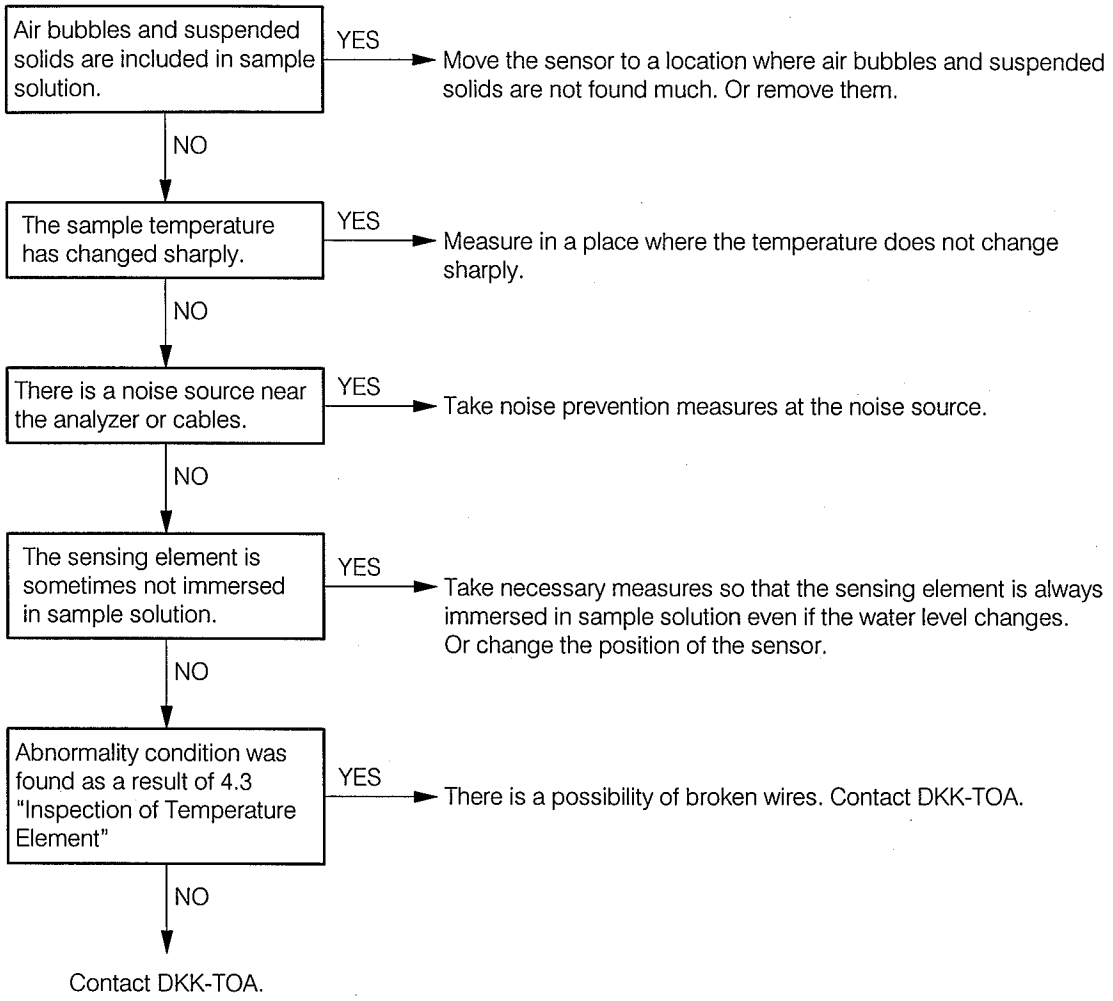
(1) No indication or indication does not change



