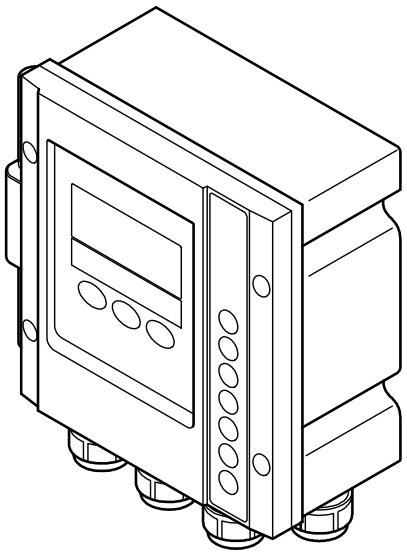
INSTRUCTION MANUAL

DISSOLVED OXYGEN ANALYZER

MODEL OBM-162A

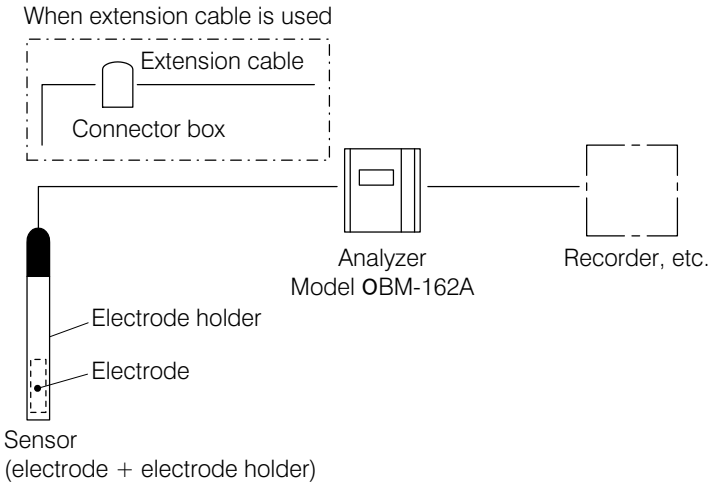


- Please keep this instruction manual close at hand of the persons who are in charge of the operation of this product.
- Before operating this product, please read this instruction manual carefully for its correct handling.

No. OBM-IB54801E

Introduction

(a) Thank you for your purchase of our product. The Model OBM-162A Dissolved Oxygen Analyzer (hereafter called the analyzer or the product) is an indicating analyzer in a measurement system to measure the dissolved oxygen (DO) in various solutions.



Example of Measurement System

(b) The full DO measuring range is 0.00 to 50.00mg/L. Though the measuring range can be arbitrarily selected within this range, the range is normally set according to the ordered specification. The power supply voltage is 100 to 240VAC ±10%. For other specifications, refer to 6.1 "Specifications".

(c) The following screens are provided. Among them, DO measured value and temperature measured value are sent out as transmission output.

DO Measured Value Screen (unit: mg/L) ····· Dissolved oxygen concentration in water

O_2 Measured Value Screen (unit: %)····· Oxygen (O_2) concentration in the air

SAT Measured Value Screen (unit: %) ····· Saturation ratio of dissolved oxygen in water (hereafter called SAT)

Temperature Display Screen (°C) ····· Temperature in water

(d) This analyzer is adjusted to conform to electrodes with the following temperature element.

- Temperature element of 10kΩ/25°C (thermistor) ····· Models 7533L, 7536L, 7540L, etc.

(e) To detect breaking of the diaphragm, the analyzer must be combined with a Model 7540L electrode and Model ELW-067 connection lead wire (options).

(f) Since this manual mainly explain about the analyzer, refer to the instruction manual attached to the sensor for the sensor combined with the analyzer.

(g) The product may indicate or output an incorrect measured value due to the following reasons. We recommend preparing a system such that the related facilities will not be damaged even in cases 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

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

(i) 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

The signal terminology and symbols related to warnings in the instruction manual are defined below. The alert symbol mark (⚠: General caution mark) indicates the possibility of hazard or damage and 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 injury or property damage if you fail to operate the product properly.
Injury means an injury not requiring hospitalization or long periods of outpatient treatment and refers to burns or electric shock. Property damage refers to widespread damage to the home, household goods and livestock, pets, equipment, materials, etc. (damage to other than the product itself).

【IMPORTANT】: Indicates important matters other than ⚠WARNING and ⚠CAUTION. They are the matters such as preventing damage to the product main body, preventing data destruction, preventing wasting time, maintaining performance, and observing regulations.

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

＞＞: Indicates reference items.

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

(2) Safety compliance items

⚠WARNING

Hazardous Gasses

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

Electric Shock

- Do not touch the terminals inside the product while power is applied. Touching the terminals can cause electric shock.
- The ground terminal must be grounded. If the ground terminal is not grounded, electric shock can result if a problem occurs in the power system.

⚠ CAUTION

Disassembly and Modification

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

Warning Label Lost

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

(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) For easier comprehension, 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.

Warranty

(1) Warranty Coverage

DKK-TOA Corporation (DKK-TOA) warrants its products against defective material or workmanship for the warranty period.

(a) The warranty period is one year from the date of delivery to the original user. If the date of delivery cannot be specified, the warranty period is 24 months from the month following the date of manufacture shown on the product nameplate.

(b) Specific written agreements with DKK-TOA, if any, shall take precedence over this warranty.

(c) The limitation of warranty described herein may not apply where applicable laws do not allow such limitation.

(2) Limited Warranty

This warranty does not cover the cases listed below.

(a) Direct or indirect failure or damage caused by the use of the product for a purpose or in a manner not prescribed by the specifications or the instruction manual for the product.

(b) Direct or indirect failure or damage caused by force majeure, including but not limited to an act of God, natural disaster such as earthquake, storm and flood damage, and lightning, fire, accident, abnormal voltage, salt damage, gas damage, labor unrest, acts of war (declared or undeclared), terrorism, .civil strife, or acts of any governmental jurisdiction.

(c) Failure or damage caused by any repair or modification not authorized by DKK-TOA.

(d) Failure or damage caused by the transport, moving, or dropping of the product after the purchase that is not attributable to DKK-TOA.

(e) Electrodes and consumables (The warranty period for each part has priority when the period is shorter than that for the main unit of the product. If the customer requires any part after more than six months from the date of manufacture, consult DKK-TOA or its distributor.)

(f) Failure or damage caused by the use of consumables, parts, or software not supplied by DKK-TOA.

(g) Malfunctions or damage caused by the use of connecting equipment not supplied by DKK-TOA.

(h) Loss of data, settings, programs, or software stored on the product not attributable to DKK-TOA.

(i) Any product other than DKK-TOA's, if specified by the purchaser or user, that incorporates, or is incorporated into or combined with DKK-TOA's products (*1). In such cases, this warranty covers DKK-TOA's products only.

(j) Any product not under proper maintenance in accordance with the instruction manual furnished by DKK-TOA.

(k) Products without a nameplate (excluding products proved to have been delivered by DKK-TOA).

EXCEPT AS EXPRESSLY SET FORTH IN THE PRECEDING SENTENCES, DKK-TOA MAKES NO WARRANTY OF ANY KIND WHATSOEVER WITH RESPECT TO ANY PRODUCT. DKK-TOA EXPRESSLY DISCLAIMS ANY WARANTY IMPLIED BY LAW, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF REMEDIES: In the event that a defect is discovered within the warranty period, DKK-TOA or its authorized distributor will, at its option, repair or replace the defective product or its part, or will refund the purchase price of the product. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

LIMITATION OF DAMAGES: IN NO EVENT SHALL DKK-TOA BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND FOR BREACH OF ANY WARRANTY, NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

(3) Others

(a) Product parts for maintenance (*2) will normally be supplied for five years (*3) from the date manufacturing and sales are discontinued.

(b) The cause of any malfunction or damage shall be determined by a DKK-TOA technician.

(c) For repairs, contact a local distributor in your country or state.

*1: Warranties for products from other companies must be maintained by the user.

*2: Maintenance parts refers to parts that are required to maintain operation of the product.

*3: This five-year period is subject to availability of parts or their replacement.

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.

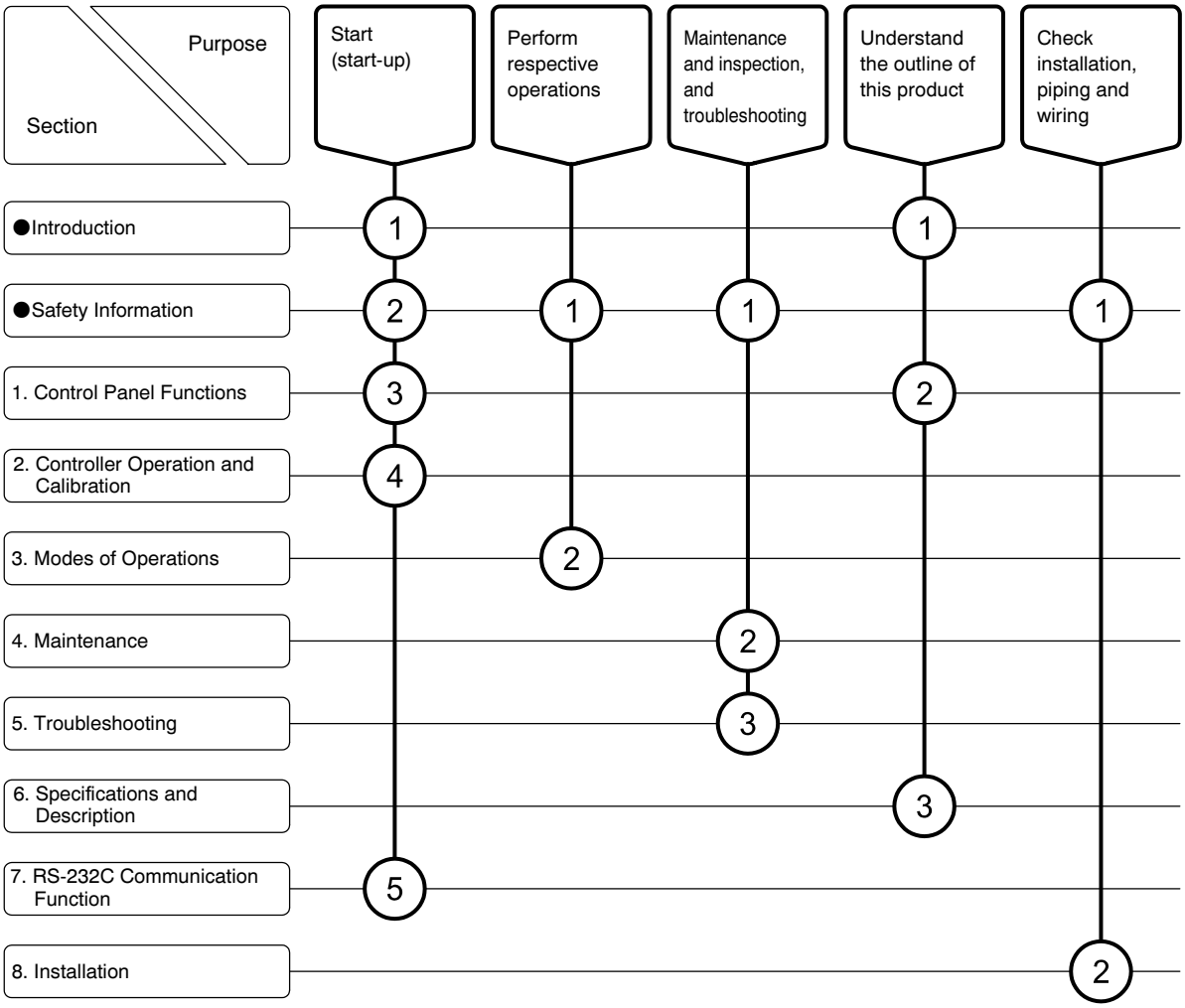
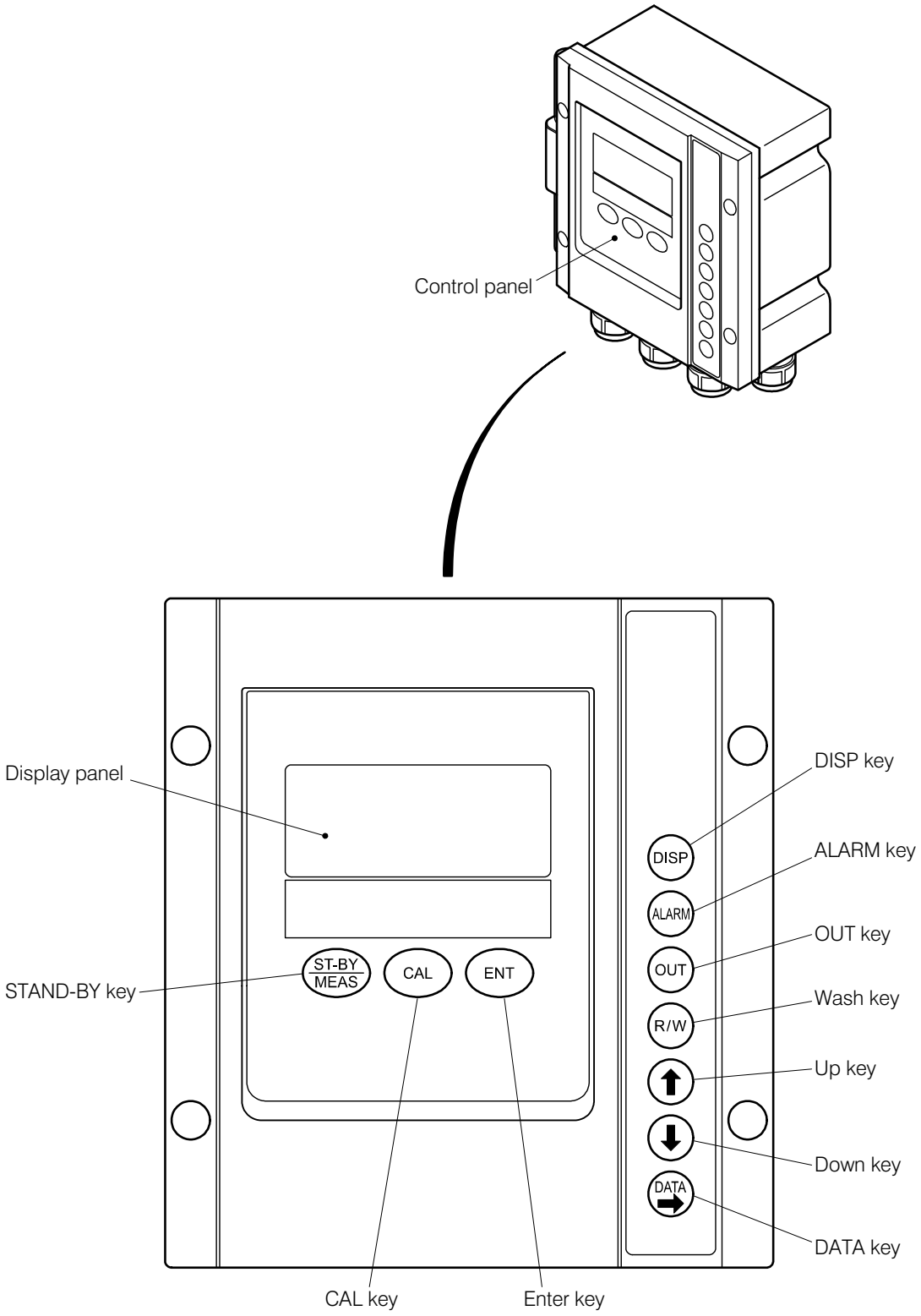


Table of Contents

1. Control Panel Functions

(1) Names of main components



Names of Main Components

(2) Functions of keys and indicators

Functions of Keys

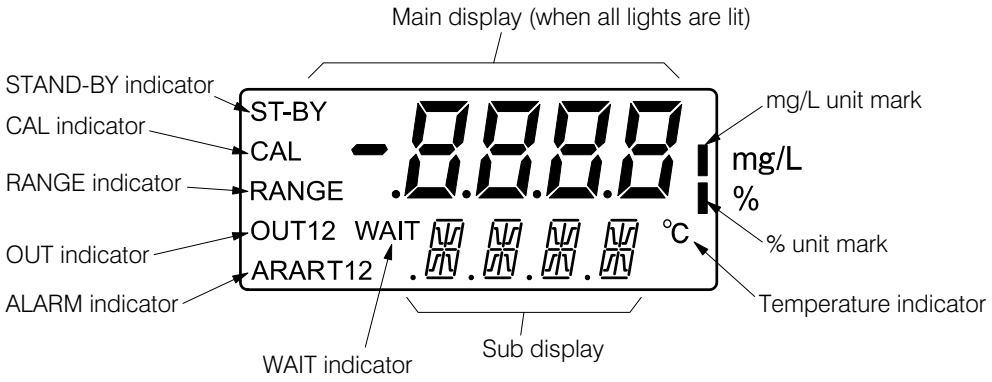
Operation key (notation in the text)	Function
Stand-by key ST-BY / MEAS (ST-BY/MEAS)	• Pressing this key for 3 seconds or more in the measurement mode changes the screen to the “Setting Mode DO Measured Value” screen (the initial screen of the setting mode). • Pressing this key for 3 seconds or more in the setting mode returns the screen to the “DO Measured Value” screen (the initial screen of the measurement mode). • Pressing this key for 3 seconds or more when “WASH” ,”HOLD”, “dU.mA” or “THR” is blinking (during wash) stops the wash operation and changes the screen to the “Setting Mode DO Measured Value” screen (the initial screen of the setting mode).
CAL key CAL (CAL)	• Pressing this key at the “Setting Mode DO Measured Value” screen changes the screen to the “Zero/Span Auto Check Calibration” (DO/O2/SAT) screen, which is the initial screen of the calibration screen group, or “Auto Calibration Select” (Z.ELC/Z.SLU/SPAN) screen. The selection of these screens depends on the “Calibration Mode” (AUTO/MANU) screen of the other screen group.
Enter key ENT (ENT)	• Pressing this key in the setting mode or in the transmission adjustment mode switches the screens in that group. • The entered number or symbol will be confirmed and the screen switches to the next screen.
DISP key DISP (DISP)	• Pressing this key when a screen in the measured value screen group is displayed switches the screens in this group. • Pressing this key for 3 seconds or more at the “Setting Mode DO Measured Value” screen changes the screen to the “DO Value Adjust On/Off” (D.ADJ) screen, the initial screen of the adjust/shift screen group.
Alarm key ALARM (ALARM)	• Pressing this key when a screen in the measured value screen group is displayed changes the screen group to the alarm display screen group. If this key is pressed repeatedly, the screens switch in this group and finally return to the “DO Measured Value” screen. • Pressing this key for 3 seconds or more at the “Setting Mode DO Measured Value” screen changes the screen to the “Alarm 1 On/Off” screen, the initial screen of the alarm screen group.
OUT key OUT (OUT)	• Pressing this key for 3 seconds or more in the measurement mode changes the mode to the transmission adjustment mode. Pressing this key for 3 seconds or more in the transmission adjustment mode returns the screen to the “DO Measured Value” screen. • Pressing this key when a screen in the measured value screen group is displayed changes the screen group to the measuring range display screen group. If this key is pressed repeatedly, the screens switch in this group and finally return to the “DO Measured Value” screen. • Pressing this key for 3 seconds or more at the “Setting Mode DO Measured Value” screen changes the screen to the “DO Measuring Range” (DO) screen of the measuring range screen group.
Wash key R/W (R/W)	(Option) • Pressing this key when a screen in the measured value screen group is displayed changes the screen group to the wash function display screen group. If this key is pressed repeatedly, the screens switch in this group and finally return to the “DO Measured Value” screen. • Pressing this key for 3 seconds or more at the “Setting Mode DO Measured Value” screen changes the screen to the “Wash Function” (WASH) screen, the initial screen of the wash function screen group. • If this function is not added, the setting cannot be changed.

(To be continued)

(Continued from previous page)

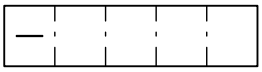
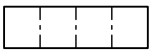
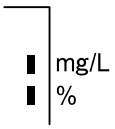
Operation key (notation in the text)	Function
Up key  (↑)	• Pressing this key in the setting mode or in the transmission adjustment mode increases the number for setting or changes the selection item.
Down key  (↓)	• Pressing this key in the setting mode or in the transmission adjustment mode decreases the number for setting or changes the selection item.
DATA key  (DATA →)	• Pressing this key when a screen in the measured value screen group is displayed changes the screen group to the other setting value display screen group. If this key is pressed repeatedly, the screens switch in this group and finally return to the "DO Measured Value" screen. • Pressing this key for 3 seconds or more at the "Setting Mode DO Measured Value" screen changes the screen to the "Zero Calibration Signal Value" (ZERO/nA) screen, the initial screen of the other screen group. • Pressing this key in the setting mode or in the transmission adjustment mode moves the digit of the number for setting to the right.

〔NOTE〕 • For mode and screen group, refer to 3.1(1) "Mode switching".
• For screen configuration and switching, refer to 3.1(2) "Operation screen map".



Display Panel

Functions of Indicators

Functions of indicators	Function
Main display 	• Displays mainly the measured value in the measurement mode. • Displays setting values, selection items, etc. in the setting mode and in the transmission adjustment mode.
Sub display 	• Displays mainly the temperature in the measurement mode. • Displays setting values, selection items, etc. in the setting mode and in the transmission adjustment mode.
Unit mark 	• Indicates the unit for the value on the main display.
Temperature indicator **°C**	• Indicates the unit for the value on the main display or sub display.
STAND-BY indicator **ST-BY**	• Lighting indicates the mode is in the setting mode, in the transmission adjustment mode or during wash operation. • Blinking indicates the setting value can be changed.
CAL indicator **CAL**	• Lighting indicates the analyzer is in the calibration screen group. • Blinking indicates the analyzer is in the transmission adjustment mode or in the process of calibration.
RANGE indicator **RANGE**	• Indicates that the main display shows the selected measuring range.
OUT indicator **OUT1** **OUT2**	• OUT1 indicates that the screen is related to the DO transmission output. • OUT2 indicates that the screen is related to the temperature transmission output.
ALARM indicator **ALARM1** **ALARM2**	• Indicates that the screen is related to the alarm output. • ALARM1 indicates that Alarm 1 has occurred and ALARM2 indicates that Alarm 2 has occurred.
WAIT indicator **WAIT**	• Indicates that the analyzer is in the process of stability check at the time of calibration.

2. Operation and Calibration

2.1 Starting the Operation

Follow the procedure below. The measurement system including the analyzer goes into normal operating state.

①Check the installation condition. ····· Check that necessary installation work is completed, which is described in 8. "Installation" (mounting, wiring) and the installation items described in the instruction manual provided for the sensor.

②Prepare for the sensor. ····· Perform the following preparation work for the sensor.
＞＞ Instruction manual provided for the sensor

- In the case of an immersion type ····· Assemble the electrode to the sensor, remove the rubber cover and immerse the tip end of the sensor in water.
- In the case of a liquid flow-through type ····· Assemble the electrode to the sensor, introduce sample water into the case of the sensor.
- In the case of a sensor with wash function ····· Other than the items above, check the power supply of the washing device.