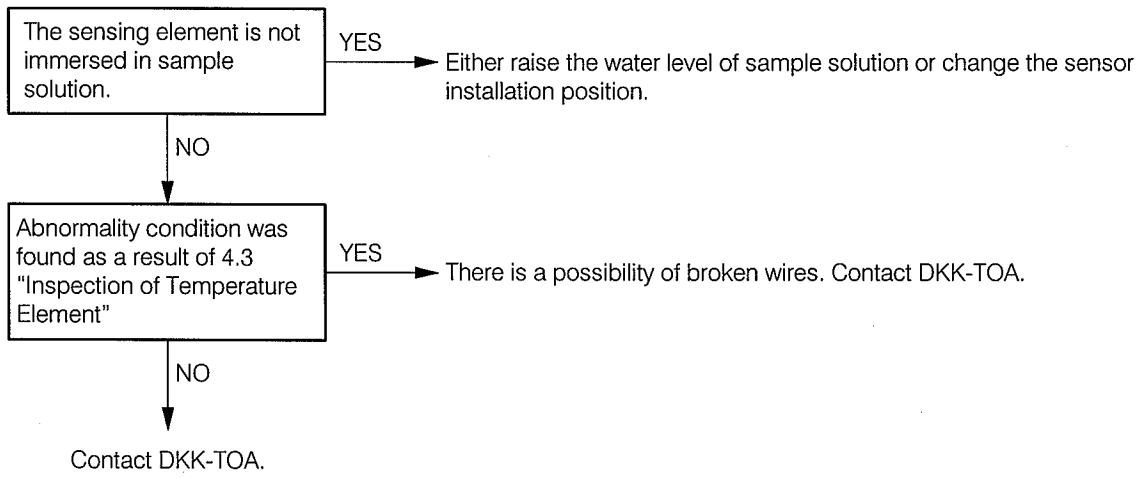
(2) Concentration is off the scale



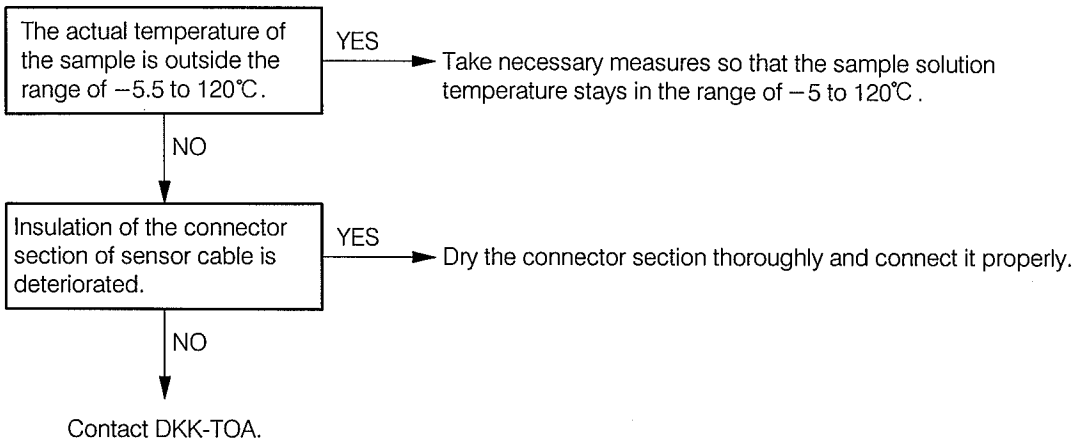
(3) Fluctuation of concentration value



(4) A large deviation of concentration



(5) Temperature scale-down or scale-over



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 "Concentration Conversion Data Setting" (DATA) screen is changed, this operation cannot be performed because the concentration conversion data differs from the numeric value in the inspection Record.

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 induction type for a dial-type variable resistor. Due to the influence of inductance, the indication may show an error.

<Recommended variable resistors>

• Dial-type variable resistor Model 2786 (Yokogawa Electric Corporation)

• 6-dial type decade standard register ADR series (Alpha Electronics Corp.)

②Write 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. If the transmission output range does not match the values described in the inspection record, adjust the range.
▷ 3.3(5) "Changing the transmission output range"

- "Proper Cell Constant" screen
- "Transmission Output Range 4mA" (4mA) screen
- "Transmission Output Range 20mA" (20mA) screen

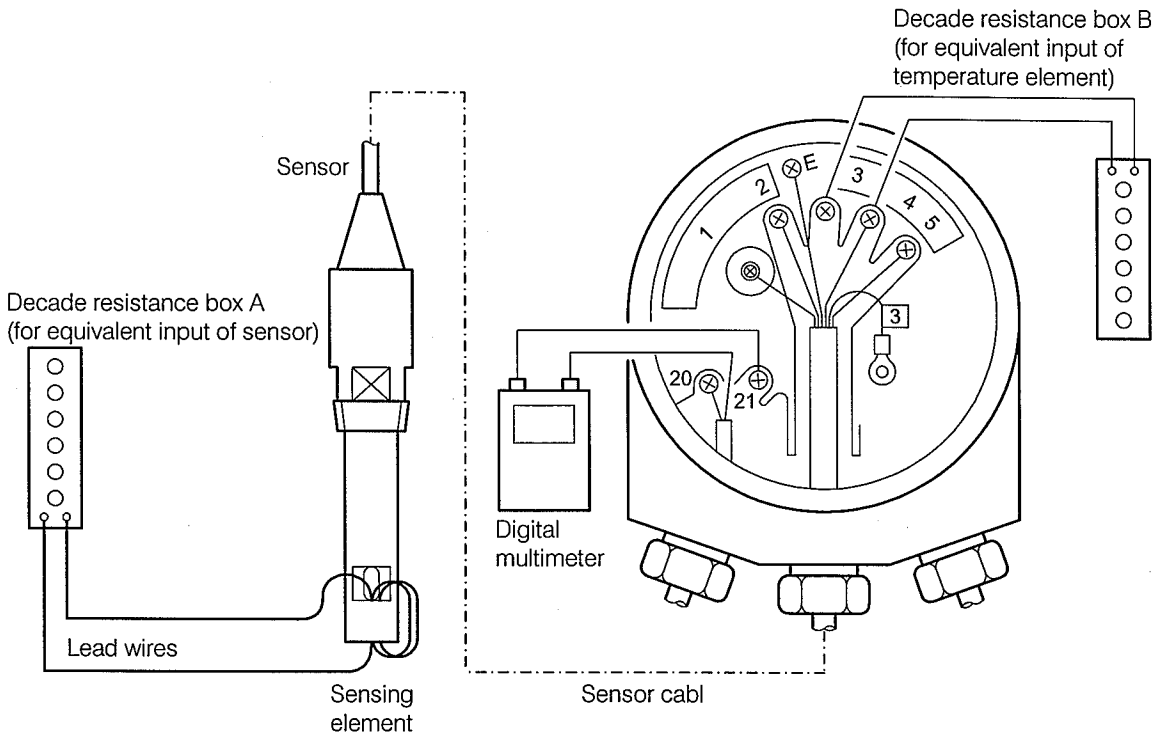
③Turn off the concentration correction function and sample temperature shift function. ····· ▷ 3. 3(2) "Changing the concentration correction", 3.3(3) "Changing the sample temperature shift"

④Turn off the power supply and remove the lead wires. ····· Turn off (OFF) the power supply to the analyzer and remove the lead wires connected to terminals "3" and "21" on the terminal board.

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

⑥Connect 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 sensing element. Wind the lead wires of a 6-decade resistance box N times to the hollow section of the sensing element. If nothing is described, use "1 turn" (the lead wire is put through the tip end of the sensor without being wound up).

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



Connecting the Devices for Operation Check

⑦Change the setting value in the "Proper Cell Constant" screen to the reference cell constant. ····· Turn on (ON) the power supply to the analyzer and change the setting value in the "Proper Cell Constant" (/cm) screen (maintenance mode) to the reference cell constant (design cell constant, the value of "cell constant" in the Inspection Record. ▷ 3.3(4) "Changing 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

⑧Select "Concentration Measured Value" screen. ····· If the analyzer is in the maintenance mode ("ST-BY" is lit), press [MEAS/ST-BY] longer. If the analyzer is in the measurement mode ("ST-BY" is unlit), press [MODE/↓] several times to select "Concentration Measured Value" screen.