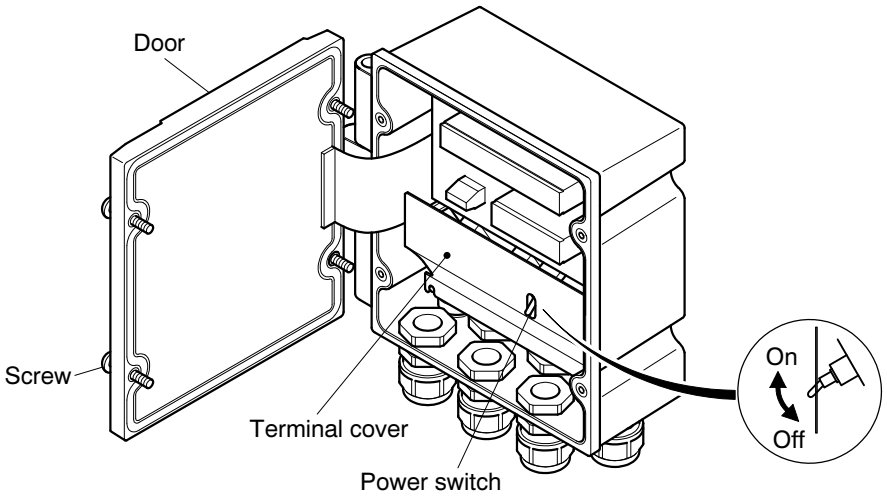
【IMPORTANT】 • For this analyzer, combine a DO electrode (such as Models 7533L, 7536L, and 7540L) with temperature element of 10kΩ/25°C (thermistor).

③Supply power. ····· Check the power to be supplied to the analyzer is 100 to 240VAC±10% and turn on power at the power source side. Next open the door of the analyzer and turn on the power switch. After that, close the door in the same way as before.

⚠ WARNING

Electric Shock

● Do not touch the terminals inside the product while power is applied. Touching the terminals can cause electric shock.

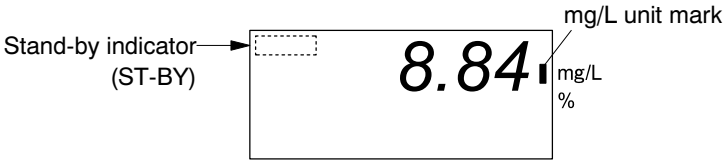


Power Switch Position

【IMPORTANT】
- Power supply voltage is 100 to 240VAC±10%. If voltage exceeding this range is applied, the analyzer may be damaged.
- When connecting a sensor with wash function, check that the washing use power output (option) conforms to the supply power specifications (100VAC±10%, etc.) of the sensor with wash function. When supplying power higher than the specified power through the analyzer, always provide a step down transformer between the analyzer and the sensor with wash function.
- The power switch is facing a little downward. When you turn on/off the switch, be sure to check that the power is actually turned on or off.

④Check the indication. ····· Check that the "DO Measured Value" screen, the initial screen of the measurement mode, appears and the DO measured value is shown on the main display and the mg/L unit mark lights.

- The stand-by indicator (ST-BY) is unlit.



〔NOTE〕
- When DO value adjust is on (valid), DO value adjusted rate appears on the sub display. >> 3.3(2) "DO value adjust"
- If an error message such as "E-04" appears on the main display, take necessary actions. >> 5.1 "Error Message"

⑤Adjust the clock. ····· When using the product for the first time or when the power has been off for 2 or 3 days after a power cut, etc., adjust the clock. >> 3.3(18) "Date and time (clock adjustment)"

⑥Check the measuring ranges. ····· Check the DO and temperature measuring ranges and check if they are appropriate for DO and temperature of sample water. If necessary, change these ranges. >> 3.2(3) "DO / temperature measuring range"

⑦Check the alarm settings. ····· Check the alarm settings and if necessary, change them. >> 3.2(2) "Alarm conditions"

⑧Set the wash function settings. ····· If the optional wash function is used to control a sensor with wash function, set the wash interval, etc. If the sensor with wash function has the control function by itself or the sensor is not equipped with wash function, these settings are not required. >> 3.2(4) "Wash function and operational conditions"

⑨Check other setting values. ····· Check the setting items set at the time of factory shipment such as Hold and if necessary, change these setting values. >> 3.2(5) "Other setting values"

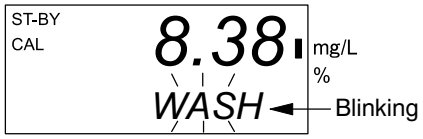
⑩Perform calibration. ·····>> 2.2 "Overview of Calibration"

⑪Select a display of the measurement mode. ·····>> 3.2(1) "Measured value screen switching"

⑫Check washing starts. ····· When the wash function is set to valid ("on" or "P-on") at step ⑧, check in the following procedures.

ⓐ Set the wash interval to the shortest time. >> 3.3(7) "Wash operation"

ⓑ Check that "WASH" (blinking) appears on the sub display when the wash time arrives.



【IMPORTANT】
- After checking that the washing operation is started, return the wash interval to its original time.
- The washing operation can be stopped by pressing ST-BY/MEAS for about 1 second during automatic wash.

⑬**Perform calibration 2 weeks later.** ····· To correct for the sensitivity change of the electrode, perform calibration again 2 weeks after the operation is started. ＞＞ 2.2 “Overview of Calibration”

The DO measurement system is now in the normal measurement condition.

2.2 Overview of Calibration

(a) It is surely necessary for this analyzer before measurement to perform calibration using standard solution and adjust the electrode characteristics and the indication of the analyzer.

(b) Though the electrode characteristics changes due to dirt accumulation by sample water when measurement is continued for a long time, this effect can be eliminated by calibration. Perform calibration periodically as well after operation is started. ＞＞ 4.1 “Maintenance List”

(c) The types of calibration methods are shown in the table below. Since two methods each are provided for zero calibration and span calibration, select one of them. Zero calibration or span calibration, whichever first, can be performed.

Types of Calibrations and Screens

Types of calibration		Calibration contents	Calibration screen group	
			“Auto Check Calibration” (DO/O2/SAT) screen	“Manual Calibration Select” (Z.ELC/Z.SLU /SPAN) screen
Zero calibration	Zero calibration using zero solution	Immerse the electrode to zero solution (sodium sulfite solution of 5 to 10%) and perform zero calibration.	○	○
	Electrical zero calibration	Perform zero calibration without using zero solution by turning off (oFF) the input signal from the electrode using key operation.	—	○
Span calibration	Span calibration using air	Perform calibration by placing the electrode in the air.	○	○
	Span calibration using air saturated water	Perform span calibration by immersing the electrode to air saturated water	○	○

(d) First, set either Auto check calibration (AUTO) or Manual calibration (MANU) using the “Calibration Mode” in the setting mode. ＞＞ 3.3(12) “Calibration mode”

(e) If “AUTO” is set in (d) and the screen is switched to the calibration screen group, the “Auto Check Calibration” (DO/O2/SAT) screen appears. The analyzer automatically determines whether zero or span calibration should be performed depending on the signal sent from the electrode. For example, if the electrode is immersed in zero solution, the analyzer goes to the zero calibration state and if the electrode is placed in the air or immersed in air saturated water, the analyzer goes to the span calibration state. However, in this case, electrical zero calibration by turning off the input cannot be performed.

(f) If “MANU” is set in (d) and the screen is switched to the calibration screen group, the “Manual Calibration Select” (Z.ELC/Z.SLU/SPAN) screen appears. At this screen, either one of electrical zero calibration (Z.ELC), zero calibration using zero solution (Z.SLU) or span calibration (SPAN) can be selected to perform calibration. Span calibration conforms to both span calibration using air and span calibration using air saturated water.

(g) To adjust the analyzer indication to the analysis value of sample water, first perform zero or span calibration of (e) or (f). ＞＞ 3.3(2) “DO value adjust”

(h) At the time of calibration, one of the indication items of DO, O_2 and SAT can be selected. ＞＞ 3.3(11) “Indication item for calibration”

2.3 Zero Calibration

If the dissolved oxygen value is near zero and thus accuracy is required, proceed with the operation in 2.3(1) “Zero calibration using zero solution” and in the case of simple calibration, proceed with the operation in 2.3(2) “Electrical zero calibration”.

【IMPORTANT】 • A span calibration error (E-02) may occur when a zero calibration is performed. In this case, refer to 5. “Troubleshooting” and replace the electrode diaphragm or take other measures.

(1) Zero calibration using zero solution

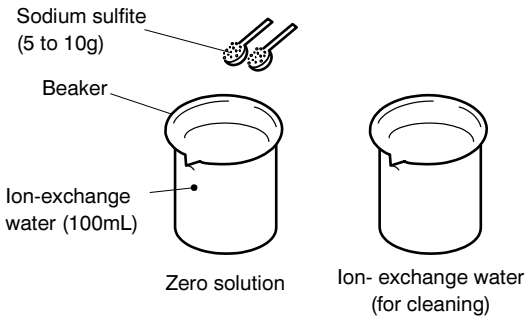
This is a calibration method using 5 to 10% sodium sulfite solution for zero solution.

①Prepare the following items. ····· Prepare the following items:

- Sodium sulfite (sulfite of soda) ····· 5 to 10g
- Ion-exchange water ····· 1 to 2L
- Beaker ····· 2 (for zero calibration solution and for cleaning water)

〔NOTE〕 • Sodium sulfite is not required to be anhydrous. In addition, the reagent is not necessarily to be high-purity reagent.

②Prepare zero solution. ····· Put the ion-exchange water of 100mL in a beaker (to the extent that the tip end of the electrode can be immersed) and add 5 to 10g of sodium sulfite (about 2 spoonfuls). For the other beaker, put in the ion-exchange water for cleaning.



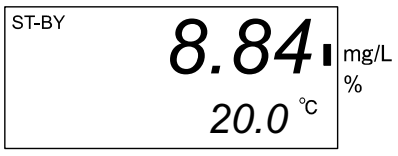
Preparing Zero Solution

③Prepare the electrode. ····· Prepare the electrode so that the tip end of the electrode can be immersed in the beaker’s zero solution. If the tip end of the electrode is dirty, clean it thoroughly with ion-exchange water.

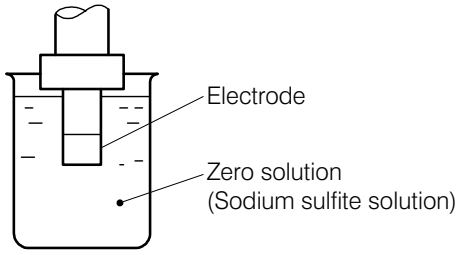
【IMPORTANT】 • The time to leave the electrode in the air must be within 30 minutes. This is because the time required for the analyzer indication to return to normal value may take about the same time as the time to leave the electrode.

④Select the setting mode. ····· If the analyzer is in the measurement mode (“ST-BY” is unlit), press ST-BY/MEAS for 3 seconds or more.

- “ST-BY” lights and the “Setting Mode DO Measured Value” screen appears.



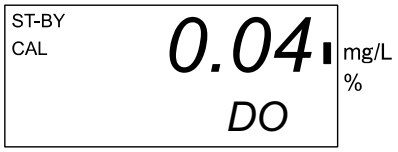
⑤Immerse the electrode in zero solution. ····· Wash the electrode with ion-exchange water and immerse it in the prepared zero solution (sodium sulfite solution).



Immersing the Electrode in Zero Solution

⑥Go to the calibration screen group. ····· Press CAL .

- "CAL" lights and the "Auto Check Calibration" (DO/O2/SAT) screen or "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears. Which screen appears depends on the setting of "Calibration Mode". ＞＞ 3.3(12) "Calibration mode"

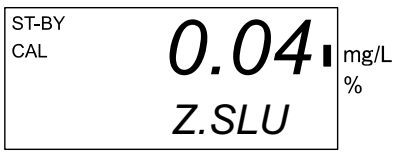


For Auto Check Calibration (DO Indication)

For Manual Calibration Select (DO Indication)

- When DO value adjust is set to on and the analyzer goes to the calibration screen group, the value on the main display becomes the value that DO value adjust is turned off.
- At the time of calibration, one of the indication items of DO, O_2 and SAT can be selected. ＞＞ 3.3(11) "Indication item for calibration"
- When "Auto Check Calibration" (DO/O2/SAT) screen appears, go to step ⑧.

⑦Select the type of manual calibration. ····· When "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears, press ↑ or ↓ until "Z.SLU (zero calibration using zero solution" appears on the sub display.

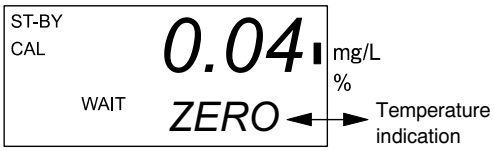


For Zero Calibration Using Zero Solution (DO Indication)

⑧Start zero calibration. ····· 30 to 60 minutes (about 1 to 2 hours for DO electrode models 7536L and 7546L) later, when the indicated value decreases and stabilized, press ENT .

- "CAL" and "WAIT" blink and zero calibration starts. When calibration ends, "CAL" lights and "WAIT" turns off.

- "0.00mg/L" appears on the main display and zero calibration ends.



For Both Auto and Manual (DO Indication)

- If zero calibration is needed again, press [ENT].
- To move to span calibration, go to the procedure in 2.4 "Span Calibration".

⑨Put the sensor back to the measurement location. ····· When calibration is completed, clean the electrode with ion-exchange water and put the sensor back to the measurement location.

⑩Return to the measurement mode. ····· Press [ST-BY/MEAS] for 3 seconds or more.

- The analyzer returns to the measurement mode ("ST-BY" is unlit) and Hold condition of the transmission output will be released.
- When DO value adjust is set to on, the DO value adjusted rate appears on the sub display and the measured value adjusted by that value appears. ＞＞ 3.3(2) "DO value adjust"

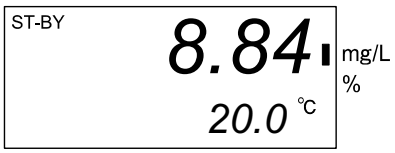
(2) Electrical zero calibration

(a) This is the method to perform zero calibration simply by turning off (oFF) the input signal in the analyzer which is sent from the electrode. This method cannot be performed at the "Auto Check Calibration" (DO/O2/SAT) screen.

(b) In this method, the measured value becomes 0.02 to 0.04mg/L higher than that in 2.3(1) "Zero calibration using zero solution", however, this method is convenient to perform calibration in a short time or to check zero point because it is not necessary to remove the sensor from the measurement location.

①Select the setting mode. ····· Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode ("ST-BY" is unlit).

- "ST-BY" lights and the "Setting Mode DO Measured Value" screen appears.



②Change the calibration mode. ····· Change the setting screen of "Calibration Mode" to "MANU" as shown in the procedure below. ＞＞ 3.3(12) "Calibration mode"

ⓐ Go to the other screen group. ····· Press [DATA➡] for 3 seconds or more.

- "ST-BY" blinks. Then press [ENT] repeatedly until "AUTO" or "MANU" blinks on the sub display.
- The setting screen of "Calibration Mode" appears.

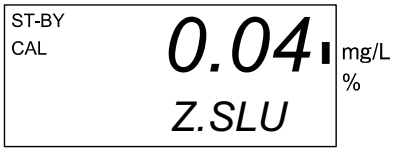
ⓑ Select manual calibration. ····· Press [↑] or [↓] until "MANU" appears on the sub display and press [ENT].

ⓒ Exit the other screen group. ····· Press [ENT] repeatedly.

- "ST-BY" lights and the screen returns to the "Setting Mode DO Measured Value" screen.

③Go to the calibration screen group. ····· Press [CAL].

- "CAL" lights and the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears.



For Manual Calibration Select (DO Indication)

- If DO value adjust is set to on and the screen goes to the calibration screen group, the value on the main display becomes the value that DO value adjust is turned off.
- At the time of calibration, one of the indication items of DO, O_2 and SAT can be selected. >> 3.3(11) "Indication item for calibration"

④Select the type of manual calibration. ····· Press [↑] or [↓] at the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen until "Z.ELC" (electrical zero calibration" appears on the sub display.

For Electrical Zero Calibration (DO Indication)

⑤Start zero calibration. ····· Press [ENT].

- "CAL" and "WAIT" blink and zero calibration starts. When calibration ends, "CAL" lights and "WAIT" turns off.
- "0.00mg/L" appears on the main display and zero calibration ends.

For DO Indication

- If zero calibration is needed again, press [ENT].
- To move to span calibration, go to the procedure in 2.4 "Span Calibration".

⑥Select the measurement mode. ····· To end the calibration, press [ST-BY/MEAS] for 3 seconds or more.

- The analyzer returns to the measurement mode ("ST-BY" is unlit) and Hold condition of the transmission output will be released.
- When DO value adjust is set to on, the DO value adjusted rate appears on the sub display and the measured value adjusted by that value appears. >> 3.3(2) "DO value adjust"

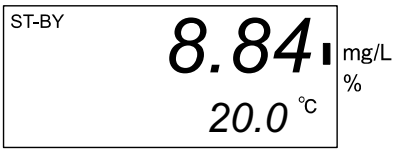
2.4 Span Calibration

(1) Span calibration using air

This analyzer uses air calibration where calibration value is precise. However, in a location near a heat source or under direct sunlight, it is recommended that you perform calibration using air saturated water because the temperature there tends to become unstable.
＞＞ 2.4(2) “Span calibration using air saturated water”

①Select the setting mode. ····· If the analyzer is in the measurement mode (“ST-BY” is unlit), press [ST-BY/MEAS] for 3 seconds or more.

- “ST-BY” lights and the “Setting Mode DO Measured Value” screen appears.

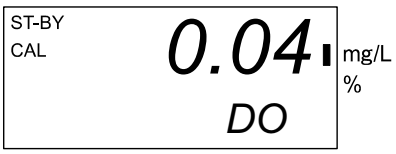


②Place the electrode in the air. ····· Wash the electrode with ion-exchange water and place it in the air.

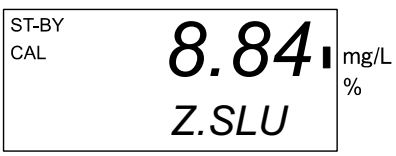
【IMPORTANT】
- The time to leave the electrode in the air must be within 30 minutes. This is because the time required for the analyzer indication to return to normal value may take about the same time as the time to leave the electrode.
- If the inside of the sample water piping is pressurized or decompressed and span calibration is performed while the electrode is still mounted to the sensor, “E-02 (unable to perform span calibration)” may occur. At the time of span calibration, be sure to remove the electrode and then place it in the air.

③Go to the calibration screen group. ····· Press [CAL].

- “CAL” lights and the “Auto Check Calibration” (DO/O2/SAT) screen or “Manual Calibration Select” (Z.ELC/Z.SLU/SPAN) screen appears. Which screen appears depends on the setting of “Calibration Mode”. ＞＞ 3.3(12) “Calibration mode”



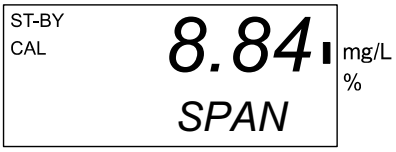
For Auto Check Calibration (DO Indication)



For Manual Calibration Select (DO Indication)

- When DO value adjust is set to on and the analyzer goes to the calibration screen group, the value on the main display becomes the value that DO value adjust is turned off.
- At the time of calibration, one of the indication items of DO, O_2 and SAT can be selected. ＞＞ 3.3(11) “Indication item for calibration”
- When the “Auto Check Calibration” (DO/O2/SAT) screen appears, go to step ⑤.

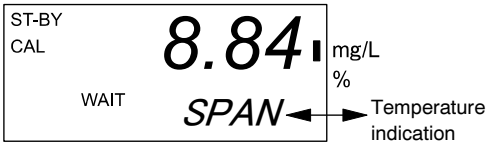
④Select the type of manual calibration. ····· When the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears, press [↑] or [↓] until "SPAN" (span calibration) appears on the sub display.



For Span Calibration Using Air (DO Indication)

⑤Start span calibration. ····· Several minutes later, when the indication is stabilized, press [ENT].

- "CAL" and "WAIT" blink and span calibration starts. When calibration ends, "CAL" lights and "WAIT" turns off.
- Calibration value appears and span calibration ends.



For Both Auto and Manual Calibrations (DO Indication)

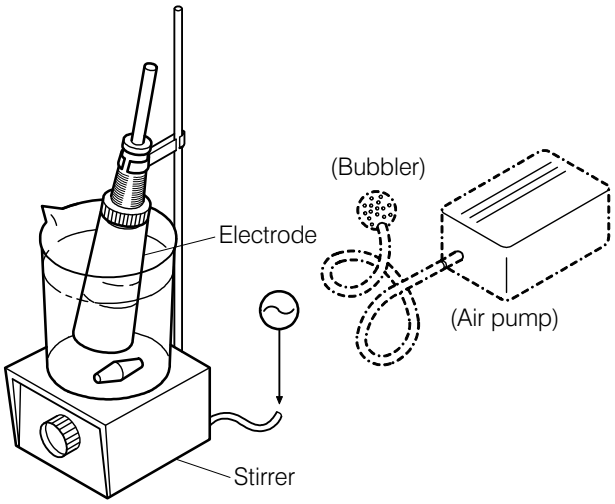
- If span calibration is needed again, press [ENT].
- To move to zero calibration, go to the procedure in 2.3 "Zero Calibration".

⑥Return the sensor to the measurement location. ····· To end the calibration, wash the electrode with ion-exchanger water and return the sensor to the measurement location.

⑦Select the measurement mode. ····· Press [ST-BY/MEAS] for 3 seconds or more.

- The analyzer returns to the measurement mode ("ST-BY" is unlit) and Hold condition of the transmission output will be released.
- When DO value adjust is set to on, the set DO value adjusted rate appears on the sub display and the measured value adjusted by that value appears.

(2) Span calibration using air saturated water



Span Calibration Using Air Saturated Water

①Preparation

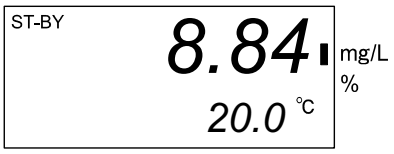
- 500mL beaker
- Stirrer
- Air pump and bubbler (used when needed)
- Ion-exchange water or city water ····· 1 to 2L

②Stir ion-exchange water. ····· Put ion-exchange water in a beaker about 1/2 to 2/3 of its capacity and stir the water using a stirrer or together with air pump.

- When only a stirrer is used, 10 to 15 minutes is required to obtain air saturated water.
- When a stirrer is used together with air bubbler, about 5 minutes is required to obtain air saturated water. In addition, once air saturated water is obtained, stirring is enough to maintain air saturated condition.

③Select the setting mode. ····· If the analyzer is in the measurement mode ("ST-BY" is unlit), press ST-BY/MEAS for 3 seconds or more.

- "ST-BY" lights and the "Setting Mode DO Measured Value" screen appears.

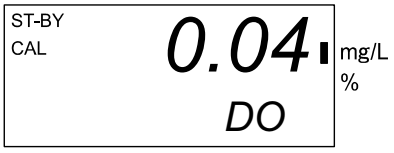


④Immerse the electrode. ····· Wash the electrode with ion-exchange water and immerse the electrode in water while continuing stirring ion-exchange water (air saturated water).

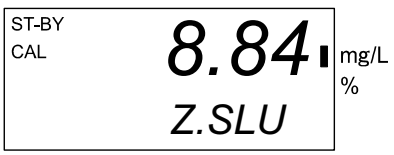
【IMPORTANT】
- The time to leave the electrode in the air must be within 30 minutes. This is because the time required for the indication to return to the normal value may take about the same time as the time to leave the electrode.
- If the inside of the sample water piping is pressurized or decompressed and span calibration is performed while electrode is still mounted to the sensor, "E-02 (unable to perform span calibration)" may occur. At the time of span calibration, be sure to remove the electrode and then immerse it in air saturated water prepared in a beaker, etc.

⑤Go to the calibration screen group. ····· Press CAL.

- "CAL" lights and the "Auto Check Calibration" (DO/O2/SAT) screen or "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears. Which screen appears depends on the setting of "Calibration Mode". ＞＞ 3.3(12) "Calibration mode"



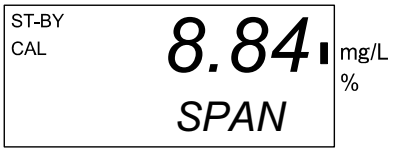
For Auto Check Calibration (DO Indication)



For Manual Calibration Select (DO Indication)

- When DO value adjust is set to on and the analyzer goes to the calibration screen group, the value on the main display becomes the value that DO value adjust is turned off.
- At the time of calibration, one of the indication items of DO, O_2 and SAT can be selected. ＞＞ 3.3(11) “Indication item for calibration”
- When the “Auto Check Calibration” (DO/O2/SAT) screen appears, go to step ⑦.

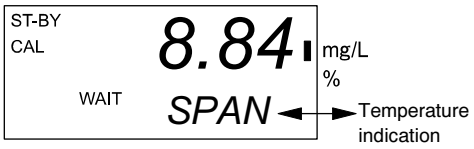
⑥Select the type of manual calibration. ····· When the “Manual Calibration Select” (Z.ELC/Z.SLU/SPAN) screen appears, press [↑] or [↓] until “SPAN” (span calibration) appears on the sub display.



For Span Calibration Using Air Saturated Water (DO Indication)

⑦Start span calibration. ····· Several minutes later, when the indication is stabilized, press [ENT].

- “CAL” and “WAIT” blink and span calibration starts. When calibration ends, “CAL” lights and “WAIT” turns off.
- Calibration value appears and span calibration ends.



For Both Auto and Manual Calibrations (DO Indication)

- If span calibration is needed again, press [ENT].
- To move to zero calibration, go to the procedure in 2.3 “Zero Calibration”.

⑧Return the sensor to the measurement location. ····· To end the calibration, wash the electrode with ion-exchanger water and return the sensor to the measurement location.

⑨Select the measurement mode. ····· Press [ST-BY/MEAS] for 3 seconds or more.

- The analyzer returns to the measurement mode (“ST-BY” is unlit) and Hold condition of the transmission output will be released.
- When DO value adjust is set to on, the DO value adjusted rate appears on the sub display and the measured value adjusted by that value appears. ＞＞ 3.3(2) “DO value adjust”

(3) Indicated value at the time of span calibration

The output of dissolved oxygen electrode is proportional to its oxygen partial pressure.

Oxygen partial pressure in air saturated water ≒ Oxygen partial pressure in the air = 100kPa × 20.9% = 20.9kPa

Atmospheric pressure

O_2 concentration

〔NOTE〕 •Air saturated water ····· Put the ion-exchange water (sample water or city water can also be used) in a beaker of 300 to 500mL to about 70 to 80% of its capacity and agitate the water for about 10 minutes using a stirrer. Then the water becomes air saturated water. Since a certain flow speed is required at the time of measurement, put the electrode in the water while still agitating the water.

This can be checked by the fact that the electrode output obtained with air saturated water and the output obtained with its electrode placed in the air of the same temperature is almost the same. Namely, when the electrode is calibrated to “8.11mg/L” or “100%” in air saturated water at 25°C, its indicated value does not change even if it is pulled up to the open air. (To be more accurate, a small difference occurs caused by temperature difference between the water and the air.)

Air calibration is a span calibration method based on the electrode characteristic described above. Since its air saturated condition is 100%, span calibration can be performed without considering saturated DO content by its temperature.

〔NOTE〕 •SAT (SAT.RATIO = Saturation ratio) ····· This is the unit of dissolved oxygen with 100% when a solution is saturated with air and this unit can be used when saturated dissolved oxygen in pure water cannot be applied due to sample water compositions, etc.

Corresponding values in each mode are shown in the table below.

Indication for Each Mode

t°C	DO (mg/L)	O_2 (%)	SAT (%)
0	14.16	20.9	100.0
⋮	⋮	⋮	⋮
25	8.11	20.9	100.0
⋮	⋮	⋮	⋮
40	6.60	20.9	100.0

↑

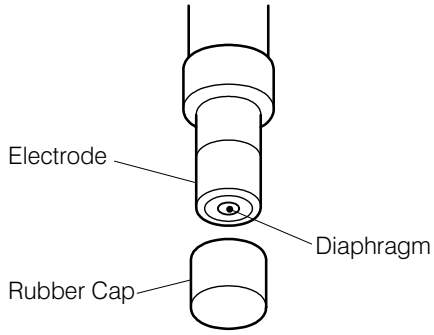
Though DO measured value changes because gas solubility changes with temperature, its oxygen partial pressure does not change.

2.5 Stopping the Operation

To stop the operation for several weeks or more, as a general rule, perform the procedure shown below.

①Turn off the supply power. ····· Turn off the power at the source side of the power cable to the analyzer.

②Store the sensor. ····· Pull up the sensor from sample water and clean it thoroughly and attach a rubber cap to the tip end of the electrode.



Attaching a Rubber Cap

- If it can be assumed that dirt accumulation on the electrode does not occur, the sensor can be left immersed in sample water.

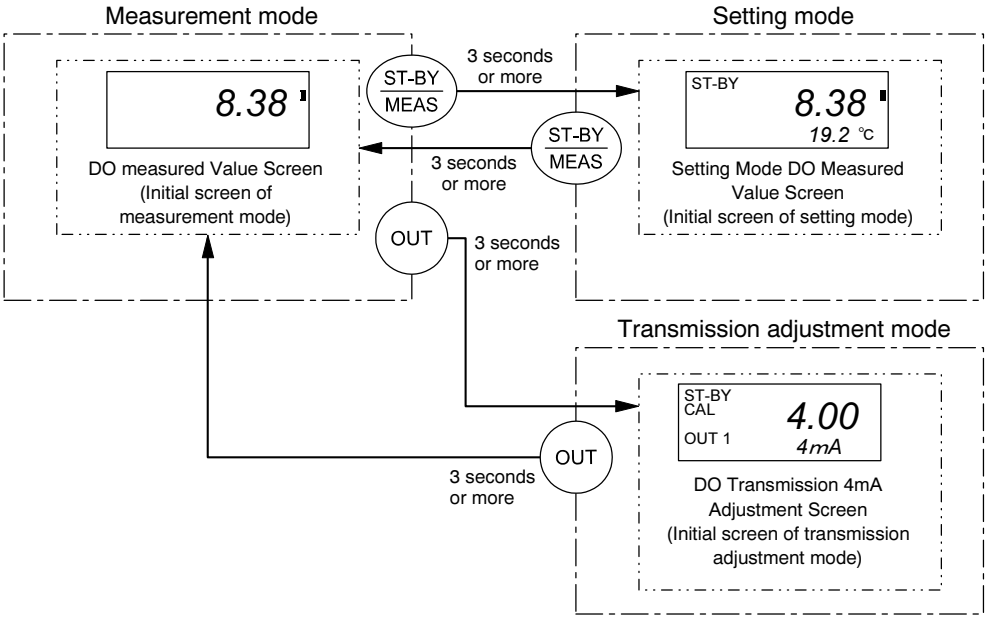
To resume operation, refer to 2.1 “Starting the Operation”.

3. Modes of Operations

3.1 Modes and Operation Screen Map

(1) Mode Switching

(a) The screens to check or perform settings are separated into 3 modes as shown below.



Mode Switching

(b) The mode that the current screen belongs to can be checked as shown below using the standby indicator (ST-BY) and CAL indicator. For example, if the standby indicator is lit and the CAL indicator is unlit, the analyzer is in the setting mode. However, during wash operation the standby indicator lights even in the measurement mode.

Indicators and the Current Mode

	Standby indicator (ST-BY)	CAL indicator (CAL)
Measurement mode	Unlit (lit during wash)	Unlit
Setting mode	Lit (blinks)	Unlit (lit or blinks at calibration)
Transmission adjustment mode	Lit	Blinks

(c) As shown in the diagram "Mode Switching," the modes can be switched by pressing [ST-BY/MEAS] for 3 seconds or more or pressing [OUT] for 3 seconds or more.

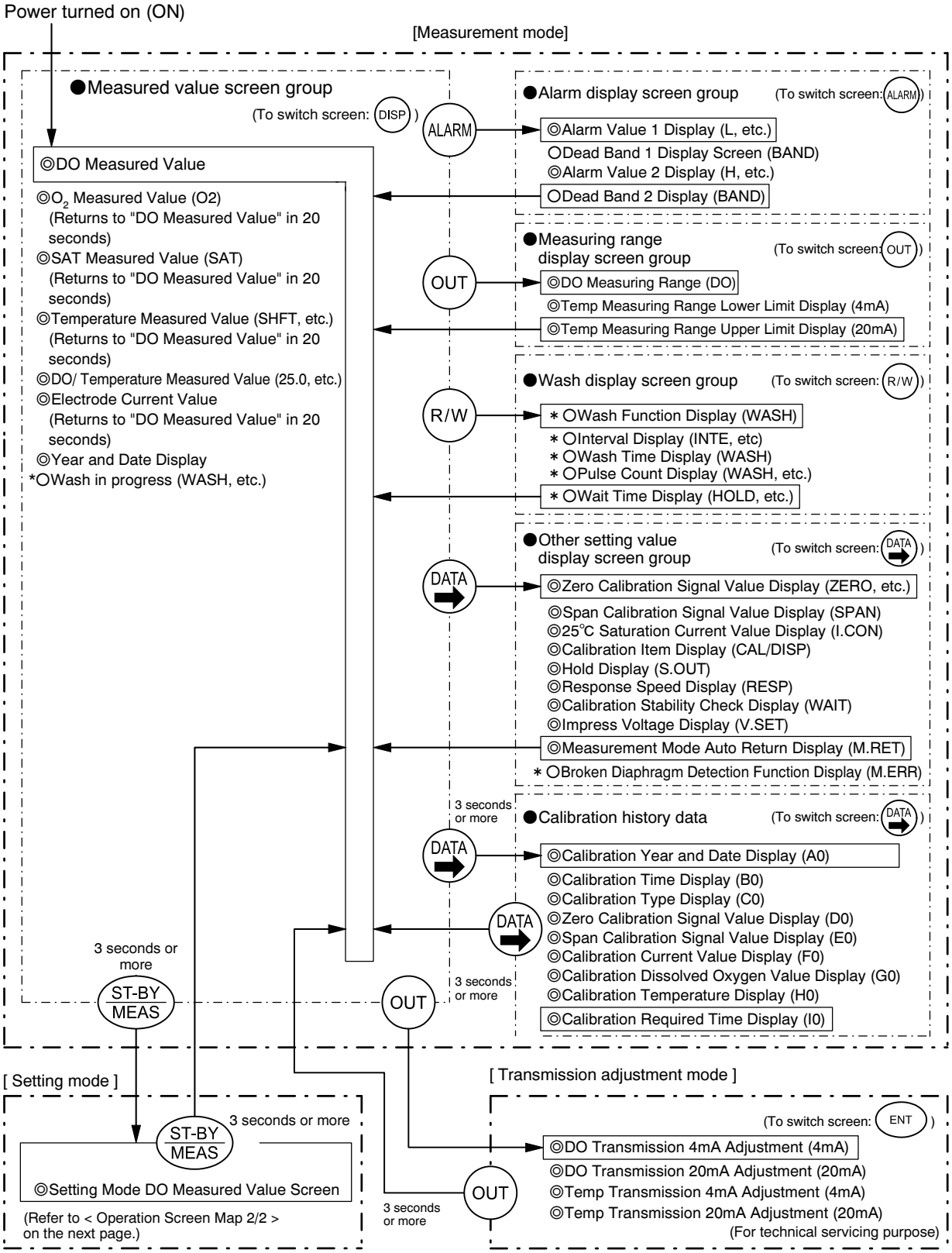
(d) When the mode is changed, the initial screen of the changed mode appears.

(e) When the analyzer goes to the setting mode, the DO transmission output (terminals 70 and 71) and the temperature transmission output (terminals 72 and 73) automatically become the "Hold" type output set in advance. >> 3.3(13) "Hold type"

(f) When the analyzer is in the setting mode, in the transmission adjustment mode, and during automatic wash, alarm output signals will be reset.

(g) If a specified key is pressed (such as [DISP]), that corresponds to each group in the measurement mode or in the setting mode, the screen goes to that group.

(2) Operation screen map



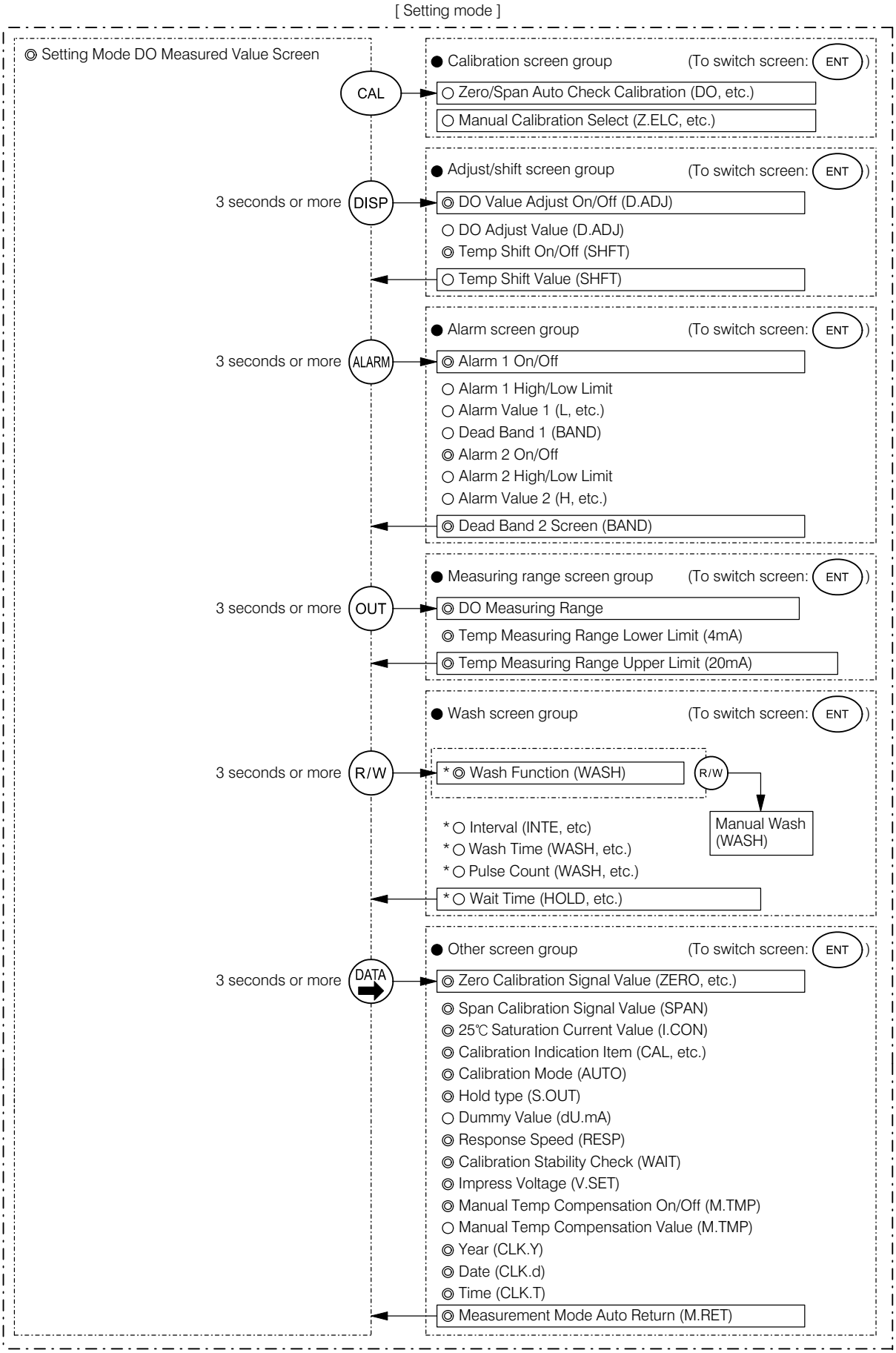
◎ : Screens that appear always

○ : Screens that appear when necessary setting is made.

＊ : Optional specification screens (depend on the ordered specification)

・The symbols in parentheses at the end of the screen name are the ones shown on the sub display. No indication if nothing is shown on the sub display.

Operation Screen Map (1/2)



Operation Screen Map (2/2)

3.2 Measurement Mode Operation

The measurement mode has screen groups given in the following table. In each screen group, the contents set in the setting mode can be checked.

Measurement Mode Screen Groups

Name	Contents
Measured value screen group >> 3.2(1)	• Checking of DO measured value and temperature measured value.
Alarm display screen group >> 3.2(2)	• Checking of alarm settings.
Measuring range display screen group >> 3.2(3)	• Checking of the higher limit of DO measuring range and of temperature measuring range.
Wash display screen group >> 3.2(4)	• Displayed only when the wash function is provided. • The screen displayed varies depending on the type of the wash function. • Checking of the wash type and conditions.
Other setting value display screen group >> 3.2(5)	• Checking of setting values and other settings such as the signal value at the time of zero calibration.
Calibration history data >> 3.2(6)	• Checking of calibration history data.

(1) Measured value screen switching

(a) The measured value screen group contains the screens shown in the table below. These screens are used in normal measurement state.

(b) Each time DISP is pressed in the measurement mode, the screens are switched. Select the desired screen when needed.

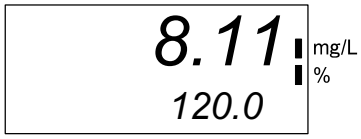
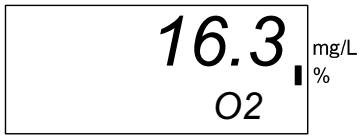
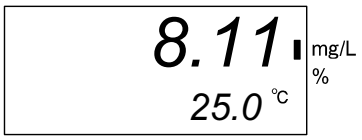
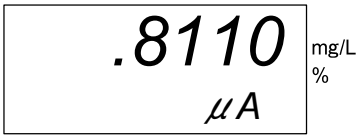
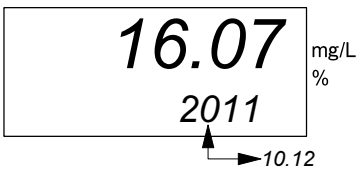
(c) The following four screens automatically return to “DO Measured Value” 20 seconds after they are displayed.

- O_2 Measured Value (O2)
- SAT Measured Value (SAT)
- Temperature Measured Value
- Electrode Current Value (μA)

(d) When the power is turned on, “DO Measured Value”, the initial screen of this group, appears. This screen appears also when the screen returns from the display screen group of the measurement mode and when the screen returns from the setting mode or transmission adjustment mode.

(e) The DO transmission output corresponds to the DO measured value regardless of the screen displayed. The same is true with the temperature transmission output.

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: DISP)
①	◎DO Measured Value		• Main display ···· DO measured value (mg/L) • Sub display ···· DO value adjusted rate (%) Not displayed if DO value adjust function is invalid. ＞＞ 3.3(2) “DO value adjust”
②	◎O_2 Measured Value		• Main display ···· O_2 Measured value • The screen returns to ① about 20 seconds after it is displayed.
③	◎SAT Measured Value		• Main display ···· SAT measured value • The screen returns to ① about 20 seconds after it is displayed.
④	◎Temperature Measured Value	 Temperature shift value When manual temperature compensation is invalid	• Main display ···· Temperature measured value • Sub display ···· Not displayed. When temperature shift function is valid, “SHFT” and temperature shift value appear alternately. ＞＞ 3.3(3) “Temperature shift”, 3.3(17) “Manual temperature compensation”
		 When manual temperature compensation is valid	• Main display ···· Manual temperature compensation value
⑤	◎DO/Temperature Measured Value		• Main display ···· DO measured value (mg/L) • Sub display ···· Temperature measured value (°C)
⑥	◎Electrode Current Value		• Main display ···· Electrode current value (μA)
⑦	◎Year and Date Display		• Main display ···· Time HH.MM • Sub display ···· Western calendar year (YYYY) and date (MM.DD) are displayed alternately.

Returns to ①.

(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
			(To switch screen: DISP)

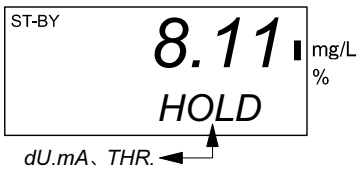
* (The screen during wash using the wash function)

"DO Measured Value" or "DO/ Temperature Measured Value"

- Main display ···· DO measured value
- Sub display ···· Blinking "WASH" indicates that wash operation is in progress.

*(The screen when a wash-in-progress signal is input from the cleaner)

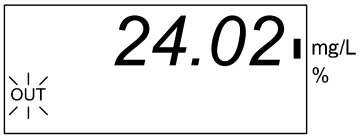
"DO Measured Value" or "DO/ Temperature Measured Value"



- Main display ···· DO measured value
- Sub display ···· Blinking "HOLD" etc. indicates that the analyzer is in Hold state of wait time by internal timer after the wash or that a wash-in-progress signal (terminals 10 and 11) is being input.
  HOLD ···· The value immediately before is held (factory setting)
  dU.mA ···· Dummy value hold
  THR. ···· Through

*(Screen example when the DO measured value went out of the measuring range)

Example of "DO Measured Value"



- Blinking "OUT" indicates that the DO measured value is out of the measuring range. Blinking indication turns off if the value returns to within the measuring range.
- Blinking "OUT" in the condition above is displayed on every screen in the measurement mode.
  >> 5.1 "Error Message"

◎: Screens that appear always
○: Screens that appear when necessary setting is made.
*: Optional specification screens (depends on the ordered specification)

(2) Alarm conditions

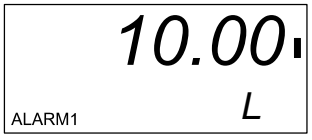
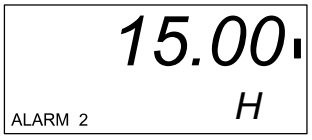
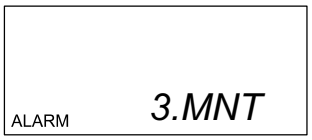
(a) The alarm display screen group contains the screens shown in the table below.

(b) When [ALARM] is pressed in the measurement mode, the screen goes to this group. If the same key is pressed again, the screen changes to the next screen. Pressing the same key while the last screen of this group is displayed brings you back to "DO Measured Value".

(c) Any screen in this group automatically returns to "DO Measured Value" 20 seconds after it is displayed.

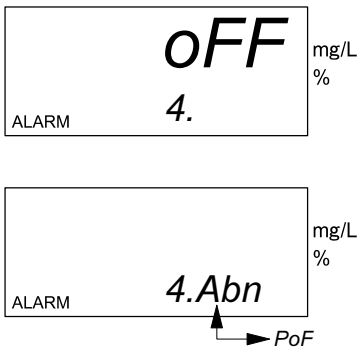
(d) The setting values of these screens can be changed by the "alarm screen group" in the setting mode. >> 3.3(4) "Alarm"

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: [ALARM])
①	◎Alarm Value 1 Display	 When Alarm 1 is Off  When Alarm 1 is Low Alarm	• Main display ···· Setting state of Alarm 1 oFF ···· Alarm 1 is invalid. (factory setting) DO measured value ···· Value of Alarm 1. Alarm 1 is valid. • Sub display ···· High or Low alarm indication L ···· Alarm 1 is a low alarm. (factory setting) H ···· Alarm 1 is a high alarm.
②	○Dead Band 1 Display Not displayed when "oFF" is set at ①.		• Main display ···· Setting state of dead band 1 (factory setting ···· 0.00 (mg/L))
③	◎Alarm Value 2 Display		• Main display ···· Setting state of Alarm 2 oFF ···· Alarm 2 is invalid. (factory setting) DO measured value ···· Value of Alarm 2. Alarm 2 is valid. • Sub display ···· High or Low alarm indication L ···· Alarm 2 is a low alarm. H ···· Alarm 2 is a high alarm. (factory setting)
④	○Dead Band 2 Display Not displayed when "oFF" is set at ③.		• Main display ···· Setting state of dead band 2 (factory setting ···· 0.00 (mg/L))
⑤	◎Maintenance in Progress Signal Output		• Main display ···· No display • Sub display ···· 3.MNT (Maintenance in progress signal output)

(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
			(To switch screen: ALARM)
⑥	◎Power Off Signal, Electrode Error Signal Output		• Main display ···· oFF Invalid • Main display ···· No display Abn (Electrode error) PoF (Power off)
	Returns to the “DO Measure Value” screen.		