⑨Enter 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.

⑩Enter 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.

⑪Check 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.

⑫Enter 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:

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

N ···· Number of windings for the hollow of the sensing element

Example: Reference cell constant: 9.00/cm (same with $9.00cm^{-1}$)
Conductivity for 20mA value: 876mS/cm
N: 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(4) "Changing the proper cell constant" and 3.3(5) "Changing the transmission output range"

⑮ **Concentration correction and temperature shift.** ····· Restore the setting if "on" was changed to "oFF" in Step ③. ▷ 3.3(2) "Changing the concentration correction", 3.3(3) "Changing the sample temperature shif"

⑯ **Remove the devices.** ····· Turn off (OFF) the power supply once. Remove the digital multimeter and dial-type variable resistor, etc. and connect the lead wires "3" and "21" of the sensor cable as it were before.

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 board cover.** ····· Install the terminal board cover and turn on (ON) the power supply.

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 ±1500Vp-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. ▷ 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 Operational Explanation

6.1 Standard Specifications

(1) Analyzer specifications

(a) Basic specifications

Product name	:	Electrodeless Concentration Analyzer
Model name	:	MDM-137A
Measurement object	:	Converts the conductivity of the solution to concentration.
Unit	:	%, mS/cm
Measurement method	:	Linear approximate concentration conversion by electromagnetic induction-type conductivity measurement.
Measured value display method	:	4-digit digital LCD with sub display and unit indicator.
Reference cell constant	:	9.00/cm or 2.60/cm Sensors of other cell constants cannot be combined with this analyzer.
Entire measuring range (display)	:	Concentration····· 0.000 to 4.000% or 0.00 to 99.99% (depends on the ordered specification.) Conductivity ····· Automatically selected by concentration conversion data setting 0.000 to 2.100, 0.00 to 7.00, 0.00 to 21.00, 0.00 to 70.0, 0.1 to 210.0, 0 to 700, 0 to 2100mS/cm Temperature ····· –5 to 120°C (depends on the heat resistance of the sensor.)
Measuring range	:	Depends on the ordered specification. (The range can be varied conditionally by concentration conversion data.)
Transmission output signal	:	Analog, corresponding to the concentration measured value. Type····· Input/output, isolated from ground Signal type····· 4 to 20mADC Load resistance ··· 650Ω max. (when the power supply voltage is 24VDC) Ripple ····· Peak value 0.3%FS max.
Temperature compensation method	:	Linear approximate microcomputer calculation method
Temperature compensation element	:	30kΩ (at 25°C), thermistor
Temperature compensation range	:	Depends on the ordered specification (concentration conversion data).
Temperature compensation coefficient	:	Depends on the ordered specification (concentration conversion data).

Power supply voltage and maximum load resistance	:	24VDC ±10%. Maximum load resistance 650Ω (when the power supply voltage is 24V) Maximum load resistance (Ω) = 50 × power supply voltage – 550
Power consumption	:	0.6VA
Allowable ambient temperature/humidity	:	(1) Performance guarantee range ····· –20 to 55°C, 0 to 99%RH (no condensation)
		(2) Operation guarantee range ····· –30 to 65°C, 0 to 99%RH (no condensation)
		(3) Transportation/storage guarantee rang ··· –30 to 70°C, 0 to 99%RH (no condensation)

(b) Performance (by equivalent input)

Linearity	:	Concentration ····· ± 3.0%FS max. (equivalent input test, however, varies depending on the concentration conversion data.)
		Conductivity ····· ± 0.5%FS max. (equivalent resistance input test)
		Temperature ····· ± 0.3°C max. (equivalent resistance input test)
Repeatability	:	Concentration ····· ± 0.2%FS max. (equivalent resistance input test, however, varies depending on the concentration conversion data.)
		Conductivity ····· ± 0.2%FS max. (equivalent resistance input test)
		Temperature ····· ± 0.1°C max. (equivalent resistance input test)
Temperature compensation accuracy	:	Concentration ····· ± 3.0%FS max. (equivalent resistance input test, however, varies depending on the concentration conversion data.)
Stability	:	Concentration ····· ± 0.3%FS/24h max. (equivalent resistance input test)
Fluctuation	:	± 0.2%FS + 1 digit/min max. (equivalent resistance input test)
Transmission ripple	:	± 0.3%FS max.
Response	:	Conductivity ····· 0 to 90%FS, 60 sec max. (equivalent resistance input test)

(c) Function

Cell constant adjustment	:	–10 to 50% of the reference value. Can be varied by key operation.
Conductivity measured value adjustment	:	Can be varied by key operation within the range of –10 to 50% of the reference value. However, must be within the range of "cell constant adjustment".
Temperature measured value adjustment	:	± 5°C. Can be varied by key operation.
Transmission output	:	Can be adjusted within the range of 4 to 20mA by key operation.
Transmission output in the maintenance mode	:	One of Hold, dummy and through can be selected by key operation.

(d) Structure, etc.