◎: Screens that appear always
○: Screens that appear when necessary setting is made

(3) DO / temperature measuring range

(a) The measuring range display screen group contains the screens shown in the table below.

(b) When [OUT] is pressed in the measurement mode, the screen goes to this group. If the same key is pressed again, the screen changes to the next screen. Pressing the same key while the last screen of this group is displayed brings you back to "DO Measured Value".

(c) Any screen in this group returns automatically to "DO Measured Value" 20 seconds after it is displayed.

(d) The setting values of these screens can be changed by the "measuring range screen group" in the setting mode. ＞＞ 3.3(5) "DO measuring range", 3.3(6) "Temperature measuring range"

(e) When the measuring range is changed, the setting values of alarms 1 and 2 are also changed according to the changed ratio. When alarms 1 and 2 were set and the measuring range was changed, always change the alarms 1 and 2 setting values.
＞＞ 3.3(4) "Alarm"

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: [OUT])
①	◎DO Measuring Range Display	RANGE 20.00 mg/L % DO	• Main display ···· DO measuring range setting value (when transmission output is 20mA)(factory setting depends on the ordered specification) • Corresponds to the DO transmission output terminals 70 and 71.
②	◎Temperature Measuring Range Lower Limit Display	OUT 2 0.0 mg/L % 4mA ℃	• Main display ···· Temperature measuring range lower limit setting value (when transmission output is 4mA)(factory setting: 0 (°C)) • Corresponds to the temperature transmission output terminals 72 and 73.
③	◎Temperature Measuring Range Higher Limit Display	OUT 2 50.0 mg/L % 20mA ℃	• Main display ···· Temperature measuring range higher limit setting value (when transmission output is 20mA)(factory setting: 50 (°C)) • Corresponds to the temperature transmission output terminals 72 and 73.
	Returns to the "DO Measured Value" screen.		

◎: Screens that appear always

(4) Wash function and operational conditions (option)

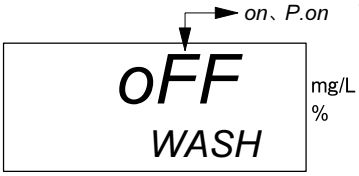
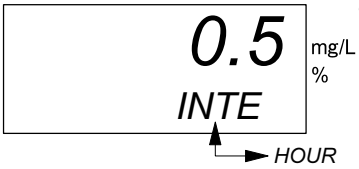
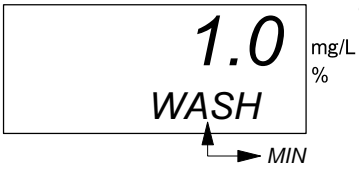
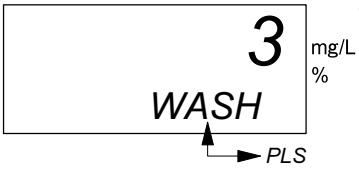
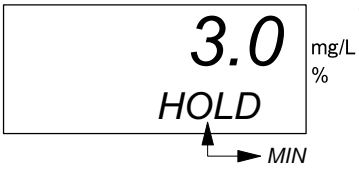
(a) When the standard specification is used, the screens in this group are not displayed. When the wash function is added, the screens in the following table are provided in the wash display screen group (option).

(b) When R/W is pressed in the measurement mode, the screen enters this group. If the same key is pressed again, the screen changes to the next screen. Pressing the same key while the last screen of this group is displayed brings you back to "DO Measured Value".

(c) Any screen of this group automatically returns to "DO Measured Value" 20 seconds after it is displayed.

(d) The setting values of these screens can be changed by the "wash function screen group" in the setting mode. ＞＞ 3.3(7) "Wash operation"

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: R/W)
①	*◎ Wash Function Display		• Main display ···· Setting state of the wash function on ···· Wash function for general use is valid. P.on ···· Pulse air jet wash is valid. oFF ···· Wash function is invalid (factory setting)
②	*○ Wash Interval Display Not displayed when "oFF" is set at screen ①.		• Main display ···· Wash interval setting value (factory setting: 0.5 (h))
③	*○ Wash Time Display Not displayed when "oFF" or "P.on" is set at screen ①.		• Main display ···· Wash time setting value (factory setting: 1.0 (min))
	*○ Wash Pulse Count Display Not displayed when "oFF" or "on" is set at screen ①.		• Main display ···· The set number of times of air jet (pulse count) (factory setting: 3 (times))
④	*○ Wash Wait Time Display Not displayed when "oFF" is set at screen ①.		• Main display ···· Setting value of wait time after wash (factory setting: 3.0 (min))
	Returns to the "DO Measured Value" screen.		

◎: Screens that appear always
○: Screens that appear when necessary setting is made.
* : Optional specification screens (depends on the ordered specification)

(5) Other setting values

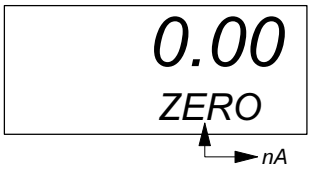
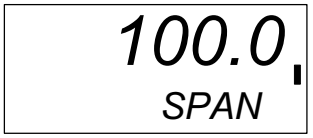
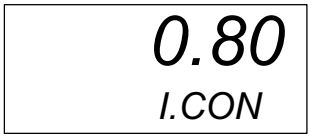
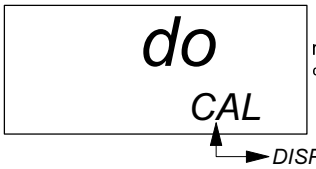
(a) The other setting value display screen group contains the screens shown in the table below.

(b) When DATA➜ is pressed in the measurement mode, the screen goes to this group. If the same key is pressed again, the screen changes to the next screen. Pressing the same key while the last screen of this group is displayed brings you back to "DO Measured Value".

(c) Any screen in this group returns automatically to "DO Measured Value" 20 seconds after it is displayed.

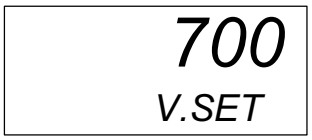
(d) The setting values of these screens can be changed by the "other screen group" in the setting mode.

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: DATA➜)
①	◎Zero Calibration Signal Value Display		• Main display ···· The last electrode zero calibration signal value (factory setting: 0.00 (nA)) • Overwritten automatically at the time of zero calibration. • To change ···· >> 3.3(9) "Zero calibration signal value and span calibration signal value"
②	◎Span Calibration Signal Value Display		• Main display ···· The last electrode span calibration signal value (factory setting: 100.0 (%)) • Overwritten automatically at the time of span calibration. • To change ···· >> 3.3(9) "Zero calibration signal value and span calibration signal value"
③	◎25°C Saturation Current Value Display		• Main display ···· 25°C saturation current value of electrode (factory setting: 0.80 (μA)) • To change ···· >> 3.3(10) "25°C saturation current value"
④	◎Calibration Item Display		• Main display ···· Set indication item at the time of electrode calibration do ···· DO indication calibration (factory setting) O2 ···· O_2 indication calibration SA ···· SAT indication calibration • To change ···· >> 3.3(11) "Indication item for calibration"

(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
			(To switch screen: DATA ➡)
⑤	◎Hold Display	 When Hold is selected  When Dummy is selected	• Main display ···· Setting state of Hold type. HoLd ···· Outputs the transmission output value immediately before the mode is changed to the setting mode (factory setting). du ···· Outputs an arbitrary set transmission output value (mA). "S.OUT" and dummy value (factory setting: 12.00mA) appear on the sub display alternately. tH ···· Outputs the current DO measured value and temperature measured value in the same way as in the measurement mode. • To change ···· ＞＞ 3.3(13) "Hold type"
⑥	◎Response Speed Display		• Main display ···· Setting state of response speed FS ···· Fast Std ···· Standard (factory setting) SL ···· Slow • To change ···· ＞＞ 3.3(14) "Response speed"
⑦	◎Calibration Stability Check Display		• Main display ···· Setting state of stability check on ···· Valid (factory setting) oFF ···· Invalid • To change ···· ＞＞ 3.3(15) "Stability check for calibration"
⑧	◎Impressed Voltage Display		• Main display ···· Impressed voltage setting value (factory setting: 700 (mV)) • To change ···· ＞＞ 3.3(16) "Impressed voltage"
⑨	◎Measurement Mode Auto Return Display		• Main display ···· Setting state of automatic return on ···· Automatic return is valid (factory setting). oFF ···· Automatic return is invalid. • To change ···· ＞＞ 3.3(19) "Measurement mode automatic return"
⑩	◎Broken Diaphragm Detection Display (option)		• Main display ···· "on" is displayed when breaking of the diaphragm is detected.

Returns to the "DO Measured Value" screen.

◎: Screens that appear always

(6) Reading the calibration history data

(a) The calibration history data contains 9 items from A to I. Each of these items is assigned 10 data numbers from 0 to 9. The contents of data items A to I are shown in the table below. The data number shows the calibration history time series, with 0 being the newest data.

(b) When [DATA ➡] is pressed for 3 seconds or more in the measurement mode, the screen goes to this group. If the same key is pressed again (for about 1 second), the screen changes to the next screen (the next data item). Pressing [DATA ➡] for 3 seconds or more while any screen of this group is displayed brings you back to "DO Measured Value".

(c) The calibration history data display screen group contains the screens shown in the table below. The standard solution calibration data for up to 10 calibrations can be read. Checking the trend of change of the calibration data is a criteria for estimating the electrode replacement timing and deciding the maintenance cycle. When data is not saved, "- - - -" appears on the display.

〔NOTE〕 • Set the date and time (clock adjustment) correctly. If you make a wrong setting, the correct date or time will not be recorded.

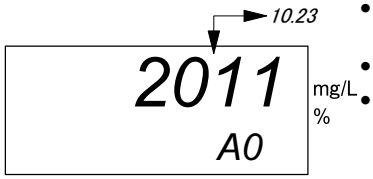
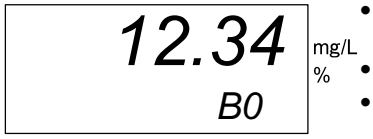
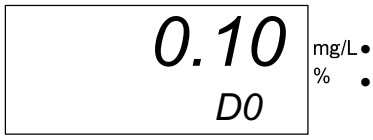
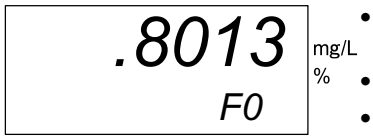
(d) Any screen in this group returns automatically to "DO Measured Value" 20 seconds after it is displayed.

(e) Calibration errors will not be recorded in the calibration history.

Calibration History Data List

Data item and contents \ Data No.			Switched using ⬇⬆									
			0	1	2	3	4	5	6	7	8	9
Switched using [DATA/➡]	A☐	Calibration year and date	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9
	B☐	Calibration time	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9
	C☐	Calibration type	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9
	D☐	Zero calibration signal value	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9
	E☐	Span calibration signal value	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9
	F☐	Calibration current value	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9
	G☐	Calibration dissolved oxygen value	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9
	H☐	Calibration temperature	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
	I ☐	Calibration required time	I0	I1	I2	I3	I4	I5	I6	I7	I8	I9

Screen Sequence and Contents

No.	Screen name	Screen example	Contents
			(To switch screen: DATA ➡)
①	Calibration Year and Date Display		• Main display … Calibration year and date (western calendar) history • Sub display … A0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
②	Calibration Time Display		• Main display … Calibration time history • Sub display … B0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
③	Calibration Type Display		• Main display … Calibration type history 0 … Electrical zero calibration 1 … Zero calibration by solution 2 … Span calibration • Sub display … C0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
④	Zero Calibration Signal Value Display		• Main display … History of signal value (nA) at zero calibration • Sub display … D0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
⑤	Span Calibration Signal Value Display		• Main display … History of signal value (nA) at span calibration • Sub display … E0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
⑥	Calibration Current Value Display		• Main display … Calibration current value (μA) history • Sub display … F0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
⑦	Calibration Dissolved Oxygen Value Display		• Main display … Calibration dissolved oxygen (mg/L) history • Sub display … G0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇. (The value converted to mg/L is displayed in the SAT mode and O2 mode.)

(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
			(To switch screen: DATA ➡)
⑧	Calibration Temperature Display		• Main display … Calibration temperature (°C) history • Sub display … H0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
⑨	Calibration Required Time Display		• Main display … History of required time to complete calibration (sec) • Sub display … I0 (Newest data No.) • Switched to the last data No. using ⬆ and switched to the next data No. using ⬇.
	Returns to the “DO Measured Value” screen when the keys have not been operated for 20 seconds or more or DATA ➡ is pressed for 3 seconds or more.		

3.3 Setting Mode Operation

(1) Calibration screen descriptions

(a) Performing actual calibration requires preparation of zero solution and operation of the sensor. Perform calibration referring to the following sections. In this section, key operation only is explained.
>> 2.2 “Overview of Calibration”, 2.3 “Zero Calibration”, 2.4 “Span Calibration”

(b) While operating the screens of the calibration screen group, DO value adjust is automatically turned off. >> 3.3(2) “DO value adjust”

(c) The initial screen of the calibration screen group differs depending on the calibration mode setting (automatic or manual). >> 3.3(12) “Calibration mode”

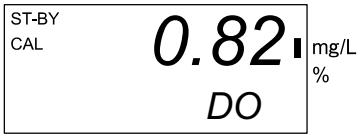
(d) If [ENT] is pressed while “Auto Check Calibration” (DO/O2/SAT) screen is displayed, the analyzer determines automatically which one of the two types of calibration (zero calibration or span calibration) should be performed. If zero calibration is selected, “Zero calibration using zero solution” will be performed.

(e) When “Manual Calibration Select” (Z.ELC/Z.SLU/SPAN) screen appears, select one from the 3 types of calibration (electrical zero calibration, zero calibration using zero solution, and span calibration) and press [ENT] and then the calibration will be performed immediately.

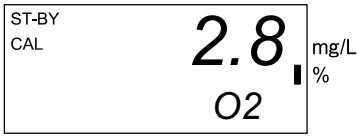
(f) For manual calibration, either zero calibration or span calibration can be performed first and either one can be performed as many times as desired.

Screen Description (Auto Check Calibration)

Procedure and screen example	Operation
① Select the “Setting Mode DO Measured Value” screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • “ST-BY” lights.
② Select the “Auto Check Calibration” screen. ·····	Press [CAL]. • If “AUTO (automatic calibration)” is set at the “Calibration Mode” (AUTO/MANU) screen and the analyzer goes to the calibration screen group, the screen switches to the “Auto Check Calibration” (DO/O2/SAT) screen. • “CAL” lights. • Main display ···· DO measured value, O_2 measured value, or SAT measured value • Sub display ···· Symbol indicating the indication item for calibration. DO ···· DO indication calibration O2 ···· O_2 indication calibration SAT ···· SAT indication calibration



(at the time of zero calibration, DO indication calibration)



(at the time of zero calibration, O2 indication calibration)

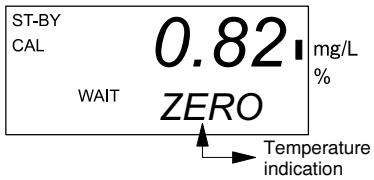
(at the time of zero calibration, SAT indication calibration)

Screen Examples

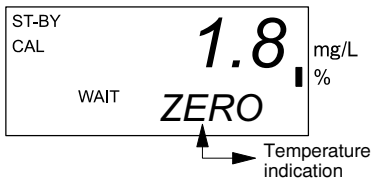
(To be continued)

(Continued from previous page)

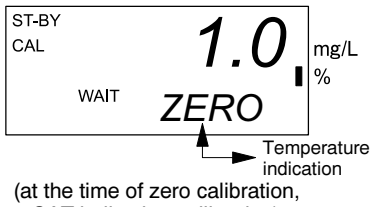
Procedure and screen example	Operation
③ Perform calibration by automatic check.	Press ENT.



(at the time of zero calibration, DO indication calibration)



(at the time of zero calibration, O2 indication calibration)



(at the time of zero calibration, SAT indication calibration)

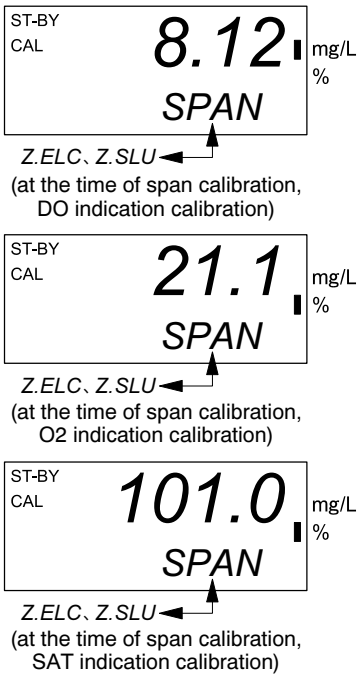
Screen Examples (During Calibration)

- Main display ···· DO measured value, O_2 measured value, or SAT measured value
- Sub display ···· Symbol indicating zero calibration or span calibration and temperature are alternately displayed.
- "CAL" and "WAIT" blink (stability check in progress or waiting) after confirmation
- To cancel the calibration, press ST-BY/MEAS.

④ Check that calibration by automatic check is ended.	Check that "CAL" is lit and "WAIT" is unlit and automatic calibration is ended. • Main display ···· DO measured value, O_2 measured value, or SAT measured value, after calibration. • To perform calibration again, press ENT.
⑤ Return to the "DO Measured Value" screen.	Press ST-BY/MEAS for 3 seconds or more.

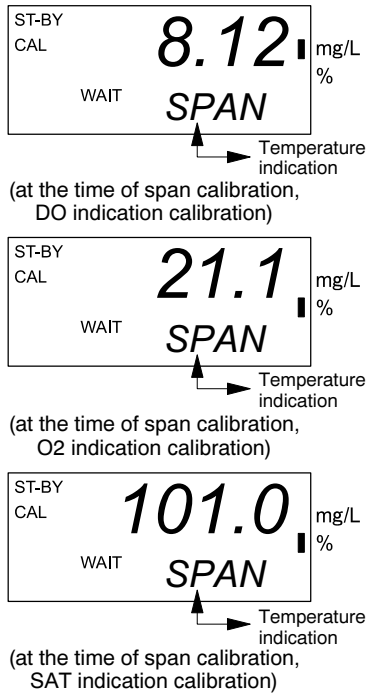
Screen Description (Manual Calibration)

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the "Manual Calibration Select" screen.	Press [CAL]. • If "MANU (manual calibration)" is set at the "Calibration Mode" (AUTO/MANU) screen and the analyzer goes to the calibration screen group, the screen switches to the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen. • "CAL" lights. • Main display ···· DO measured value, O_2 measured value, or SAT measured value • Sub display ···· Symbol indicating the type of manual calibration. Z.ELC ···· Electrical zero calibration Z.SLU ···· Zero calibration using zero solution SPAN ···· Span calibration



Screen Examples

③ Perform calibration.	Press [↑] or [↓] to select the necessary item on the sub display and then press [ENT]. • Main display ···· DO measured value, O_2 measured value, or SAT measured value • Sub display ···· Symbol indicating zero calibration or span calibration and temperature are alternately displayed. • "CAL" and "WAIT" blink (stability check in progress or waiting) after confirmation. • To cancel the calibration, press [ST-BY/MEAS].



Screen Examples (During Calibration)

(To be continued)

(Continued from previous page)

Procedure and screen example	Operation
④ Check that calibration is ended in manual operation.	Check that "CAL" is lit and "WAIT" is unlit and manual calibration is ended. • Main display ···· DO measured value, O_2 measured value, or SAT measured value, after calibration • To perform calibration again, press [ENT].
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(2) DO value adjust

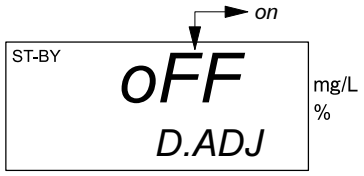
(a) This function adjusts the current DO measured value to other measuring instrument (such as measurement standard) or manual analysis value. Selecting valid/invalid for this function and adjusting the DO measured value are available.

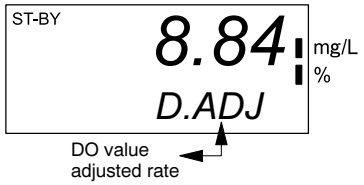
(b) This function is effective when the chlorine ion concentration is high and a high DO value is indicated.
>> 6.2(3) "Measurement of sample water containing salt"

(c) Even if this function is set to valid, it usually becomes invalid while operating screens of the calibration screen group.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [DISP] for 3 seconds or more. • Goes to the adjust/shift screen group and this screen appears. • "ST-BY" blinks • Main display ···· "on" or "oFF" on ···· Valid oFF ···· Invalid (factory setting)
③ Change the setting.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • If "on" is selected, the next screen appears after confirmation • If "oFF" is selected, go to the operation in ⑤.
④ Adjust the DO value.	Change the blinking numbers on the main display and then press [ENT]. • Main display ···· DO measured value after adjustment. To increase/decrease the number ···· [↑] [↓] • Sub display ···· "D.ADJ" and DO value adjusted rate (%) are displayed alternately. • Setting range ···· 60.0 to 140.0% with respect to the factory setting (100%) (factory setting: 100.0) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more





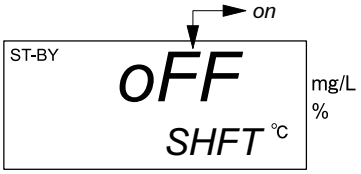
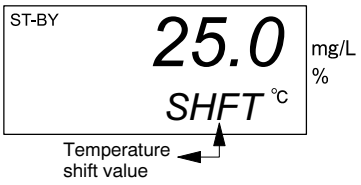
(3) Temperature shift

(a) This function adjusts the current temperature measured value to the value of other measuring instrument (such as a thermometer). Selecting valid/invalid for this function and changing the value after temperature shift (parallel shift) are available.

(b) If this function is set to valid, not only the temperature measured value, but also the DO measured value with automatic temperature compensation and the DO measured value with DO value adjust are dependent on the temperature after the shift.

(c) If the manual temperature compensation is valid, the screens in the following table are not displayed. ＞＞ 3.3(17) “Manual temperature compensation”

Operation Procedure

Procedure and screen example	Operation
① Select the “Setting Mode DO Measured Value” screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • “ST-BY” lights.
② Select the setting screen. 	Press [DISP] for 3 seconds or more and then press [ENT] repeatedly until “SHFT” appears on the sub display. • Goes to the adjust/shift screen group and this screen appears. • “ST-BY” blinks. • Main display ···· “on “ or “oFF” on ···· Valid oFF ···· Invalid (factory setting)
③ Change the setting.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • If “on” is selected, the next screen appears after confirmation. • If “oFF” is selected, go to the operation in ⑤.
④ Shift the temperature. 	Change the blinking number on the main display and then press [ENT]. • Main display ···· Temperature measured value after the shift To increase/decrease the number ··· [↑] [↓] • Sub display ···· “SHFT” and temperature shift value (°C) appear alternately. • Setting range ···· Temperature measured value before the shift ±5.0°C (factory setting: 0.0) • After confirmation, the screen returns to screen ①.
⑤ Return to the “DO Measured Value” screen.	Press [ST-BY/MEAS] for 3 seconds or more..

(4) Alarm

(a) This function takes out an alarm signal from the alarm output terminals. Selection of this function, distinction between high and low limits, alarm values and dead band can be changed.