Sensor	: 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-4G
Sensor cable	: (Option) Model EC-11 (up to 10mm is allowed when the connector box is used)
Connection terminal	: M4
Cable port	: G3/4 3 places
Structure	: Outdoor installation, IP55 (optionally, IP65 is allowable.)
Dimensions and installation method	: 118 × 129 × 178 (main body), 50A pipe mounting
Mass	: Approx. 3kg
Material	: Main body···· Aluminum Window····· Plastic
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) Specifications of Model ME-111 sensor

Product name and model name	: Electrodeless concentration sensor Model ME-111
Measurement target	: Conductivity of general water, acid, alkali, salt solution, etc.
Measurement method	: Electric conductivity measurement using electromagnetic induction.
Reference cell constant	: 9.00/cm
Temperature element	: Thermistor, 4 to 10min for 90% response (depends on flow rate condition.)
Sample condition	: Temperature ···· 0 to 100°C (Solution contacting material: PFA) 0 to 65°C (Solution contacting material: Heat resistance PVC) Pressure ····· 0.5MPa max. (Solution contacting material: PFA) 0.3MPa max. (Solution contacting material: Heat resistance PVC) Flow rate····· 2m/s max.
Ambient temperature	: −10 to 60°C
Mounting method	: R3/4 screw-in
Sensor cable	: 5m
Mass	: Approx. 0.4kg

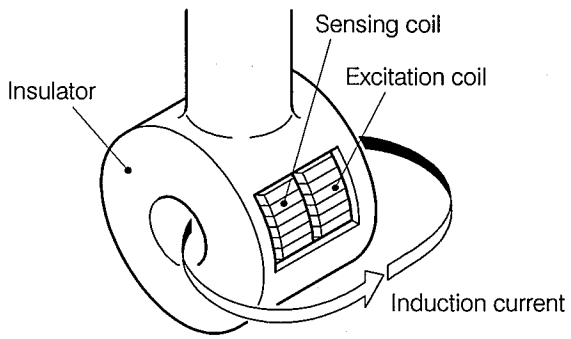
(b) Specifications of Model ME-11T

Product name and model name	: Electrodeless concentration sensor Model ME-11T-1-0
Measurement target	: Conductivity of general water, acid, alkali, salt solution, etc.
Measurement method	: Electric conductivity measurement using electromagnetic induction
Reference cell constant	: 2.60/cm
Temperature element	: Thermistor, 4 to 10min for 90% response (depends on the flow rate condition.)
Sample condition	: Temperature ····· –10 to 150°C (Solution contacting material: PFA) Pressure ····· 2.0MPa max. (Temperature 150°C: 1.0MPa max.) Flow rate ····· 5m/s max.
Ambient temperature	: –10 to 60°C
Mounting method	: G3/4 screw-in
Sensor cable	: 5m
Mass	: Approx. 0.5kg

6.2 Principle of Operation

(1) Principle of sensor

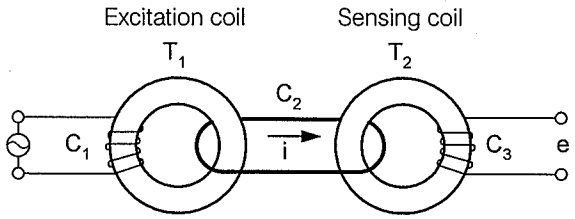
The sensor is structured with two transformers placed one on top of another in a insulator case and this structure is immersed in a sample solution to measure the electrical conductivity of the sample using electromagnetic induction.



Structure of Sensor

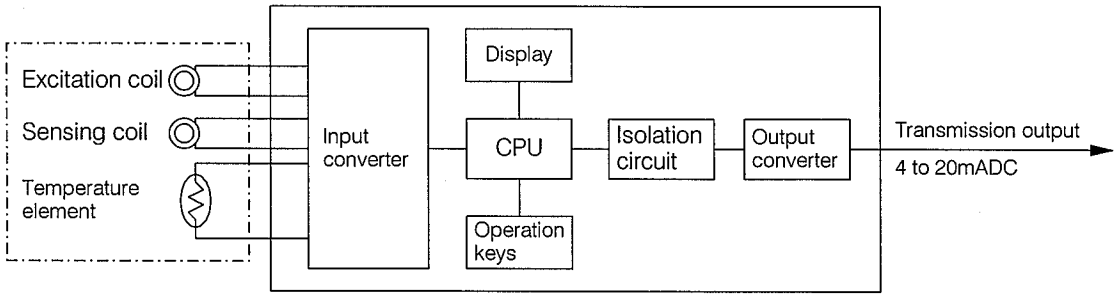
If T_1 and T_2 coils are placed as transformers in a sample solution as shown in the diagram "Principle of Sensor," the sample solution, in equivalent circuit, forms a 1-turn circuit intercrossing T_1 and T_2. If an AC current is made to flow in the primary circuit C_1, an induced current i flows in C_2, which is proportional to the electrical conductivity 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 conductivity of the solution and by measuring the voltage e, the conductivity of the sample solution can be obtained.



Principle of Sensor

(2) Analyzer operation



Measurement System

The analyzer performs calculation as follows. The input transmitter receives conductivity measurement and temperature signals from the excitation and sensing coils and converts these signals, respectively. The CPU (central processing unit) reads these signals and calculates the conductivity value at the conversion temperature (normally 25°C). Then the conductivity is converted to concentration based on the concentration conversion data and output on the display. At the same time, the value is sent to the output transmitter via the isolation circuit and converted to a transmission output signal of 4 to 20mADC.

7. Installation

7.1 Analyzer Mounting

(1) Analyzer Installation location

Install the transmitter 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.

(e) A location where sea water or chemicals are not sprayed.

(f) A location without vibration.

(g) A location without corrosive gasses.

(h) A location where drops of water are not sprinkled.

⚠ WARNING

Hazardous Gasses

- Do no 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.

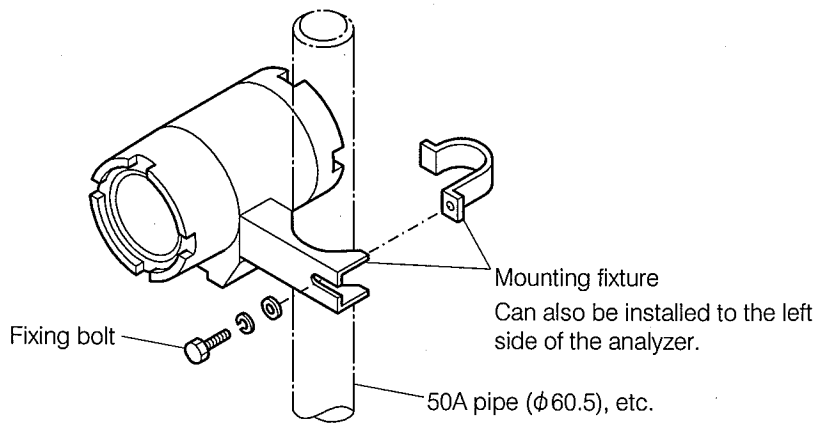
(2) Installing the Analyzer

Install a mounting fixture to the 50A pipe, etc., as shown in the figure below.

(a) When the analyzer is installed 1.3 to 1.5m above the floor, readout or other work is easy to perform.

(b) Reserve a space of at least 100mm between the rear face of the analyzer and the surrounding object. This makes maintenance work easy to perform.

(c) Mount the analyzer so that its top surface will be level.



Installing the Analyzer

7.2 Sensor Mounting

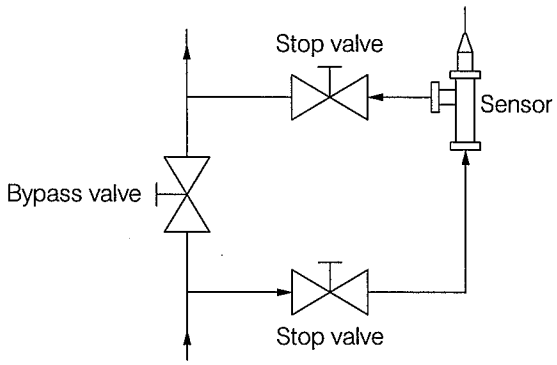
(1) Key points of sensor mounting

(a) Install the sensor in a location that meets the following conditions.

- Maintenance space can be reserved and work can be easily performed.
- The ambient temperature and the temperature of sample do not exceed the specified range (described in the delivery specifications).
- The temperature of sample does not change quickly.
- There is no equipment that generates electric noise nearby.
- The flow rate does not exceed the specified range (described in the delivery specifications).
- Vibration-free location.

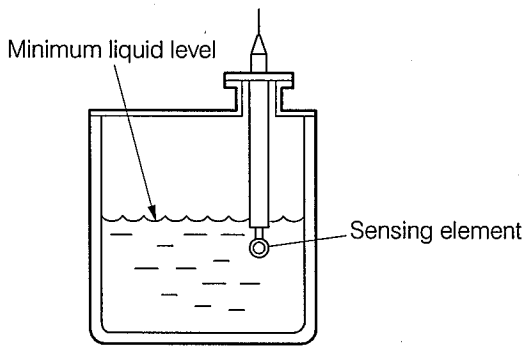
(b) If the sensor is provided with a case, use the specified types of bolts and packing.

(c) 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

(d) Even if the liquid level varies, the sensing element must always be immersed in sample solution.



Sensing Element and Minimum Liquid Level

(e) If a noise current flows through the sample solution or piping, an error may occur. Therefore, sample solution must be grounded in some way.

(f) 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.

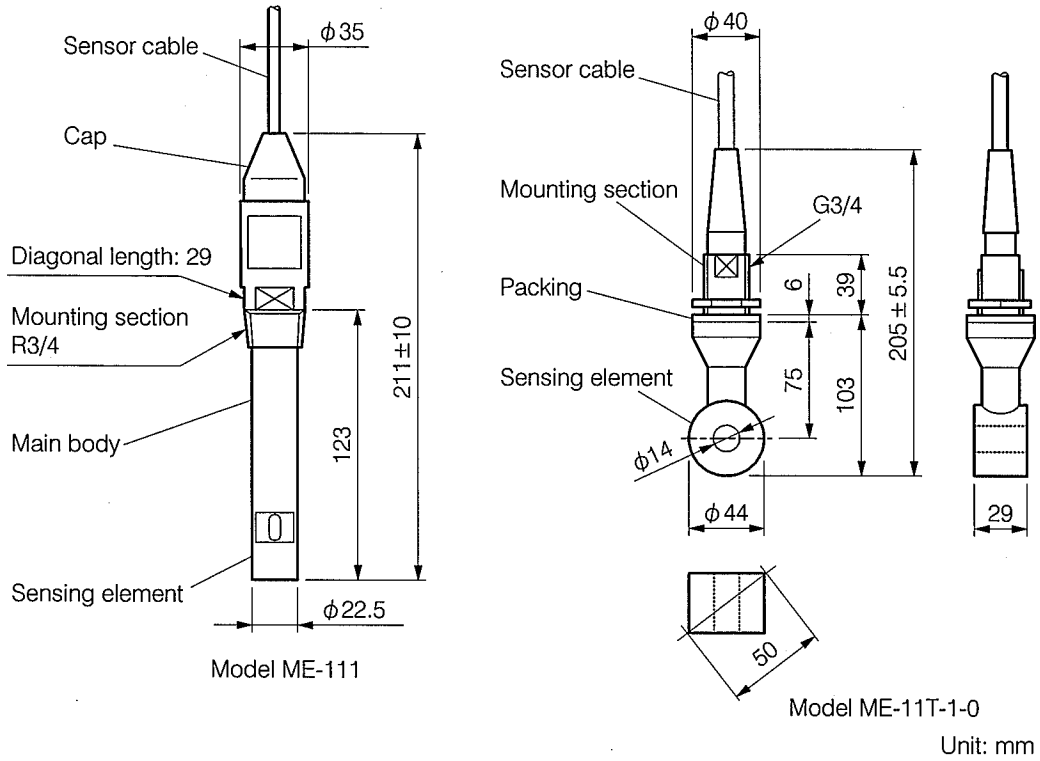
(g) The flow rate around the sensing element of the sensor with case must not exceed the specified range. The flow rate does not directly affect the measured value. However, if the flow rate is large,

air bubbles are easy to be generated. On the contrary, if the flow rate is small, the indication will be slow.