(b) Each alarm conforms to the following alarm output terminals.

Alarm 1 ····· Terminals 30 and 31, "make" contact (form A contact) ALARM1

Alarm 2 ····· Terminals 32 and 33, "make" contact (form A contact) ALARM2

Alarm 3 ····· Terminals 34 and 35, "make" contact (form A contact) ALARM3.MNT (maintenance-in-progress output)

Alarm 4 ····· Terminals 36, 37, and 38, "transfer" contact (form C contact) ALARM4. (choose either power off output or electrode error output)

(c) When the alarm function is valid and the dead band is zero, if a DO measured value goes outside the set alarm value, an alarm condition occurs. The contact signal of the corresponding alarm output terminals changes and the alarm indicator (ALARM1, 2) blinks. If the DO measured value returns to within the alarm set value, the alarm condition will be reset.

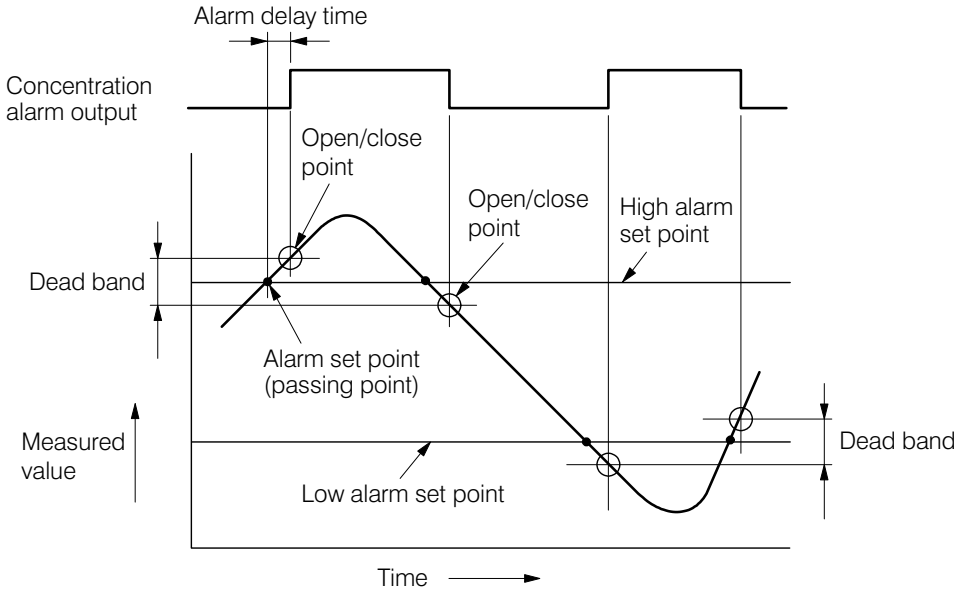
(d) If this function is set to valid, it operates under normal measurement condition but becomes invalid under the conditions shown below:

- When a screen of the setting mode or the transmission adjustment mode is displayed.
- When the wash function is within the wash time and within the wait time after wash.
- When a "closed" contact signal is input to the wash-in-progress input terminals (10 and 11).
- At the time of power failure or power supply is turned off.

(e) The alarm point can be slowed down by setting the dead band to a value other than zero. An alarm condition occurs when the measured value passes the alarm value and the measured value further exceeds one half of the dead band. The same thing occurs when the alarm condition is reset.
The setting range of dead band is within 5% of the DO measuring range higher limit. If dead band changes, increase the value gradually to obtain an appropriate setting value.

[Example of the setting range of dead band]

- In the case of the measuring range 0 to 5mg/L ····· 0.00 to 0.25mg/L
- In the case of the measuring range 0 to 10mg/L ····· 0.00 to 0.50mg/L



Dead Band

(f) Alarm 3 outputs the maintenance-in-progress signal.

- If the mode is changed to the setting mode (press [ST-BY/MEAS] for 3 seconds or more) and the wash function is within the wash time or the wait time after wash, the signal sent from the maintenance-in-progress signal output terminals (34 and 35) is switched to "closed".

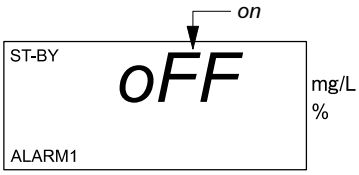
(g) Alarm 4 outputs either the power off signal or the electrode error signal (temperature error or diaphragm breakage detected).

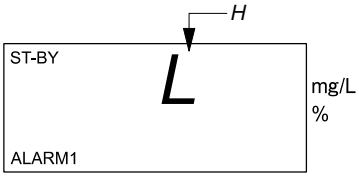
- If the power off signal is selected, the signal from the terminals (36, 37, and 38) is switched to "closed" when the power supply to the analyzer stops.
- If the electrode error signal is selected, the signal from the terminals (36, 37, and 38) is switched to "closed" when a temperature error (E-04, E-05) or diaphragm breakage error (E-08) occurs.

【IMPORTANT】
- Select either the power off signal or electrode error signal in advance. >> Step ⑨ of the following table
- Breaking of the diaphragm is detected by measuring the resistance between the interior of the special electrode and the diaphragm breakage detection electrode. For diaphragm breakage detection to function, the special electrode and lead wires must be used and the electrical conductivity of the sample water must be 10mS/m or greater (25°C).
- When the resistance between the interior of the electrode and the diaphragm breakage detection electrode becomes low because the diaphragm was not installed properly and the internal solution is leaking, it is detected the same as diaphragm breakage detection.

Operation Procedure

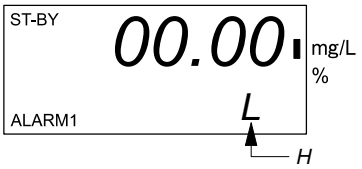
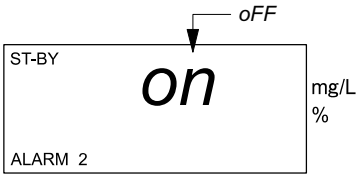
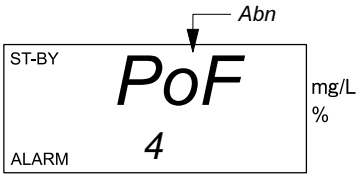
Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [ALARM] for 3 seconds or more. • Goes to the alarm screen group and this screen appears. • "ST-BY" blinks and "ALARM1" lights. • Main display ···· "on" or "oFF" on ···· Valid oFF ···· Invalid (factory setting)
③ Change Alarm 1.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • If "on" is selected, the next screen appears after confirmation. • If "oFF" is selected, the screen goes to step ⑦ after confirmation.
④ Select High or Low for Alarm 1.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • Main display ···· High/ Low selection for Alarm 1 L ···· Low alarm (factory setting) H ···· High alarm • The next screen appears after confirmation.





(To be continued)

(Continued from previous page)

Procedure and screen example	Operation
⑤ Change alarm value 1.	Change the blinking digit on the main display and then press [ENT].
	• Main display ···· Alarm value 1 (DO value) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➔] Setting range ···· Within the DO measuring range (factory setting: L ···· 0.00, H ···· full-scale value) • The next screen appears after confirmation.
⑥ Change dead band 1.	Change the blinking digit on the main display and then press [ENT].
	• Main display ···· Dead band 1 (DO value) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➔] Setting range ···· Within 5% of DO measuring range higher limit (factory setting: 0.00) • The next screen appears after confirmation.
⑦ Change Alarm 2.	Change the Alarm 2 settings as in steps ③ to ⑥. • "ALARM2" lights. • Alarm 2 selection ···· >> ② and ③ • Alarm 2 High/Low ···· >> ④ L ···· Low alarm. H ···· High alarm (factory setting) • Alarm value 2 ···· >> ⑤ Setting range ···· Within the DO measuring range (factory setting: L ···· 0.00, H ···· full-scale value) • Dead band 2 ···· >> ⑥ • The next screen appears after confirmation.
	
⑧ Change selection for Alarm 4.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • If "on" is selected, the next screen appears after confirmation. • If "oFF" is selected, the screen goes to step ⑨ after confirmation.
⑨ Change the signal for Alarm 4.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • Main display ···· Type of Alarm 4 PoF ···· Power off signal Abn ···· Electrode error • After confirmation, the screen returns to screen ①. *Electrode error The contact "closes" when a temperature sensor error (E-04, E-05) occurs or, for analyzer with the diaphragm breakage detecting function (option), an "E-08" error occurs.
	
⑩ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(5) DO measuring range

(a) This function changes the DO measuring range. Changing the DO value corresponding to the transmission output 20mA is available.

(b) This measuring range corresponds to the transmission output range (4 to 20mADC). The factory setting is set according to the ordered specification.

(c) If the measured value goes out of the measuring range, "OUT" blinks and when the measured value returns to within the measuring range, "OUT" will be turned off.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [OUT] for 3 seconds or more. • Goes to the measuring range screen group and this screen appears. • "ST-BY" blinks and "RANGE" lights. • Main display ···· Higher limit value of the DO measuring range
③ Change the higher limit value.	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➔] Setting range ···· 1.00 to 50.00mg/L (factory setting: depends on the ordered specification) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(6) Temperature measuring range

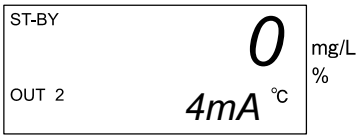
(a) This function changes the temperature measuring range. The range corresponds to the temperature transmission output (4 to 20mADC). The display section shows the temperature in the range of −10 to 100°C, which is the entire measuring range, regardless of the setting of the temperature measuring range.

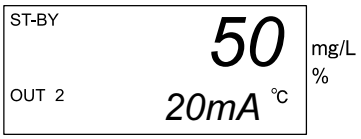
(b) The temperature measuring range can be changed within −5 to 100°C in the unit of 1°C and with width of 10°C or more.

(c) The measuring range may be limited by the specifications of the DO electrode to be combined.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [OUT] for 3 seconds or more and then press [ENT] repeatedly until "OUT 2" lights and "4mA" appears on the sub display. • Goes to the measuring range screen group and this screen appears. • "ST-BY" blinks and "OUT 2" lights. • Main display ···· Lower limit temperature value of the measuring range
③ Change the lower limit value.	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➡] Setting range ···· −5 to 90°C (factory setting: 0) • The next screen appears after confirmation.
④ Change the higher limit value.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Higher limit temperature value of the measuring range To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➡] Setting range ···· 5 to 100°C (factory setting: 50) • After confirmation, the screen returns to screen ①.
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.





(7) Wash operation (option)

(a) When the analyzer is equipped with wash function (option), this screen group appears. Washing on/off, wash interval, wash time, pulse count, and wait time can be set using this function.

(b) The combined sensor with wash function can be controlled by setting the wash type and conditions.

(c) Set the wash conditions as follows depending on the sensor to be combined. ＞＞ Step ② of the following table

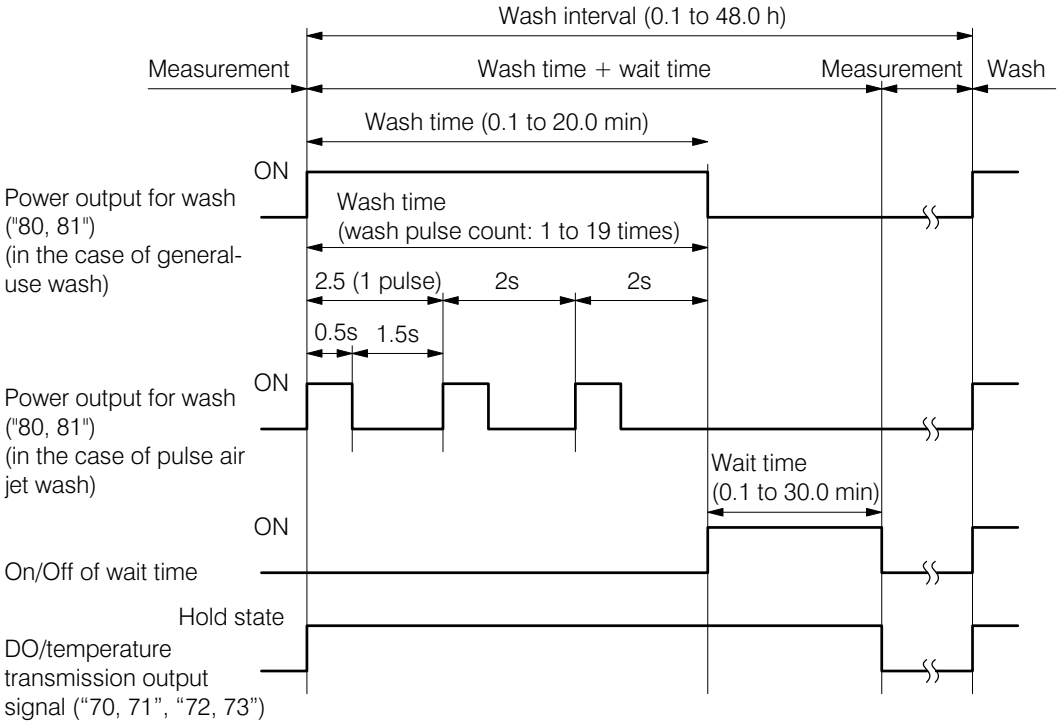
- For a sensor with general wash function (water jet, etc.) ···· “on”
- For a sensor with pulse air jet wash ···· “P.on”
- When a sensor is not equipped with wash function or when the wash function of the analyzer is not used (the control function of the cleaner is used) ···· “oFF”

(d) If “on” or “P.on” is set in (c), AC power supply for sensor will be output from the power supply output terminals for wash (80 and 81). In addition, at the time of wash, the analyzer goes to Hold state set by 3.3(13) “Hold type”.

(e) Even if “tH” is set by 3.3(13) “Hold type”, an alarm output signal will be reset during the wash operation and wait time after wash.

(f) If the power to the analyzer is turned off (including a power failure), wash interval is not counted and counting starts again after the power is turned on. Likewise, wash interval is not counted in the setting mode or in the transmission adjustment mode and counting starts when the mode returns to the measurement mode.

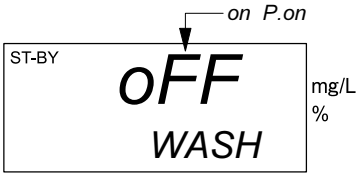
(g) Wash operation is not performed while the analyzer is in the setting mode.

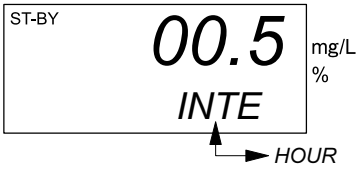


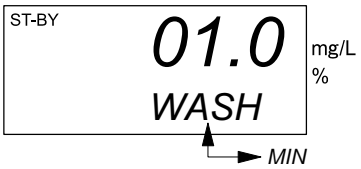
Sequence of Wash Operation

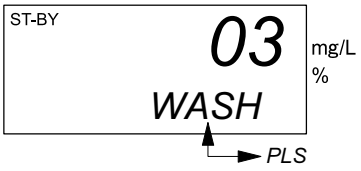
Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [R/W] for 3 seconds or more. • Goes to the wash function screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "on" or "oFF" on ···· Valid (for sensor with general wash) P.on ···· Valid (for sensor with pulse air jet wash) oFF ···· No wash function equipped or not using wash function (factory setting)
③ Change the setting.	Press [↑] or [↓] to select the necessary item on the main display and then press [ENT]. • If "on" or "P.on" is selected, the next screen appears after confirmation. • If "oFF" is selected, the screen goes to step ⑦ after confirmation.
④ Change the interval.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Wash interval (h) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➜] Setting range ···· 0.1 to 48.0h (in the unit of 0.1h) (factory setting: 0.5) **【IMPORTANT】** • The interval must be set longer than the total of wash time (number of times × 2s for pulse air jet wash) and the wait time. • The screen goes to step ⑤-1 after confirmation when "on" is selected at ②. The screen goes to step ⑤-2 after confirmation when "P.on" is selected at ②.
⑤–1 Change the wash time.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Wash time (min) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➜] Setting range ···· 0.1 to 20.0min (factory setting: 1.0) • The screen goes to step ⑥ after confirmation.
⑤–2 Change the pulse count.	Change the blinking number on the main display and then press [ENT]. • Main display ···· The number of times the pulse air jet is discharged (pulse count) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➜] Setting range ···· 1 to 19 times (factory setting: 3) • The next screen appears after confirmation.



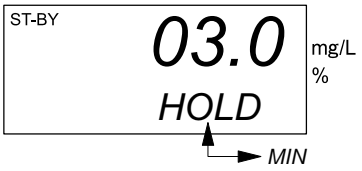






(To be continued)

(Continued from previous page)

Procedure and screen example	Operation
⑥ Change the wait time.	Change the blinking number on the main display and then press [ENT].
	• Main display ···· Wait time (min) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➔] Setting range ···· 0.1 to 30.0min (factory setting: 3.0) • After confirmation, the screen returns to screen ①.
⑦ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

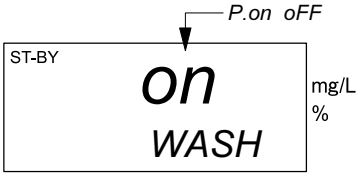
(8) Manual wash (option)

(a) This function starts manual wash by key operation when the analyzer is equipped with wash function (option).

(b) After starting manual wash, the wash operation can be stopped and the screen returns to the "DO Measured Value" screen by pressing [ST-BY/MEAS] for 3 seconds or more.

(c) Manual wash is performed and finished by the set wash time or pulse count. >> 3.3(7) "Wash operation"

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [R/W] for 3 seconds or more.
	• Goes to the wash function screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "on" or "oFF" on ···· General wash is performed (for sensor with general wash function) P.on ···· Pulse air jet wash is performed (for sensor with pulse air jet wash function) oFF···· No washing is performed • Do not press [ENT] while this screen is displayed. If pressed, screen ④ etc. of the table in 3.3(7) "Wash operation" appears.
③ Change the setting.	Press [↑] or [↓] to select the necessary item on the main display.
④ Start wash operation.	Press [R/W]. • Main display ···· DO measured value. • Sub display ···· "WASH" blinks. • After confirmation, the screen returns to screen ①.
	
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(9) Zero calibration signal value and span calibration signal value

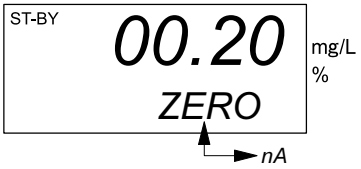
(a) This function is mainly used for technical service. Do not operate this function unless otherwise required.

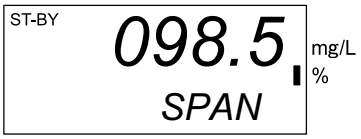
【IMPORTANT】 • If the setting value is changed when not necessary, correct measured values will not be obtained. If this happens, perform DO calibration to set the value back to normal value.

(b) Two signal values (at zero calibration and span calibration), both are the output conditions of the electrode, can be checked. In addition, these values can be intentionally changed as necessary. However, each time DO calibration is performed, the corresponding value will be automatically rewritten by the signal value from the electrode.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [DATA ➡] for 3 seconds or more. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· Signal value at the time of zero calibration (nA)
③ Change the zero calibration signal value.	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] Setting range ···· –50.00 to 50.00nA (*1, *2) (factory setting: 00.00) • The next screen appears after confirmation.
④ Change the span calibration signal value.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Signal value at the time of span calibration (%) • To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] Setting range ···· 60.0 to 140.0% (factory setting: 100.0) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.





*1: 1/1000 of μA

*2: In the case where the span calibration signal value is 100%. The setting range varies depending on the span calibration signal value.

(10) 25°C saturation current value

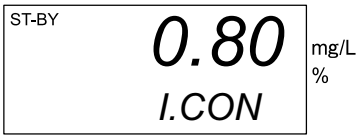
The 25°C saturation current values for dissolved oxygen electrode to be combined are shown in the table below. These values differ for each model name. If the 25°C saturation current value differs from the following values such as when the operation is started or when the electrode is changed to another model, set the value again using the procedure shown below.

Dissolved Oxygen Electrode Model and 25°C Saturation Current Value

	25°C saturation current value (μA)		
	0.08	0.8	1.6
Corresponding electrode model names	ELD-011	7533L	7536L
	ELD-012	765□L	7546L
	ELD-013	766□L	7695L
	ELD-015	767□L	7540L
	ELD-029	768□L	
		7699L	

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [DATA➔] for 3 seconds or more and then press [ENT] repeatedly until "I.CON" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· 25°C saturation current value (μA)
③ Change the setting.	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA➔] Setting range ···· 0.08 to 4.9 μA (factory setting: 0.8) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.



(11) Indication item for calibration

(a) One of the 3 types of indication items to be used at the time of calibration can be selected.

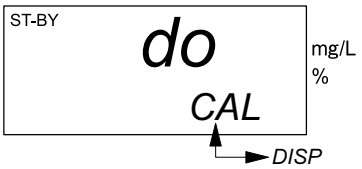
(b) Normally select DO indication calibration (do). Change the selection if necessary.
＞＞ 2.4(3) “Indicated value at the time of span calibration”

DO indication calibration (do)····· Perform calibration using dissolved oxygen concentration (mg/L).

O_2 indication calibration (O2) ····· Perform calibration using oxygen concentration (%).

SAT indication calibration (SA)····· Perform calibration using dissolved oxygen saturation ratio (%).

Operation Procedure

Procedure and screen example	Operation
① Select the “Setting Mode DO Measured Value” screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • “ST-BY” lights.
② Display the setting. ····· 	Press [DATA➡] for 3 seconds or more and then press [ENT] repeatedly until “CAL” and “DISP” appear alternately on the sub display. • Goes to the other screen group and this screen appears. • “ST-BY” blinks. • Main display ···· Indication item for calibration do ···· DO indication calibration (factory setting) O2 ···· O_2 indication calibration SA ···· SAT indication calibration
③ Change the setting. ·····	Press [⬆] or [⬇] to select the necessary item on the main display and then press [ENT]. • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the “DO Measured Value” screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more.

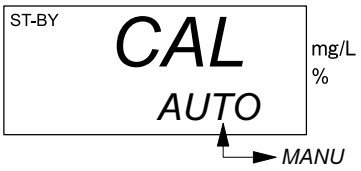
(12) Calibration mode

(a) For calibration mode, automatic and manual modes are provided and either one can be selected.

(b) If "AUTO (automatic calibration)" is set at this screen, the analyzer automatically determines whether zero or span calibration should be performed before performing calibration. If zero calibration is determined, "Zero calibration using zero solution" will be performed. In this case, the "Auto Check Calibration" (DO/O2/SAT) screen appears as the initial screen of the calibration screen group. >> Table "Screen Description (Auto Check Calibration)" of 3.3(1)

(c) If "MANU (manual calibration)" is set at this screen, one of the electrical zero calibration, zero calibration using solution, and span calibration (SPAN) can be selected by key operation to perform calibration. In this case, the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen appears as the initial screen of the calibration screen group. >> Table "Screen Description (Manual Calibration)" of 3.3(1)

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. 	Press [DATA➡] for 3 seconds or more and then press [ENT] repeatedly until "CAL" appears on the main display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "CAL" lights. • Sub display ···· Type of calibration mode AUTO ···· Automatically determines the calibration method to perform calibration (factory setting) MANU ···· The calibration method selected by the calibration screen group or manual calibration is performed. >> "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen
③ Change the setting.	Press [⬆] or [⬇] to select the necessary item on the sub display and then press [ENT]. • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(13) Hold type

(a) In the cases described in (b), the DO transmission output and the temperature transmission output become the pre-selected Hold type output. This is used to prevent the measured value error from disturbing the control system. This setting can be changed.

(b) The analyzer goes to Hold state in the following cases:

- When the cleaner control function is within the wash time and within the wait time after wash
- When a closed contact signal is input to the wash-in-progress contact signal input terminals (10 and 11) (option)
- When the screen displayed is a setting mode screen

(c) The Hold type can be selected from the types shown below:

- Preceding value hold (HoLd)····· Holds and outputs the immediately preceding transmission output value.
- Dummy value hold (du)····· Outputs an arbitrary set fixed transmission output value.
- Through (tH)····· Outputs the measured value as usual even in the Hold state.

(d) The converted value of DO or temperature for dummy value (mA) can be obtained in the formula below.

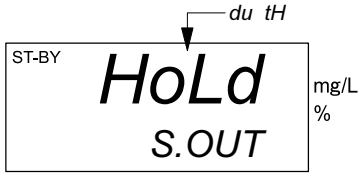
$$\text{DO or temperature converted value} = \frac{\text{Dummy value} - 4}{20 - 4} \times \text{Maximum scale value of measuring range}$$

(Example) In the case of Dummy value 12.00mA and DO measuring range 0.00 to 10.00mg/L

$$\text{DO} = \frac{12 - 4}{20 - 4} \times 10$$

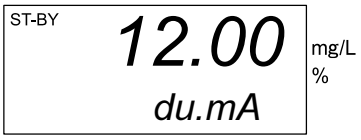
$$= \frac{8}{16} \times 10 = 5 \text{ (mg/L)}$$

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. ····· 	Press [DATA ➡] for 3 seconds or more and then press [ENT] repeatedly until "S.OUT" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· Hold type HoLd ···· Preceding value hold (factory value) dU ···· Dummy value hold tH ···· Through
③ Change the Hold type. ·····	Press [⬆] or [⬇] to select the necessary item on the main display and then press [ENT]. • When "du" is selected, the next screen appears after confirmation. • When "Hold" or "tH" is selected, the screen returns to screen ① by pressing [ENT] repeatedly. Go to step ⑤.

(To be continued)

(Continued from previous page)

Procedure and screen example	Operation
④ Change the dummy value. ····· 	Change the blinking number on the main display and then press [ENT]. • Main display ···· Dummy value (mA) To increase/decrease the number ···· [↑] [↓] To move the digit ···· [DATA ➔] Setting range ···· 4.00 to 20.00mA (factory setting: 12.00) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
⑤ Return to the "DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more.

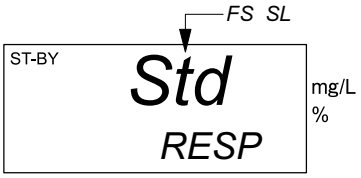
(14) Response speed

(a) The response speed for the analyzer from the time it takes the input signal of the electrode until the transmission output is set out can be selected. If the fluctuation of DO measured value occurs intensely in a short time, measurement may be controlled easily by slowing down the response speed.

(b) Response speed can be selected from the following speeds:

- FS (fast)····· Fast (approx. 10 seconds/90%FS, using equivalent input)
- Std (standard) ···· Standard (approx. 15 seconds/90%FS, using equivalent input) (factory setting)
- SL (slow)····· Slow (approx. 30 seconds/90%FS, using equivalent input)

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. ····· 	Press [DATA ➔] for 3 seconds or more and then press [ENT] repeatedly until "RESP" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· Type of response speed FS ···· Fast Std ···· Standard (factory setting) SL ···· Slow
③ Change the setting. ·····	Press [↑] or [↓] to select the necessary item on the main display and press [ENT]. • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more.

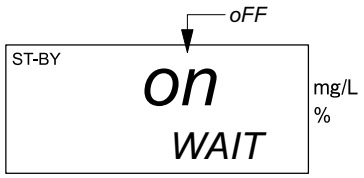
(15) Stability check for calibration

(a) Stability check for calibration is the function to automatically determine that the measured value is stabilized at the time of DO calibration and then takes in the calibration value. Valid/invalid for this function can be selected..

(b) When this function is on, if the measured value obtained at 10 second intervals is below the design standard three times in succession, the analyzer determines that the value is stable and takes in the measured value as calibration value.

(c) If this function is turned off, check that the DO value is stabilized at the "DO Measured Value" screen and then perform calibration.

Operation Procedure

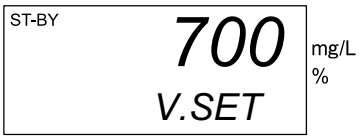
Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. 	Press [DATA ➔] for 3 seconds or more and then press [ENT] repeatedly until "WAIT" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "on" or "oFF" on ···· Valid (factory setting) oFF ···· Invalid.
③ Change the setting.	Press [⬆] or [⬇] to select the necessary item on the main display and press [ENT]. • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(16) Impressed voltage

This function is mainly used for technical service. Do not operate this function unless otherwise required

【IMPORTANT】 • If the setting value is changed when not necessary, correct measured values will not be obtained.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. ····· 	Press [DATA ➡] for 3 seconds or more and then press [ENT] repeatedly until "V.SET" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· Impressed voltage (mV)
③ Change the setting. ·····	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] Setting range ···· 0 to 999mV (factory setting: 700mV) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen. ·····	Press [ST-BY/MEAS] for 3 seconds or more.

(17) Manual temperature compensation

(a) Normally, “temperature compensation for sample water and electrode” is automatically carried out using the measured value by the temperature element of the electrode. When electrode without a temperature element (for fermentation, etc.) is used, or when electrode of temperature element other than 10kΩ/25°C (thermistor) is used, temperature compensation can be carried out by entering the temperature of the sample water by key input.

(b) When DKK-TOA’s Model 7533L or Model 7536L DO electrode is used, temperature compensation is carried out using the measured temperature and thus it is not necessary to set for manual temperature compensation.

(c) Manual temperature compensation value to be set using this screen is the current temperature of the sample water. Measurement using manual temperature compensation is useful when the temperature variation of the sample water is small.

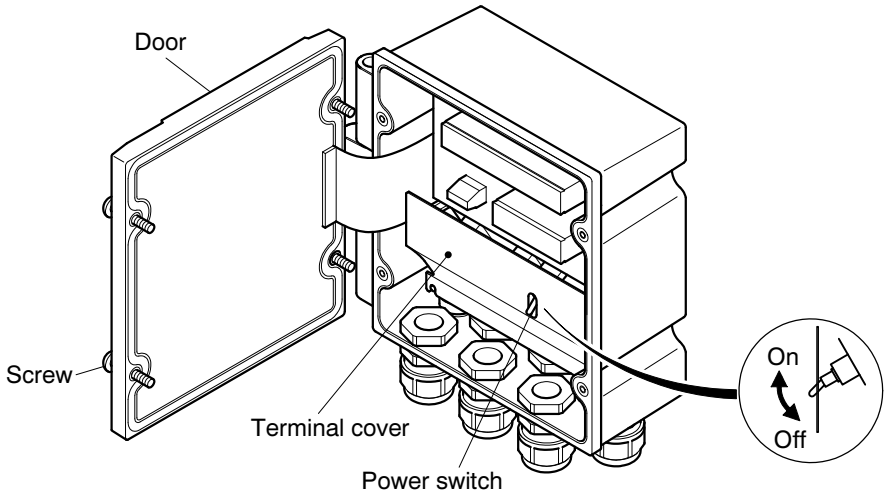
(d) When the manual temperature compensation has been changed, return the mode to the measurement mode and restart the analyzer by the following procedure.

⚠ WARNING

Electric Shock

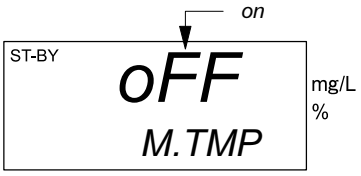
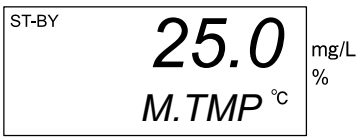
- Do not touch the terminals inside the product while power is applied. Touching the terminals can cause electric shock.

【IMPORTANT】 • The power switch is facing a little downward. When you turn on/off the switch, be sure to check that the power is actually turned on or off.



Analyzer Power Switch

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen. 	Press [DATA ➡] for 3 seconds or more and then press [ENT] repeatedly until "M.TMP" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "on" or "oFF" on ···· Valid oFF ···· Invalid (factory value)
③ Change the setting.	Press [⬆] or [⬇] to select the necessary item on the main display and press [ENT]. • When "on" is selected, the next screen appears after confirmation. • When "oFF" is selected, the screen returns to screen ① by pressing [ENT] repeatedly. Go to step ⑤.
④ Change the manual temperature compensation value. 	Change the blinking number on the main display and then press [ENT]. • Main display ···· Manual temperature compensation value To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] • Setting range ···· 0.0 to 45.0°C (factory setting: 25.0) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
⑤ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.
⑥ Restart the analyzer.	After checking that the "DO Measured Value" screen is displayed, open the door of the analyzer and turn the power switch off and then back on. Next, check that the power is turned on and close the door.

(18) Date and time (clock adjustment)

(a) The current date and time of the clock built into the product can be adjusted. The built-in clock is used for recording the calibration date/time as calibration history and for clock display.

(b) When the product power has been off for 2 or 3 days or more, adjust the clock by the following procedure to restart the operation.

【IMPORTANT】 • The clock will not work normally if a date which does not exist (Ex: February 30) is set.

〔NOTE〕 • The setting values and calibration data are recorded in EEPROM (non-volatile memory) and thus turning off the power does not affect them.

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [DATA ➡] for 3 seconds or more and go to the other screen group. • Press [ENT] repeatedly until "CLK.Y" appears on the sub display. • Main display ···· Western calendar year
③ Change the year.	Change the blinking number on the main display and then press [ENT]. • To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] • Setting range ···· 08 to 99 (2008 to 2099) • After confirmation, the "Month and Day" screen appears.
④ Change the month and day.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Month and day To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] • Setting range ···· 01.01 to 12.31 (Jan 1 to Dec 31) • After confirmation, the "Time" screen appears.
⑤ Change the time.	Change the blinking number on the main display and then press [ENT]. • Main display ···· Time To increase/decrease the number ···· [⬆] [⬇] To move the digit ···· [DATA ➡] • Setting range ···· 00.00 to 23.59 (00:00 to 23:59) • The next screen appears after confirmation. If [ENT] is pressed repeatedly here, the screen returns to screen ①.
⑥ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.

(19) Measurement mode automatic return

(a) When 2 hours passes after the mode is changed from the measurement mode to the setting mode, the mode automatically returns to the measurement mode. This function complements the analyzer so that the mode returns to the measurement mode without fail. This function can be turned on or off.

(b) The screen returns to the "DO Measured Value" screen of the measured value screen group in the measurement mode.

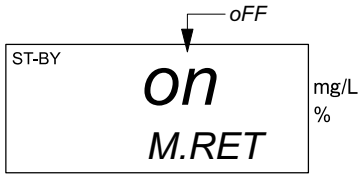
⚠ CAUTION

Automatic Wash at Automatic Return

- When maintenance work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function at this screen. If this function is on, the analyzer will automatically return to the measurement mode after 2 hours has elapsed and automatic wash by set intervals will start in the case where the wash function is enabled, which is dangerous..

Operation Procedure

Procedure and screen example	Operation
① Select the "Setting Mode DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more in the measurement mode. • "ST-BY" lights.
② Select the setting screen.	Press [DATA➡] for 3 seconds or more and press [ENT] repeatedly until "M.RET" appears on the sub display. • Goes to the other screen group and this screen appears. • "ST-BY" blinks. • Main display ···· "on" or "oFF" on ···· Valid (factory setting) oFF ···· Invalid
③ Change the setting.	Press [⬆] or [⬇] to select the necessary item on the main display and then press [ENT]. • After confirmation, the screen returns to screen ①.
④ Return to the "DO Measured Value" screen.	Press [ST-BY/MEAS] for 3 seconds or more.



3.4 Transmission Adjustment Mode Operation

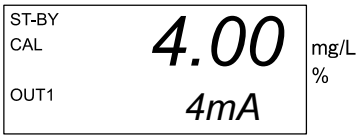
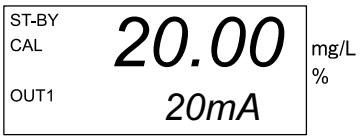
(1) DO transmission output

(a) This function is mainly used for technical service. Do not operate this function unless otherwise required.

【IMPORTANT】 • If the setting values are changed when not necessary, correct measured values will not be obtained. In this case, set the value back to the factory setting.

(b) 4mADC and 20mADC values of the DO transmission output can be adjusted. This adjustment can be used when adjustment function is not provided for a receiving device (recorder, etc.)

Operation Procedure

Procedure and screen example	Operation
① Select the adjustment screen.	Press [OUT] for 3 seconds or more in the measurement mode.
	• Goes to the transmission adjustment mode and this screen appears. • "ST-BY" and "OUT1" light and "CAL" blinks. • Main display ···· Value near 4mA after the previous adjustment
② Adjust the 4mA value.	Press [↑] or [↓] so that the indication of a receiving device becomes 4mA and then press [ENT]. • To increase/decrease the number ···· [↑] [↓] (Output value changes by 0.005mA each time the key is pressed.) Setting range ···· 3.00 to 5.00mA DC (factory setting: 4.00) • The next screen appears after confirmation.
③ Adjust the 20mA value.	Press [↑] or [↓] so that the indication of a receiving device becomes 20mA and then press [ENT]. • Main display ···· Value near 20mA after the previous adjustment To increase/decrease the number ···· [↑] [↓] (Output value changes by 0.005mA each time the key is pressed.) Setting range ···· 19.00 to 21.00mA DC(factory setting: 20.00) • "OUT 2" lights and "Temperature Transmission 4mA Adjustment (4mA)" screen appears. Furthermore, if [ENT] is pressed twice, the screen returns to screen ①.
	
④ Repeat the adjustment.	Repeat steps ② and ③ until the indication of a receiving device match 4mA and 20mA.
⑤ Return to the "DO Measured Value" screen.	Press [OUT] for 3 seconds or more.

(2) Temperature transmission output

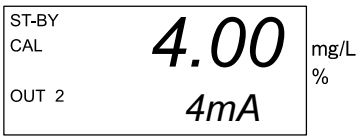
(a) This function is mainly used for technical service. Do not operate this function unless otherwise required.

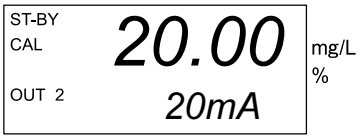
【IMPORTANT】 • If the setting values are changed when not necessary, correct measured values will not be obtained. In this case, set the value back to the factory setting.

(b) 4mADC and 20mADC values of the temperature transmission output can be adjusted. This adjustment can be used when adjustment function is not provided for a receiving device (recorder, etc.)

Operation Procedure

Procedure and screen example	Operation
① Select the transmission adjustment mode.	Press [OUT] for 3 seconds or more in the measurement mode. • "ST-BY" and "OUT 1" light and "CAL" blinks.
② Select the adjustment screen.	Press [ENT] (twice) until "OUT 2" lights and "4mA" appears on the sub display. • Main display ···· Value near 4mA after the previous adjustment.
③ Adjust the 4mA value.	Press [↑] or [↓] so that the indication of a receiving device becomes 4mA and then press [ENT]. • To increase/decrease the number ···· [↑] [↓] (Output value changes by 0.005mA each time the key is pressed.) Setting range ···· 3.00 to 5.00mA DC (factory setting: 4.00) • The next screen appears after confirmation.
④ Adjust the 20mA value.	Press [↑] or [↓] so that the indication of a receiving device becomes 20mA and then press [ENT]. • Main display ···· Value near 20mA after the previous adjustment. To increase/decrease the number ···· [↑] [↓] (Output value changes by 0.005mA each time the key is pressed.) Setting range ···· 19.00 to 21.00mA DC (factory setting: 20.00) • After confirmation, "OUT 1" lights and "DO Transmission 4mA Adjustment (4mA)" screen appears. Furthermore, if [ENT] is pressed twice, the screen returns to screen ②.
⑤ Repeat the adjustment.	Repeat steps ③ and ④ until the indication of a receiving device match 4mA and 20mA.
⑥ Return to the "DO Measured Value" screen	Press [OUT] for 3 seconds or more.





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) For measurement system, maintenance of sensor is especially important. Refer to the Instruction Manual attached to the sensor.

(c) The “Maintenance cycle” described in the table “Standard Maintenance List” is based on the standard installation condition (condition that satisfies the items in 8.1(1) “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.

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

Standard Maintenance List

No.	Subject	Contents	Start	Maintenance cycle						Execution method, etc.
				1 week	2 weeks	1 month	6 months	1year	When needed	
1	Analyzer and sensor	Calibration *	○			○				＞＞ 2.2 “Overview of Calibration”, 2.4“Span Calibration”
2	Analyzer	Check and adjust the indicated value and transmission output using an equivalent input.						○		＞＞ 4.3 “Operation Check Using Equivalent Input”

* ……Perform calibration at the start of operation and when electrode/diaphragm is replaced and calibration is needed again 2 weeks later

4.2 Spare Parts

- Dissolved oxygen electrode of the same model as the one being used

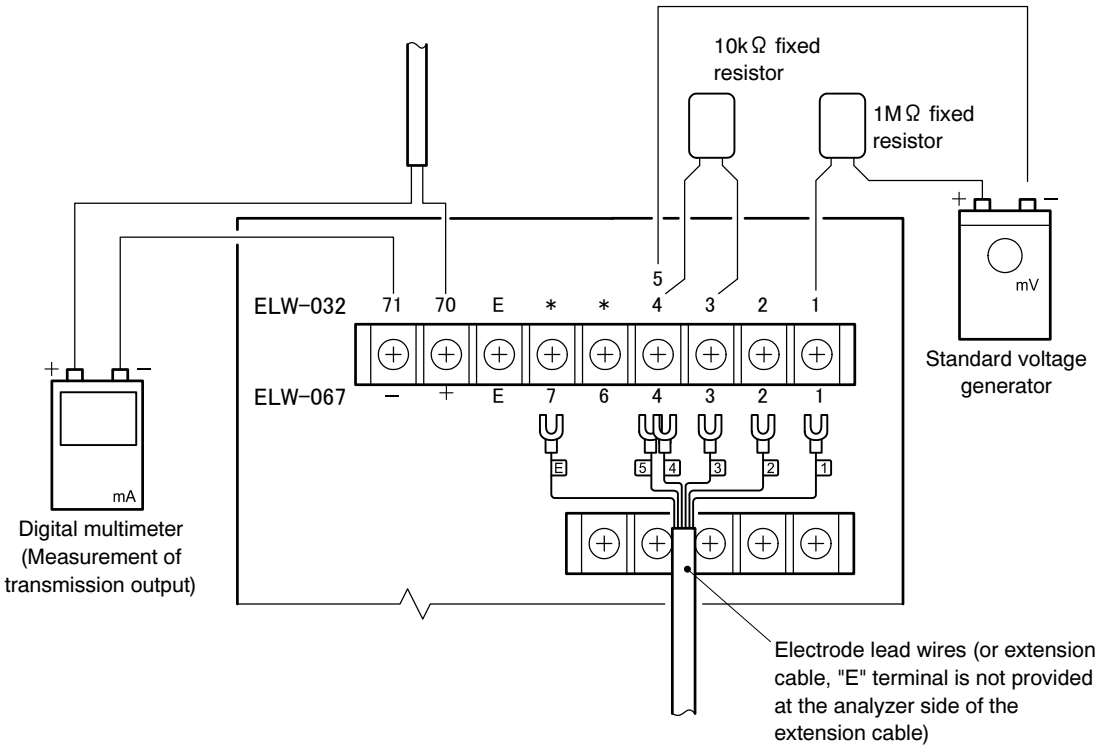
  Model 7533L, Model 7536L, Model 7540L, etc.

- Sodium sulfite (Sulfite of soda) ····· When zero calibration is performed using zero solution

  〔NOTE〕 • Sodium sulfite is not required to be anhydrous. In addition, the reagent is not necessarily to be high-purity reagent.

- Diaphragm for electrode (refer to the separate instruction manual attached to the sensor or electrode)
- Internal solution for electrode (refer to the separate instruction manual attached to the sensor or electrode)

4.3 Operation Check Using Equivalent Input



Operation Check Using Equivalent Input

①Preparation

- Standard voltage generator (the one that can generate 0 to 5V)
- Digital multimeter (internal resistance 10Ω or less, current measuring range is used)
- 10kΩ fixed resistor
- 1MΩ fixed resistor

⚠ WARNING

Electric Shock

● Do not touch the terminal board in the analyzer while power is applied. Touching the terminal board may cause electric shock.

②Turn off power and remove the electrode lead wires. ····· Turn off the power at the power source side and open the door of the analyzer and remove the electrode lead wires (or extension cable) connected to terminals 1 to 5 and E. In addition, remove the wire from terminal 71.

③Connect the devices. ····· Connect the following devises to each terminal.

- Standard voltage generator··· Connect the "–" side of the output terminals to terminals 4 and 5. Connect the 1MΩ fixed resistor to the "+" side of the output terminals.
- 10kΩ fixed resistor ····· Between terminals 3 and 4
- 1MΩ fixed resistor ····· Between terminal 1 and the "+" side of the output terminals of the standard voltage generator
- Digital multimeter ····· Between terminal 71 and its removed lead wire

④Perform calibration. ····· Perform zero and span calibrations as shown below.

ⓐ Turn on power. ····· Turn on the power at the source side and wait for about 5 minutes until the measured value is stabilized.

ⓑ Select the setting mode. ····· Press [ST-BY/MEAS] for 3 seconds or more.

- "ST-BY" lights and the "Setting Mode DO Measured Value" screen appears.

ⓒ Change the settings. ····· Write down the currently set values of the following screens and change the values as follows:

- Set "oFF" at the setting screen for DO value adjust. ····· >> Table ② of 3.3(2) "DO value adjust"
- Set "MANU" at the setting screen for calibration mode. ····· >> Table ② of 3.3(12) "Calibration mode"
- Set "FS" at the setting screen for response speed. ····· >> Table ② of 3.3(14) "Response speed"

ⓓ Select "Calibration screen group." ····· Press [CAL].

- "CAL" lights and the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen of the calibration screen group appears. >> 3.3(1) "Calibration screen descriptions"

ⓔ Select electrical zero calibration. ····· Press [↑] or [↓] until "Z.ELC" (electrical zero calibration) appears on the sub display of the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen.

ⓕ Start zero calibration. ····· Press [ENT] once.

- "CAL" and "WAIT" blink and zero calibration starts. When calibration ends, "CAL" lights and "WAIT" turns off.

ⓖ Set the output value of standard voltage generator. ····· Set the output value obtained in the following equation to the standard voltage generator.

$$\text{Output value of standard voltage generator} = \frac{\text{Setting value (I.CON) for 25°C saturation current value}}{0.8} \times 0.811\ (\text{V})$$

ⓗ Select span calibration. ····· Press [↑] or [↓] until "SPAN" (span calibration) appears on the sub display of the "Manual Calibration Select" (Z.ELC/Z.SLU/SPAN) screen.

ⓘ Start span calibration. ····· Press [ENT] once.

- "CAL" and "WAIT" blink and span calibration starts. When the span calibration ends, "CAL" lights and "WAIT" turns off.

ⓙ Return to the measurement mode. ····· Turn off the output of the standard voltage generator and press [ST-BY/MEAS] for 3 seconds or more.

- The analyzer returns to the measurement mode ("ST-BY" is unlit).

⑤Check the measuring range. ····· ＞＞ 3.2(3) "DO/temperature measuring range"

⑥Check the indication using an equivalent input. ····· Enter each equivalent input value corresponding to the measuring range checked in step ⑤ of the table "Input/Output Standard Values for Each Measuring Range (when setting value (I.CON) for 25°C saturation current value is 0.80)" and check the indicated value and the transmission output value.

- If the measured value is out of the tolerance value shown below, check and confirm the accuracy of the devices used for this operation and if it is OK, contact the sales agent from which you bought this product.