(h) Do not allow solids to flow into sample solution, which may scratch or damage the sensing element.

(2) Examples of sensor installation

(a) The following types of sensors are provided; screw-in type, flange type and sensor with case. The solution contacting material may differ depending on the type. Mount the sensor referring to the delivery specifications, etc. The following figure shows examples of dimensions of screw-in type sensors.



Dimensions Examples of Screw-in Type Sensors

【IMPORTANT】
- Do not apply strong shock to the extent the sensing element 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.

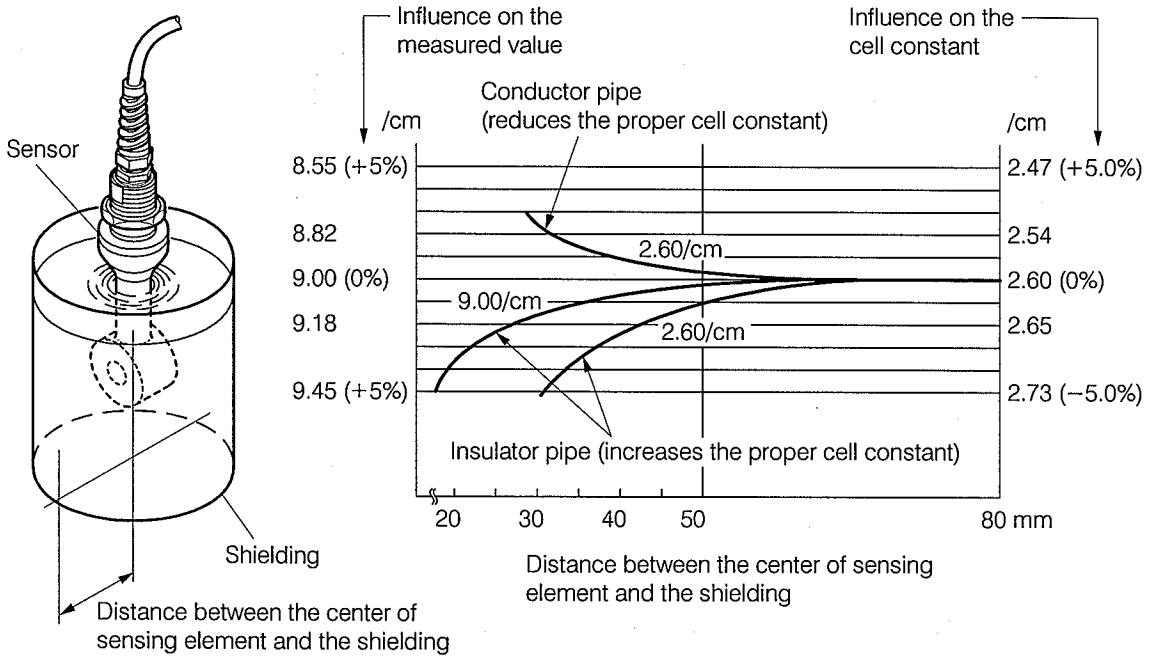
(b) If the mounting section is made of resin, the opposite side must also be made of resin. If it is made of metal, select the opposite side which is made of metal. This is needed to prevent liquid leak.

(c) 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 sensing element and a shielding object (conductor or insulator) is 50mm (inner diameter ϕ100mm) 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.

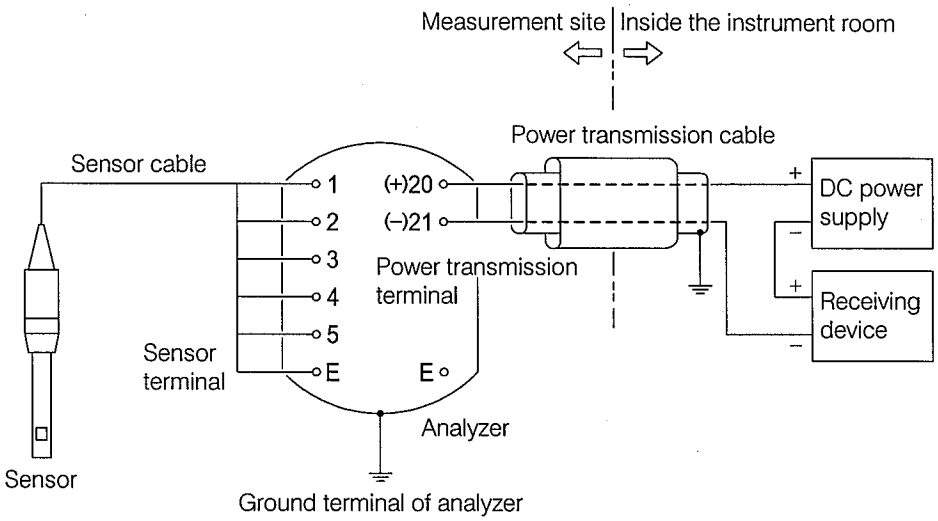
(Example) Sensor reference cell constant: 2.60/cm
Type of shielding: Conductor pipe (metal)
Distance between the center and the shielding: 50mm (inner diameter ϕ100mm)

①Check the cell constant affected by shielding. ····· Read the cell constant (approx. 2.59/cm) when the distance between the center of the sensing element and the shielding is 50mm referring to the diagram "Effect of Sensor Cell Constant by Shielding Object."

②Adjust the proper cell constant. ····· Open the "Proper Cell Constant Setting" screen in the setting mode and set the cell constant affected by shielding. ▷ 3.4(4) "Changing the proper cell constant"

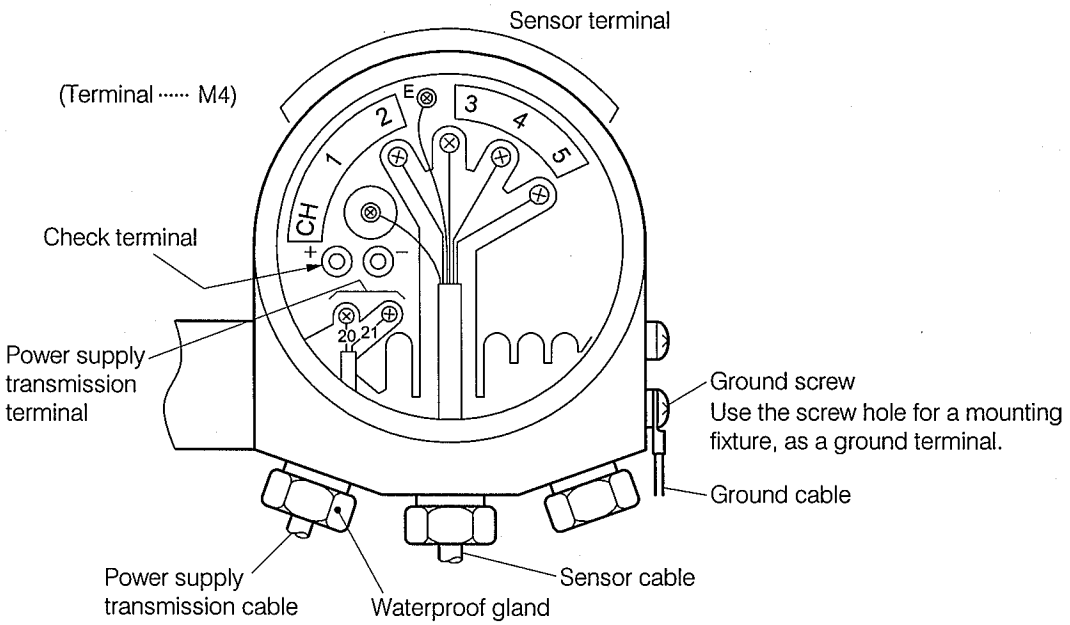
7.3 Wire Connection

(1) Connection diagram and terminal board



Connection diagram

【IMPORTANT】
- It is recommended to use a conduit pipe for wiring. When using a conduit pipe, because the sensor may be removed for maintenance work, use a flexible metal conduit pipe in a range of approx. 1m around the analyzer and the sensor. ▷ 7.3(6) "Wiring with a conduit pipe"
- To connect the sensor to the analyzer, user a "ϕ4" crimping terminal.



Terminal Board

(a) Each terminal number indicates the following:

1, 5: Sensing transformer

2, 4: Excitation transformer

3, 4: Temperature element

E: Shield (ground)

20(+), 21(–): Power input, transmission output

(b)The check terminals are used to check the current signal of the power transmission cable in a simplified manner. For this checking, use a digital multimeter with internal resistance 10Ω max.

(2) Sensor terminal

(a)Connect the sensor cable to the sensor terminal of the analyzer.

(b)Connect to match the terminal number of each lead wire of the sensor cable with the number of the sensor terminal. ▷ 7.3(5) "Installation of waterproof gland"

【IMPORTANT】
- If the terminal of the sensor cable gets wet or gets dirty due to oil and grim off of hands, it may cause unstable indication. Always keep it dry and clean. If it gets dirty, wipe it off with high-purity alcohol and dry it thoroughly.
- Do not use a jointed cable. Be sure to use one sensor cable long enough.

(c)Do not cut the sensor cable. If it is cut, terminal treatment must be performed again. If it must be cut necessarily, ask a technical service company to do terminal treatment for you. This is because the terminal treatment is relatively complex, requiring preparations for crimping terminals and insulated tubes. Ask the technical service company to do terminal treatment properly in the same manner as for the delivered sensor cable.

【IMPORTANT】
- For terminal treatment of the sensor cable, ask a technical service company to do it. If terminal treatment fails, measurement cannot be performed correctly.

(3) Power transmission terminal

(a)Connect the analyzer terminal board "20 (+), 21 (–)" with DC power supply and receiving device (recorder, etc.) using a 2-core shielded cable.

(b)Provide a power switch outside the analyzer so that the power supply can be turned off (OFF) at the power source side.

【IMPORTANT】
- Do not supply voltage power higher than the specified range. The analyzer will be damaged.
- Do not mistake the polarity. 20····+, 21·····–

(4) Ground terminal of analyzer

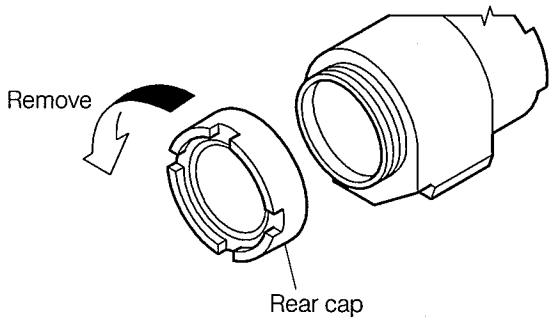
(a) Ground the ground screw on the side face of the case or the ground terminal (E) in the analyzer. Use the D type grounding method (ground resistance 100Ω max.). Avoid sharing the ground with power equipment.

(b) If the analyzer cannot be grounded near the installation site, it is possible to ground at the power source side. Use a power transmission cable 3-core instrumentation cable and connect the ground core wire to a ground terminal "E" on the terminal board.