< Tolerance for indicated value >

Within ±0.05mg/L or ±1%FS (whichever is larger)

〔NOTE〕 • When the setting value (I.CON) for 25°C saturation current value is other than 0.80, obtain the equivalent input using the following equation.

$$\text{Equivalent input (V)} = \frac{\text{Setting value (I.CON) for 25°C saturated current value}}{8} \times (\text{Indicated value})$$

Example) Indicated value: 10.00mg/L
I. CON: 1.6

$$\frac{1.6}{8} \times 10 = 2\ (\text{V})$$

⑦Return to the original state. ····· If no error occurs, turn off the power to the analyzer and remove all the wiring of the devices connected in step ③ and connect the lead wires in the same way as before and close the door of the analyzer.

⑧Restore the setting. ····· Supply power to the analyzer and restore the settings changed in step ④ⓒ "Change the settings".

⑨Return to the measurement mode. ····· Press [ST-BY/MEAS] for 3 seconds or more.

Input/Output Standard Values for Each Measuring Range

(when setting value (I.CON) for 25°C saturation current value is 0.80)

DO 0 to 1mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.020	0.20	7.20
0.040	0.40	10.40
0.060	0.60	13.60
0.080	0.80	16.80
0.100	1.00	20.00

DO 0 to 2mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.040	0.40	7.20
0.080	0.80	10.40
0.120	1.20	13.60
0.160	1.60	16.80
0.200	2.00	20.00

DO 0 to 5mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.100	1.00	7.20
0.200	2.00	10.40
0.300	3.00	13.60
0.400	4.00	16.80
0.500	5.00	20.00

DO 0 to 10mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.200	2.00	7.20
0.400	4.00	10.40
0.600	6.00	13.60
0.800	8.00	16.80
1.000	10.00	20.00

DO 0 to 15mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.300	3.00	7.20
0.600	6.00	10.40
0.900	9.00	13.60
1.200	12.00	16.80
1.500	15.00	20.00

DO 0 to 20mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.400	4.00	7.20
0.800	8.00	10.40
1.200	12.00	13.60
1.600	16.00	16.80
2.000	20.00	20.00

DO 0 to 25mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.500	5.00	7.20
1.000	10.00	10.40
1.500	15.00	13.60
2.000	20.00	16.80
2.500	25.00	20.00

DO 0 to 30mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
0.600	6.00	7.20
1.200	12.00	10.40
1.800	18.00	13.60
2.400	24.00	16.80
3.000	30.00	20.00

DO 0 to 50mg/L measuring range

Equivalent input (V)	Indicated value (mg/L)	Transmission output (mA)
0.000	0.00	4.00
1.000	10.00	7.20
2.000	20.00	10.40
3.000	30.00	13.60
4.000	40.00	16.80
5.000	50.00	20.00

〔NOTE〕 • Be sure to connect the standard voltage generator through a 1MΩ fixed resistor. The equivalent input of Table “Input/Output Standard Values for Each Measuring Range” is the value based on the assumption of this fact.

• Though an equivalent input of a small current signal is required to check the operation of this analyzer, the method to obtain a convenient current signal is used here by applying a voltage of the standard voltage generator through a 1MΩ fixed resistor.

5. Troubleshooting

5.1 Error message

(1) Error messages for calibration and necessary actions

(a) When measurement is continued, the characteristic of the DO electrode changes gradually by contaminants and chemical reactions. By performing calibration, correct measurement can be continued. However, if the characteristic change goes too far, correct measurement cannot be maintained. This analyzer indicates error messages during calibration and temperature measurement meaning "You cannot use this controller under this condition."

(b) Error message indication can be reset by pressing ST-BY/MEAS for 3 seconds or more to return to the measurement mode.

(c) Calibration can be performed again by pressing ENT while error message is displayed.

(d) When the controller returns to the measurement mode after error message is indicated, the controller returns to the measurement condition under the previous calibration value.

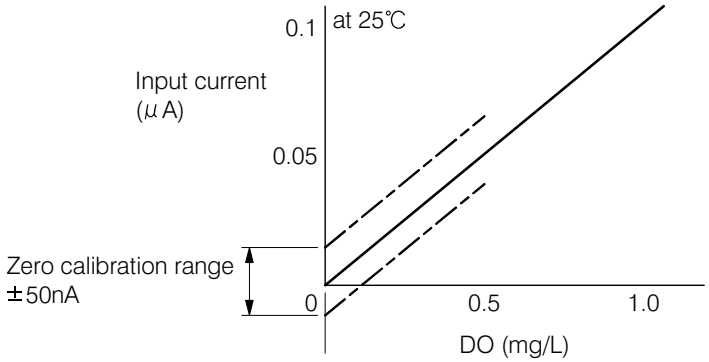
Error Messages for Calibration and Necessary Actions

Item	Indication	Message name and contents	Actions, etc.
1	ST-BY CAL E-01 mg/L %	[Zero calibration cannot be made] • As a result of zero calibration, the obtained value is out of the range of design standard±50nA.	• Replace the electrode diaphragm and internal solution. • Clean the detection part of the electrode. • Prepare zero calibration solution again. • If the characteristic of the electrode does not return to normal when internal solution or diaphragm is replaced, replace the electrode. • If indicated by electrical zero calibration (Z.ELC), contact DKK-TOA.
2	ST-BY CAL E-02 mg/L %	[Span calibration cannot be made] • As a result of span calibration, the obtained value is out of the range of design standard±40%.	• Replace the electrode diaphragm and internal solution. • Clean the detection part of the electrode. • If the problem does not return to normal, replace the electrode.
3	ST-BY CAL E-03 mg/L %	[Stability check cannot be made] • This indicates that the signal from the electrode does not stabilize within 5 minutes after stability check is started during zero or span calibration.	• Clean the detection part of the electrode. • Replace the electrode diaphragm and internal solution. • If the temperature of the electrode goes down, the response deteriorates. If the temperature is low in wintertime, etc., either take enough time to perform calibration or perform calibration at 15 to 20°C. • If measurement is continued, silver-like deposit accumulates on the detection part of the electrode and this may adversely affect the response. If the deposit is accumulated, scrape it off using a knife, etc. taking care not to damage the detection part. • If indicated by electrical zero calibration (Z.ELC), contact DKK-TOA.

〔NOTE〕 • The relationship between the input current from the DO electrode and error message is shown in the graph.

(a) Zero calibration cannot be made (E-01)

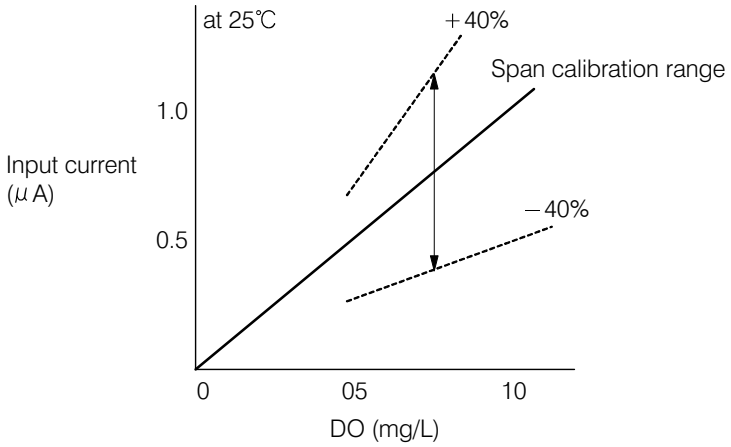
If zero calibration is performed with its result out of the range of design standard by ±50nA, an error message “E-01” appears.



Range of Improper Zero Calibration

(b) Span calibration cannot be made (E-02)

If span calibration is performed with its result out of the range of design standard by ±40%, an error message “E-02” appears.



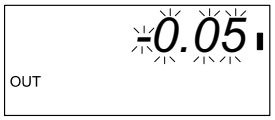
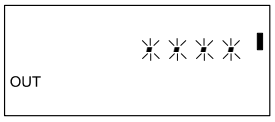
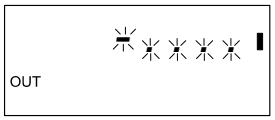
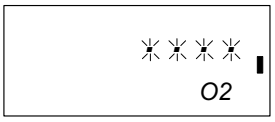
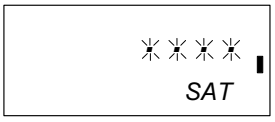
Range of Improper Span Calibration

(c) Stability check cannot be made (E-03)

At the time of zero or span calibration, if the signal from the electrode continues to change 5 minutes after the stability check is started, an error message “E-03” appears.

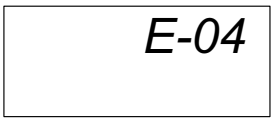
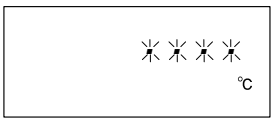
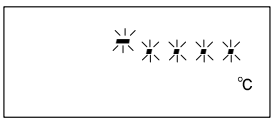
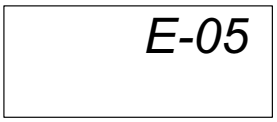
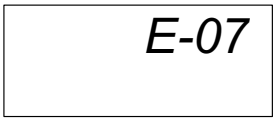
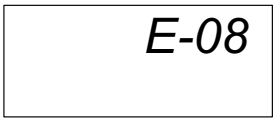
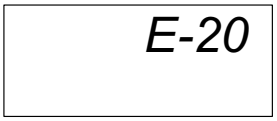
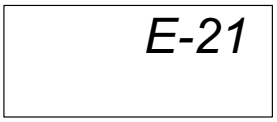
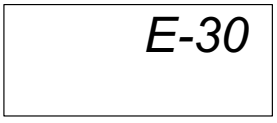
(2) Other error messages and necessary actions

Other Error Messages and Necessary Actions

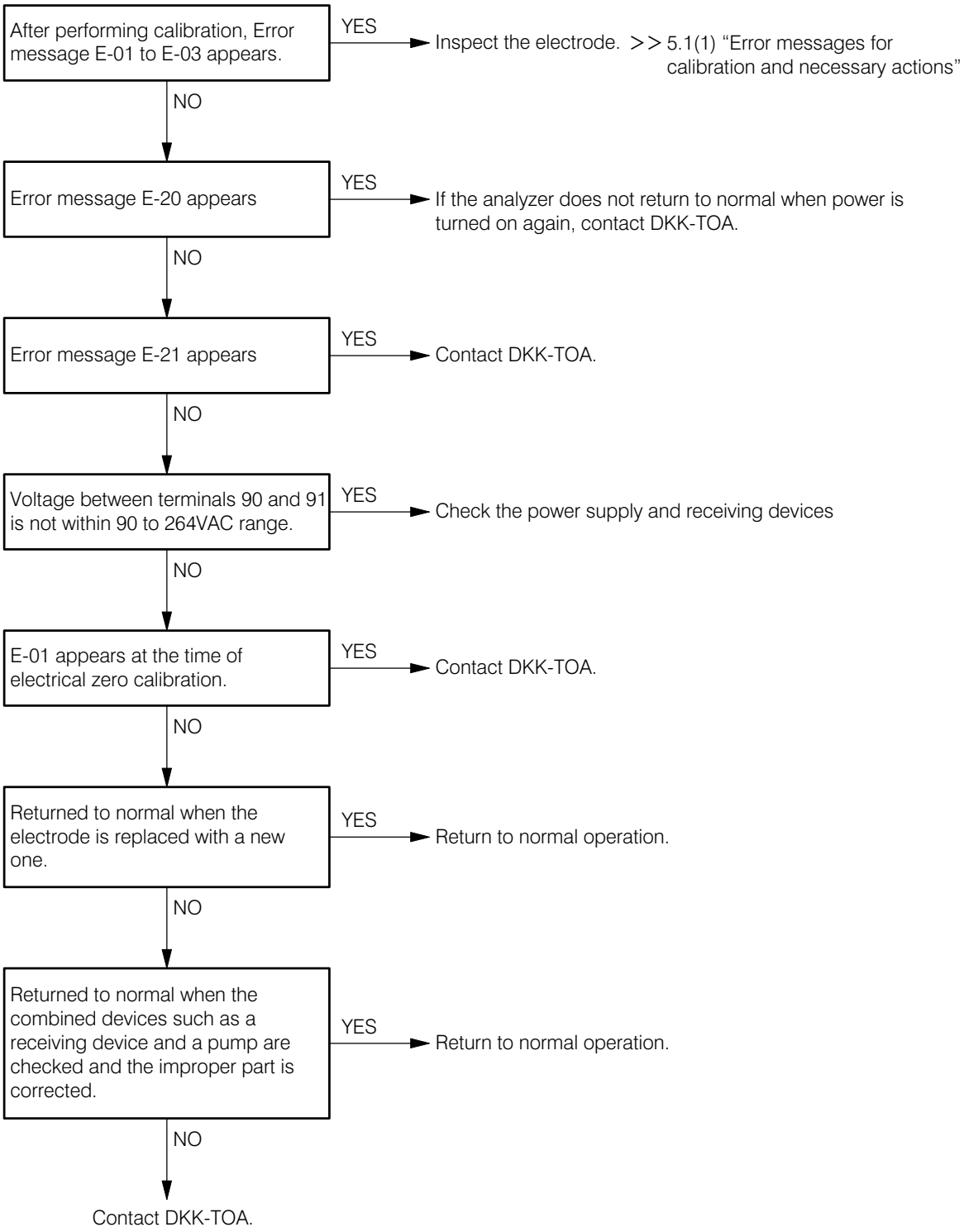
Item	Indication	Message name and contents	Actions, etc.
1	  With "DO Measured Value" screen	[Overflowed] or [Underflowed] • Blinking of the value on the main display of the “DO Measured Value” screen indicates that the DO measured value is within the range of 100 to 105% of the high limit of the measuring range or the measured current value is in the range of –0.06 to 0.0μA.	• Set the DO measuring range again. • Check the insulation of the extension cable. • Perform zero calibration again. • Perform span calibration again.
	  With "DO Measured Value" screen	[Overflowed] or [Underflowed] • Blinking of the decimal point on the main display of the “DO Measured Value” screen indicates that the DO measured value is above 105% of the high limit of the measuring range or the measured current value is less than –0.06μA.	
	 With "O_2 Measured Value" screen	[Overflowed] or [Underflowed] • Blinking of the decimal point on the main display of the “O_2 Measured Value” (O2) screen indicates that the O_2 (oxygen concentration in the air) is above 31.5% or the measured current value is less than –0.06μA.	
	 With "SAT Measured Value" screen	[Overflowed] or [Underflowed] • Blinking of the decimal point on the main display of the “SAT Measured Value” (SAT) screen indicates that the SAT (dissolved oxygen saturation ratio) is above 210.0% or the measured current value is less than –0.06μA.	

(To be continued)

(Continued from previous page)

Item	Indication	Message name and contents	Actions, etc.
2	 Other than "Temperature Measured Value" screen	[Temperature measured value error] • This indicates that the temperature of sample water is out of the temperature compensation range 0.0 to 50.0°C for 30 seconds or more.	• Take measures to set the temperature of sample water to within the range of 0.0 to 50.0 °C. The error message will be automatically reset. • Temperature measured value error (E-04) can be temporarily reset by pressing any key. 30 seconds later, a temperature measured value error (E-04) appears again.
	  With "Temperature Measured Value" screen	[Temperature measured value error] • Blinking of the decimal point on the main display of the “Temperature Measured Value” screen indicates that the temperature of sample water is out of the range of –10.0 to 100.0°C. 30 seconds later, (E-04) appears.	
3		[Temperature element error] • This indicates that the wiring of temperature element is broken or short-circuited.	• Check that the electrode lead wires are not disconnected. • If the temperature element or lead wires are erroneous, replace it.
4		[Impress voltage error] • This indicates that the obtained value is out of the impress voltage setting value ±5% for 30 seconds or more.	• If error message is reset when the terminal 1 of the electrode lead wires is removed, replace the electrode diaphragm.
5		[Electrode membrane abnormal] • Electrode membrane damaged • Membrane installation faulty (internal solution leakage, etc.) • Indicates an insulation drop due to entry of water into the connector.	• When the membrane is damaged or its installation is faulty, replace the electrode membrane. • When solution has entered the connector, replace the electrode and cable.
6		[Storage element error] • Indicates that the read/write test to/from the EEPROM (non-volatile memory) executed immediately after power is turned on has failed.	• If the analyzer does not return to normal when power is turned on again, contact DKK-TOA.
7		[Setting data error] • Indicates that the in-house calibration data and setting data of the EEPROM (non-volatile memory) taken immediately after power is turned on was outside of the specified range.	• Contact DKK-TOA.
8		[Built-in clock data abnormal] • Date and time are not set.	• Set the date and time.

5.2 Troubleshooting Flowchart



5.3 Measures against Noise

(a) Error symptom due to noise

If a strong noise source exists near this DO measurement system, the following symptoms may occur.

This controller 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.

(i) Alarm operating point changes.

(ii) Indication flickers erroneously.

(iii) Indication stays unmoved.

(b) 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. ＞＞ 5.3(c) “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.

(i) Electromagnetic switch

(ii) Solenoid valve

(iii) Pump

(iv) Motor

(c) 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:

(i) Use a CR filter type surge absorber. The life of a semiconductor absorber such as a varistor is relatively short.

(ii) Use a surge absorber with its rating exceeding the drive voltage of the target device.

(iii) DKK-TOA sells the following type of a surge absorber.
Spark killer XE1201 (part code No. 112Z014)

(iv) 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 Description

6.1 Specifications

(a) Basic items

Product name	:	Dissolved Oxygen Analyzer
Model	:	OBM-162A
Measuring object	:	Dissolved oxygen value (DO) in water, Oxygen value (O_2) in the air, Dissolved oxygen saturation ratio (SAT) in water, Temperature (TEMP)
Measurement method	:	Diaphragm polarographic method
Measured value display	:	Digital LCD display
Measuring range (display)	:	(1) DO measurement ····· 0.00 to 50.00mg/L (minimum indication: 0.01mg/L) (2) O_2 measurement ····· 0.0 to 30.0% (minimum indication: 0.1%) (3) SAT measurement ····· 0.0 to 200.0% (minimum indication: 0.1%) (4) Temperature measurement ···· –10.0 to 100°C (minimum indication: 0.1°C)
Measuring range (transmission output)	:	(1) DO measurement ···· 0.00 to 1.00mg/L to 0.00 to 50mg/L. Measuring range high limit can be arbitrarily set within the range of 1.00 to 50.00mg/L in increments of 0.01mg/L. (2) Temperature ···· Arbitrarily settable in the range of –5 to 100°C in the unit of 1°C with width of 10°C or more
Transmission output signal	:	Output, corresponds to DO measured value Type ···· Input/output, isolated from ground Signal ···· 4 to 20mADC Load resistance ···· 650Ω max. Ripple ···· Peak value 0.3%FS max.
Temperature compensation resistance	:	10kΩ/25°C (thermistor)
Temperature compensation range	:	0.0 to 45.0°C
Temperature compensation	:	(1) Automatic temperature compensation ···· Temperature compensation for sample water and electrode is carried out at the temperature measured with electrode where temperature element is built in (2) Manual temperature compensation ···· Temperature compensation for sample water and electrode is carried out at the set temperature intended for electrode with different specification of temperature element or for electrode without a temperature element
Power voltage	:	100 to 240VAC±10%, 50/60Hz.

Power consumption : Approx. 10VA

Alarm output : Number of circuits ···· 4-circuit
Output contacts ···· 3-circuit make contacts (NO contacts)
1-circuit transfer contacts (CO contacts)
Output contact capacity ···· 250VAC, 3A 30VDC 3A (resistance load)
Output function ···· Alarms 1 and 2: Upper limit alarm and lower limit alarms
Alarm 3: Maintenance in progress signal
Alarm 4: Selected as either power off or sensor abnormal

(b) Performance

Linearity : DO measurement ···· Within ±1.0%FS, however, within ±0.05mg/L for the range of 0 to 2mg/L (equivalent input)

Repeatability : Within ±0.8%FS, however, within ±0.04mg/L for the range of 0 to 2mg/L (equivalent input)

Temperature compensation accuracy : Within ±3%FS for the range of 0 to 45°C

Stability : Within ±1.0%FS/24h, however, within ±0.05mg/L/24h for the range of 0 to 2mg/L (equivalent input)

Response time : FS ···· Approx. 10 seconds (90%FS response),
Std ···· Approx. 15 seconds (90%FS response)
SL ···· Approx. 30 seconds (90%FS response)

Ambient temperature/humidity : (1) Performance guaranteed range ····· –20 to 55°C, 0 to 95%RH (No condensation)
(2) Operation guaranteed range ····· –25 to 60°C 0 to 99%RH (No condensation)
(3) Transport/storage guaranteed range····· –30 to 65°C 0 to 99%RH (No condensation)

(c) Structure, etc.

Sensor : Option: Model OC-64, Model BOC-64 etc.

Connector box : Option: Model FC-4

Sensor cable : Option: Model EC-22

Connecting terminals : M3

Structure : Outdoor installation (IP65 or equivalent)

Dimensions and mounting method : 181 × 180 × 95mm, waterproof gland not included
50A pipe mounting or wall mounting (option)

Material : Main unit ···· Aluminum die-cast

Display section and key operation section ····· polyester resin

Surface color : Main body ···· Metallic silver
Display section and key operation section ···· Munsell N1.5

Mass : Approx. 2kg

(d) Function

Calibration method : Zero calibration····· Electrical method to turn off the electrode input in the analyzer or the method to immerse the electrode in sodium sulfite solution of 5 to 10%

Span calibration ···· Method to calibrate the electrode using air or air saturated water

Indication (function) mode : ＞＞ 3.2 “Measurement Mode Operation”

Calibration (adjustment) function :
- DO value adjust (slope adjustment)
- Electrode zero current value adjustment (parallel shift)
- Electrode slope factor (slope adjustment
- Liquid temperature shift (within ±5°C shift)
- Transmission output (4mA and 20mA adjusted)

External hold function : Controls the transmission output by receiving a dry contact signal from various washing devices.

Manual temperature compensation : Enter the solution temperature by key operation.

Self-diagnosis : Temperature measured value error (E-04), temperature element error (E-05), impress voltage error (E-07), electrode diaphragm error (E-08) (option), storage element error (E-20), setting data error (E-21)

(e) Option

Power supply output for wash : Controls power supply for external washing device (100VAC) using internal timer

Diaphragm breakage detection function : Abnormality detection when broken diaphragm (E-08) (when special sensor and special cable used) (Improper installation of diaphragm is also detected)

(f) Reference standard

Japanese Industrial Standards : JIS K0803 Dissolved oxygen automatic measuring instrument
JIS K0101 Industrial use testing method
JIS K0803 Boiler water testing method

6.2 Key Points of Dissolved Oxygen Measurement

Key points of dissolved oxygen measurement such as the characteristics of a dissolved oxygen meter and the nature of dissolved oxygen.

(1) Factors that influence the measurement

The factors that influence the measurement are temperature, pressure, flow rate and the composition of sample water.

(a) Temperature

Since the electrode output has a temperature coefficient of about +3% per 1°C and the amount of saturated dissolved oxygen has a temperature coefficient of about –3% per 1°C, a deviation of 6% per 1°C occurs between the electrode output and the amount of saturated dissolved oxygen. Since temperature element is combined into the electrode, normally the deviation is corrected at the analyzer side using the signal from this element. However, if the temperature at the time of calibration and that of measurement differ greatly, an error in temperature compensation may occur. If you perform calibration in a temperature nearer to that of sample water, an error can be reduced.

(b) Pressure

The electrode output is proportional to the oxygen partial pressure. If the pressure increases twofold, that is, the gauge pressure increases from 0.0MPa to 0.1MPa (absolute pressure from 0.1MPa to 0.2MPa), the electrode output increases twofold. However, if sample water is not in contact with air, the electrode output (saturated dissolved oxygen value) does not change even if the pressure changes. This cannot be corrected by the electrode. Therefore, when sample water is under positive pressure or negative pressure and sample water is in contact with air, it is necessary to convert the analyzer indication according to its pressure.