(5) Installation of waterproof gland

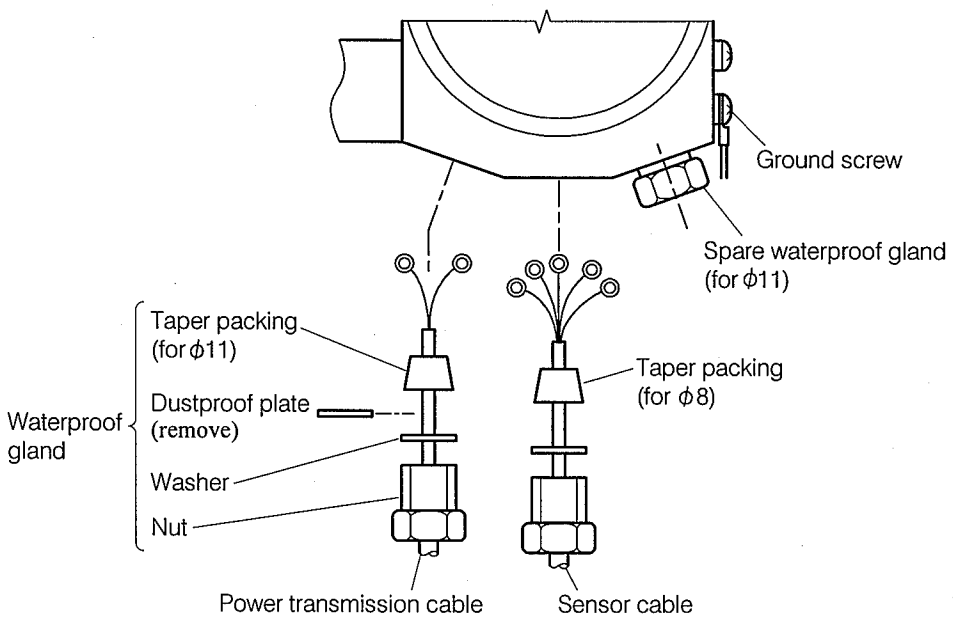
①Confirm that the power supply is off. ····· Confirm that the power supply to the analyzer is turned off.

②Remove the rear cap. ····· Remove the rear cap of the analyzer by turning it counterclockwise. Remove the insulation cover.



Removing the Rear Cap

③Install the waterproof gland. ····· Remove the left and middle waterproof glands out of 3 waterproof glands and put the cables through respective glands, as shown in the figure below:



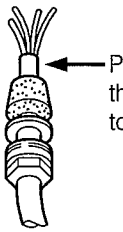
Installation of Waterproof Gland

Left waterproof gland (for ϕ11 cable): Put the power supply cable through this gland.

Middle waterproof gland ((for ϕ8 cable): Put the sensor cable through this gland.

Right waterproof gland ((for ϕ11 cable): Spare

【IMPORTANT】



- To keep airtight, put the cable through the gland fully until the outside of the cable comes to the top of the taper packing.
- Use a cable suitable for the taper packing size. If not suitable, the airtightness in the analyzer cannot be kept. This will cause insulation degradation.
- Do not perform wiring in rain. It will cause insulation degradation. If rainwater gets into the cable, the temperature inside the analyzer will be high.
- Be sure to keep the terminal of each cable dry and clean.

④**Connect to the analyzer.** ····· ▷ 7.3 (1) "Connection diagram and terminal board"

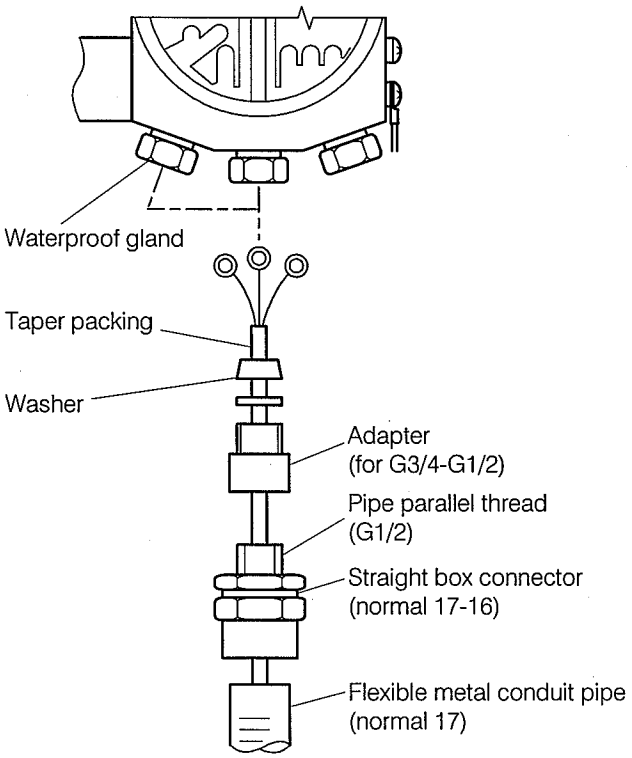
⑤**Tighten the waterproof gland.** ····· Tighten the waterproof gland to keep airtight.

⑥**Install the cap, etc.** ····· After checking the connection to the terminal board again, install the rear cap.

(6) Wiring with a conduit pipe

(a)It is recommended to use a conduit pipe for connection. When using a conduit pipe, use a flexible metal conduit pipe, in the range of approx. 1m around the analyzer and the sensor.

(b)Each cable port of the analyzer is a pipe parallel thread (G3/4). When using a box connector for flexible metal conduit pipe (normal 17-16) (G1/2), use an adapter between them.

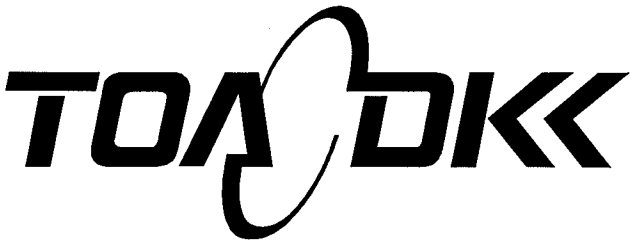


Piping with Flexible Metal Conduit Pipe

Revision History

Instruction Manual No. MDM-IB45201E	11/21/2006/ (NC)	New Version in English

YDKK (NC)



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