(c) Flow rate

On the surface of the diaphragm, to be more precise, on the surface of the cathode, an oxygen depleted layer spreads toward outside due to oxygen consumption inside the electrode. Therefore, the electrode output decreases gradually. To replace this oxygen depleted layer always with new sample water, a certain flow speed of sample water is required. This is a characteristic of a diaphragm type electrode. Generally speaking, the necessary flow speed is said to be 10 to 20cm/s but practically speaking, if 5cm/s or more is assured, it is enough.

The problem of dirt accumulation is because it stops the flow speed of sample on the diaphragm surface and not because it blocks the permeation of oxygen. For an example of this fact, the dissolved oxygen concentration in oil, which tends to be considered as dirt in the past, the same measurement result as that measured in water is known now.

(d) Composition of sample water

If an aqueous solution component such as sodium chloride (NaCl) is added to the sample, the dissolved oxygen concentration in solution decreases. On the other hand, its oxygen partial pressure does not change and thus correction is required. This is the reason why salt correction value is listed in the table of oxygen solubility in pure water. Generally speaking, in sample water of high salt or high sugar content, solubility of oxygen decreases but in sample water containing organic solvent such as alcohol, solubility of oxygen increases. These differences cannot be corrected by the electrode.

〔NOTE〕 • Though “mg/L” is normally used to indicate the dissolved concentration in water, saturation ratio is also used to indicate a completely air saturated condition as 100%. For sample water with complicated components and adjusting the measured value with lab analysis value is difficult, by recording its temperature and saturation ratio, the dissolved oxygen concentration can be calculated later using the amount of saturated dissolved oxygen of the sample water.

(2) Amount of saturated dissolved oxygen in water

(in water vapor-saturated air with atmospheric pressure 0.1MPa (absolute pressure) {760mmHg} and oxygen 20.9%)

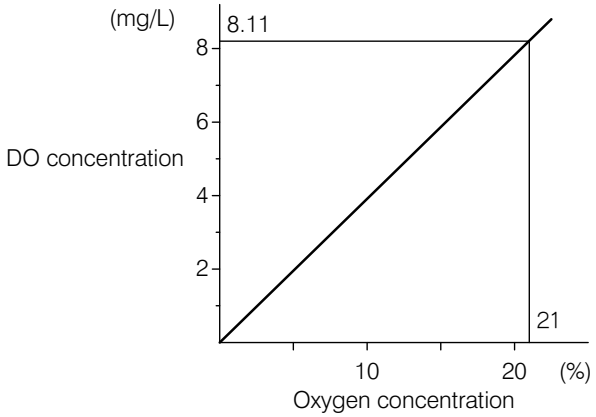
Temperature (°C)	Chlorine ions in water (mg/L)						Amount of dissolved oxygen to be reduced for each amount of chlorine ions of 100mg/L
	0	5000	10000	15000	20000	25000	
	Amount of dissolved oxygen (mg/L)						
0	14.16	13.40	12.63	11.87	11.10	10.33	0.0153
	13.77	13.03	12.29	11.55	10.80	10.06	0.0148
	13.40	12.68	11.97	11.25	10.52	9.80	0.0144
	13.04	12.35	11.65	10.95	10.25	9.55	0.0140
	12.70	12.03	11.35	10.67	9.99	9.31	0.0135
5	12.37	11.72	11.06	10.40	9.74	9.08	0.0131
	12.06	11.42	10.79	10.15	9.51	8.87	0.0128
	11.75	11.15	10.52	9.90	9.28	8.66	0.0124
	11.47	10.87	10.27	9.67	9.06	8.46	0.0120
	11.19	10.61	10.03	9.44	8.85	8.27	0.0117
10	10.92	10.36	9.79	9.23	8.66	8.09	0.0113
	10.67	10.12	9.57	9.02	8.47	7.92	0.0110
	10.43	9.90	9.36	8.82	8.29	7.75	0.0107
	10.20	9.68	9.16	8.64	8.11	7.59	0.0104
	9.97	9.47	8.97	8.46	7.95	7.44	0.0101
15	9.76	9.27	8.78	8.29	7.79	7.29	0.0099
	9.56	9.06	8.60	8.12	7.63	7.15	0.0096
	9.37	8.90	8.44	7.97	7.49	7.02	0.0094
	9.18	8.73	8.27	7.82	7.36	6.89	0.0091
	9.01	8.57	8.12	7.67	7.22	6.77	0.0089
20	8.84	8.41	7.97	7.54	7.10	6.65	0.0087
	8.68	8.26	7.83	7.40	6.97	6.54	0.0086
	8.53	8.11	7.70	7.26	6.85	6.43	0.0084
	8.39	7.98	7.57	7.16	6.74	6.33	0.0082
	8.25	7.85	7.44	7.04	6.65	6.23	0.0081
25	8.11	7.72	7.32	6.95	6.52	6.13	0.0079
	7.99	7.60	7.21	6.82	6.42	6.03	0.0078
	7.87	7.48	7.10	6.71	6.32	5.93	0.0077
	7.75	7.37	6.99	6.61	6.22	5.84	0.0076
	7.64	7.26	6.88	6.51	6.12	5.74	0.0076
30	7.53	7.16	6.78	6.41	6.03	5.65	0.0075
	7.43	7.06	6.66	6.31	5.93	5.56	0.0075
	7.32	6.96	6.59	6.21	5.84	5.47	0.0074
	7.23	6.86	6.49	6.12	8.75	5.38	0.0074
	7.13	6.77	6.40	6.03	5.65	5.28	0.0074
35	7.04	6.67	6.30	5.93	5.56	5.19	0.0074
	6.95	6.58	6.21	5.84	5.46	5.10	0.0074
	6.86	6.49	6.12	5.75	5.37	5.00	0.0074
	6.77	6.40	6.03	5.65	5.27	4.90	0.0075
	6.68	6.31	5.94	5.55	5.17	4.80	0.0075
40	6.60	6.22	5.84	5.46	5.07	4.69	0.0076
	6.51	6.13	5.75	5.36	4.97	4.58	0.0077
	6.42	6.04	5.65	5.25	4.86	4.47	0.0078
	6.33	5.94	5.55	5.15	4.75	4.35	0.0079
	6.24	5.84	5.45	5.04	4.64	4.23	0.0080
45	6.15	5.75	5.34	4.93	4.52	4.11	0.0082
	6.06	5.65	5.23	4.81	4.39	3.98	0.0084
	5.96	5.54	5.12	4.69	4.26	3.84	0.0085
	5.86	5.43	5.00	4.56	4.13	3.69	0.0087
	5.76	5.32	4.88	4.43	3.99	3.54	0.0089
50	5.66	5.21	4.75	4.30	3.84	3.39	0.0091

Note: However, when temperature is 40°C or above and the amount of chlorine ions is 25000mg/L, the amount of dissolved oxygen is obtained based on the equation of Truesdale < G. A. Truesdale, et al. * J. Appl. Chem., 5, 53 (1955) >.

(3) Measurement of sample water containing salt

(a) Chlorine ion concentration and DO meter indication

Generally speaking, when sample water contains plenty of salt, solubility of oxygen decreases compared with that of pure water. For this reason, correction is necessary for sample water containing plenty of salt (such as sea water).

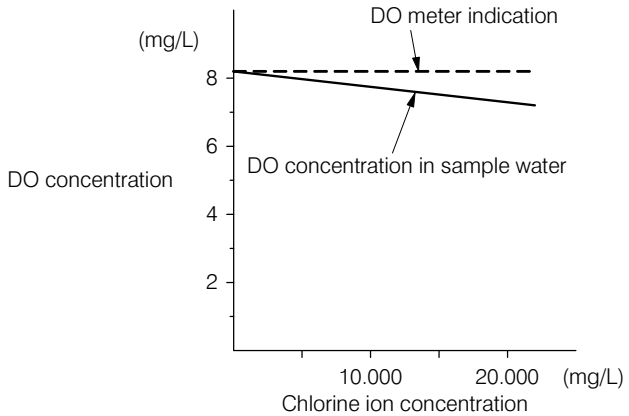


Relationship between Oxygen Concentration and Dissolved Oxygen Concentration (25°C)
(when salt is not contained)

The graph "Relationship between Oxygen Concentration and Dissolved Oxygen Concentration" shows the relationship between the oxygen concentration of pure water with almost no salt (such as city water, demineralized water) at 25°C when gas containing oxygen is passed through the water and the dissolved oxygen concentration in the water that stays balanced in that condition.

For example, take this water in a beaker and pass air (oxygen concentration 21%) through the water and immerse the DO electrode in the water and then perform calibrating so that DO meter indicates 8.11mg/L. Next, if the oxygen concentration of the air gas is reduced to 14%, 2/3 of the first time, the dissolved oxygen concentration becomes 8.11 × 2/3 = 5.41mg/l and the DO meter also indicates 5.41mg/L correctly. This is because the oxygen partial pressure is 14% corresponding to the dissolved oxygen concentration 5.41mg/L in water containing no salt and thus DO meter indication decreases to 2/3.

Next, while air is passed through water (at this time DO meter indicates 8.11mg/L), if salt is added, actual dissolved oxygen concentration decreases. (See the graph "Relationship between Chlorine Ion Concentration and Dissolve Oxygen Concentration.")



Relationship between Chlorine Ion Concentration and Dissolve Oxygen Concentration (25°C)

For example, if the chlorine ion concentration reaches 20,000mg/L, the amount of saturated dissolved oxygen decreases to 6.52mg/L. However, DO meter indication does not decrease and still indicates 8.11mg/L. This is because the oxygen partial pressure is still 21% corresponding to the amount of saturated dissolved oxygen 6.52mg/L in water containing chlorine ions of 20,000mg/L and the indication of DO meter which uses a diaphragm electrode based on the oxygen partial pressure does not decrease. When the dissolved oxygen concentration of water containing chlorine ions of 20,000mg/L becomes 6.52×2/3 = 4.35mg/L, the oxygen partial pressure to counterbalance that condition becomes 14% and the DO meter indicate 8.11×2/3 = 5.41mg/L and decreases by 2/3.

Therefore, to measure the dissolved oxygen concentration of water containing chlorine ions (such as sea water), take either of the following methods considering the above.

(b) Method to indicate the dissolved oxygen concentration directly

In this case, calibrate the DO meter in the procedure shown below.

①Obtain chlorine ion concentration. ····· Obtain the chlorine ion concentration of sample water in some way. For example, suppose the chlorine concentration is approx. 20,000mg/L.

②Pass air through water. ····· Put city water in a beaker and pass air through the water. Maintain the temperature of the water the same as that of sample water (for example, 25°C).

③Immerse the electrode in the water. ····· Insert the DO electrode in the water in Step ②.

④Perform span calibration. ····· >> 2.4(2) “Span calibration using air saturated water”

⑤Obtain the amount of saturated dissolved oxygen. ····· Use the procedure 6.2(2) “Amount of saturated dissolved oxygen in water” to obtain the amount of saturated dissolved oxygen at 25°C. The amount turns out to be 6.52mg/L.

⑥Perform correction for indication. ····· Adjust the concentration to 6.52mg/L using the DO value adjust function. >> 3.3(2) “DO value adjust”

⑦Immerse the electrode in same water. ····· Next, when you immerse the DO electrode in sample water, you can read the dissolved oxygen concentration directly.

(c) Method to obtain the DO concentration using the correction factor

This method is suitable to measure various sample water.

Also in this case, suppose the chlorine ion concentration of sample water is 20,000mg/L and its temperature is 25°C. In addition, check that the amount of saturated dissolved oxygen in this condition is 6.52mg/L referring to 6.2(2) “Amount of saturated dissolved oxygen in water.”

①Perform calibration. ····· While passing air through city water at 25°C, immerse the DO electrode in the water and perform calibration so that DO meter indicates 8.11mg/L. (The same calibration method as that of dissolve oxygen measurement for normal water)

②Immerse the DO electrode in sample water. ····· Immerse the DO electrode in sample water and read the indication of the DO meter.

③Calculate the dissolved oxygen concentration. ····· Multiply the indicated value read in Step ② by $\frac{6.52}{8.11}$ to obtain the dissolved oxygen concentration of the same water,

$$4.00 \times \frac{6.52}{8.11} = 3.22 \text{ (mg/L)}$$

〔NOTE〕 • If the indicated value is stable, dissolved oxygen concentration can be read directly by adjusting the indicated value to the concentration value calculated in Step ③ using the DO value adjust function. ＞＞ Step ⑥ in 6.2 (3) (b) “Method to indicate the dissolved oxygen concentration directly”

• Oxygen supersaturation …… When DO is measured in a location where algae occurs, its dissolved oxygen concentration may be higher than the amount of dissolved oxygen in air saturated water. This occurs when carbon assimilation by algae occurs and oxygen is generated and water is oxygen supersaturated.
This phenomenon occurs especially in fine weather during daylight hours and this is not caused by analyzer failure. Taking this sample water in a beaker and passing air through the water and then supersaturated oxygen will be dispelled and the indication of the DO meter decreases gradually and then settles down to indicate the amount of saturated dissolved oxygen.

7. RS-232C Communication Function (Option)

(1) Outline and specifications of RS-232C communication function

(a) When the analyzer is equipped with RS-232C connector (option), the analyzer can be connected with a PC using a communication cable. The digital measured value can be imported to PC by connecting the analyzer with PC.

(b) Communication specifications are as follows:

Standard : JIS X5103 compliance

Transmission method : Asynchronous, half-duplex communication

Baud rate : 9600 bps

Character framing : Data length····· 8 bits
Parity check ····· Non-parity
Stop bit ····· 1 bit

Connection method : 4-pin terminal block (a dedicated communication cable is required)

(2) Terminal arrangement and a dedicated communication cable

(a) The terminal arrangement for RS-232C communication is shown in the table below.

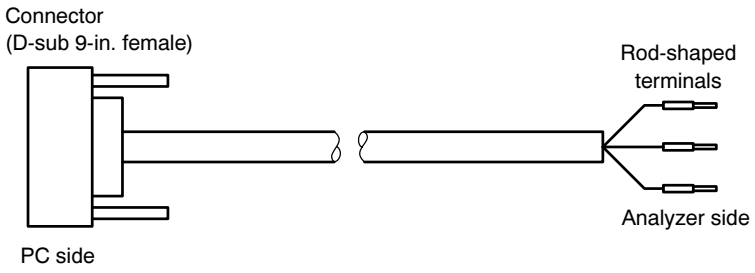
Terminal Block for RS-232C Connector

Terminal No.	Signal symbol	Signal name	Direction
1	RD (RXD)	Receive Data	Input
2	SD (SXD)	Send Data	Output
3	SG	Signal Ground	—
4	—	Not connected	—

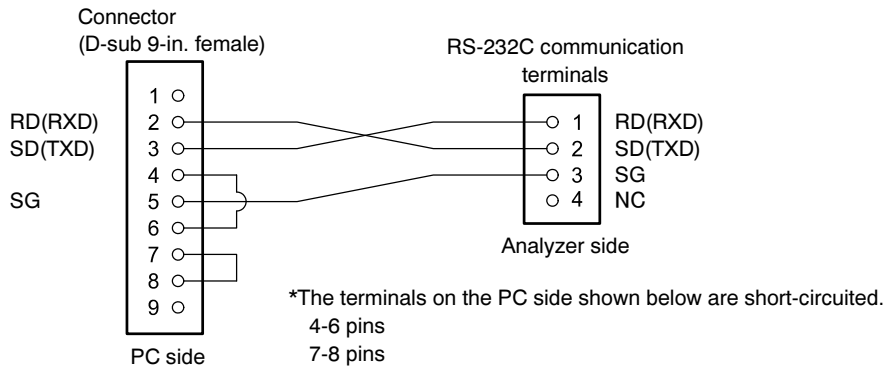
(b) To connect with a PC, be sure to prepare a communication cable (standard 1.5m) made by DKK-TOA.

(c) Make the length of the cable within 10m.

【IMPORTANT】 • If the length of the cable exceeds 10m, the product may not work properly.

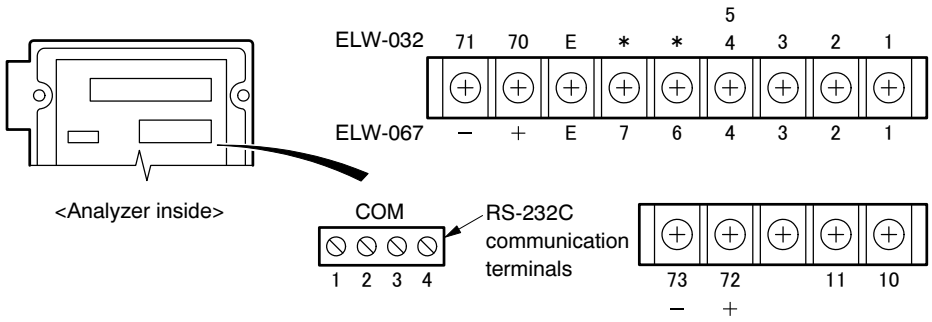


Appearance of Communication Cable



Configuration of Communication Cable

(3) RS-232C wiring



Terminal block

(a) Be sure to turn off the power source to the analyzer and turn off the power of PC, and then connect the communication cable to the RS-232C communication terminals shown above. After connecting the cable, turn on the power source and turn on the PC. The purpose of this procedure is to prevent electric shock by touching the terminals and erroneous operations of the dedicated application software.

(b) Please maintain the communication cable apart from the power cable and alarm output cable.

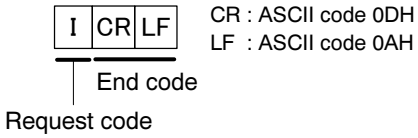
【IMPORTANT】 • If the communication cable is installed together with a power cable or alarm output cable, a communication error may occur caused by noise.

(c) The ground terminal must be grounded. This is also to prevent noise.

(4) Command format

(a) PC command (I)

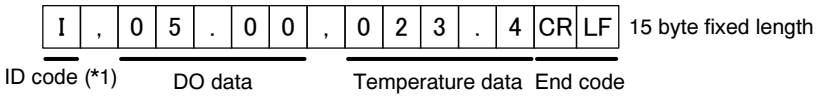
The command format for PC to request the analyzer to send the measurement data is shown below.



Command Format from PC

(b) Analyzer response (I)

Responding to a request from PC, the analyzer sends data in the format below.



*1: When data other than ID code "I" is received, the analyzer sends "E".

Command Format from Analyzer

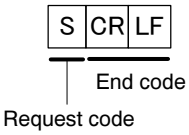
- DO data consists of 4-digit data shown in an example below.

  (Example) DO 5.00mg/L → 05.00
  20.00mg/L → 20.00

- Temperature data consists of 4-digit data shown in an example below.

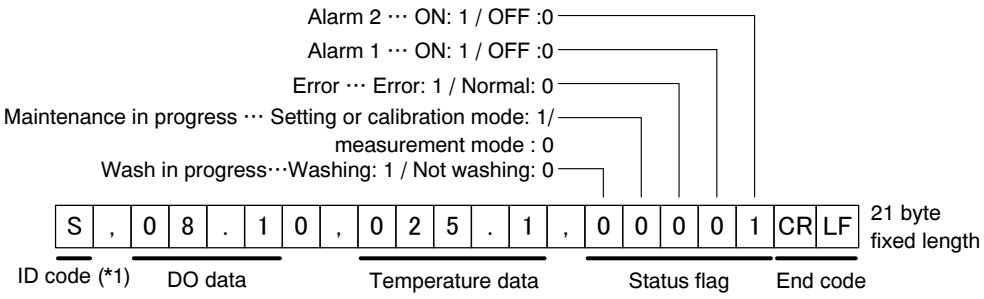
  (Example) Temperature 23.4ºC → 023.4
  −5.6ºC → −05.6
  104.8ºC → 104.8

(c) PC command (S)



(d) Analyzer response (S)

Responding to a request from PC, the analyzer sends data in the format below.



*2: When data other than ID code "S" is received, the analyzer sends "E".

Command Format from Analyzer

8. Installation

8.1 Analyzer Mounting

(1) Installation location

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

(a) A location where the lead wires of the sensor, etc. can reach.

(b) A location where installation and maintenance work can be performed easily.

(c) A location where not exposed to direct sunshine and where temperature does not change quickly and temperature change does not occur locally.

(d) A location where no equipment is nearby that generates electric noise. ＞＞ 5.3 “Measures against Noise”

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

(f) A location without vibration.

⚠ 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) Mounting example and external dimensions

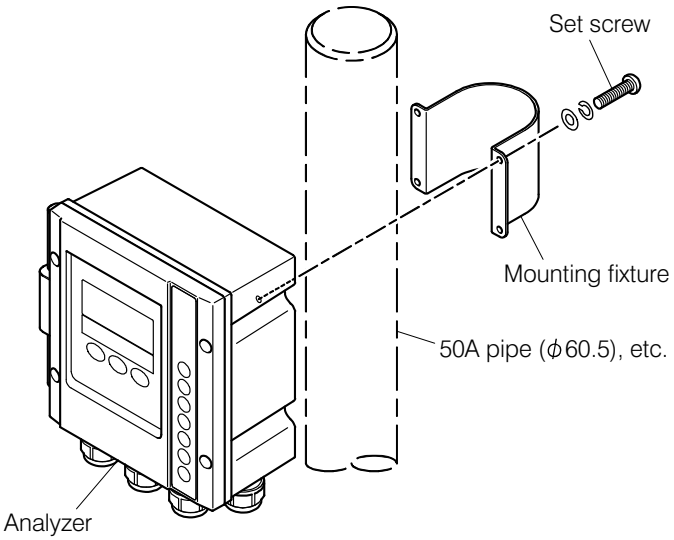
(a) Loosen the fixing screws and install a mounting fixture from the rear of 50A pipe (outer diameter 60.5mm), etc. and tighten the fixing screws. To mount the analyzer to the wall, use an optional wall mounting plate.

(b) If the installation height is 1.3 to 1.5m from the floor, readout or calibration work can easily be done.

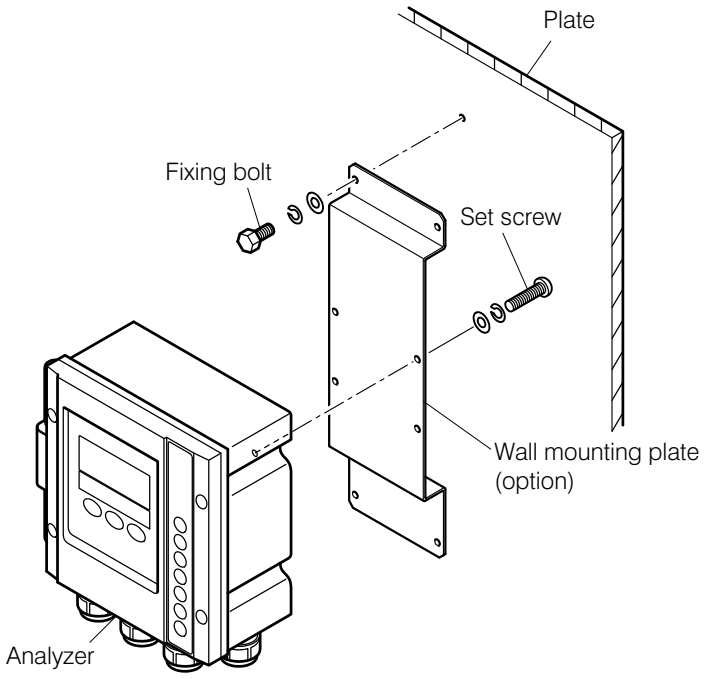
(c) Provide clearance space of 30cm or more between the analyzer rear side and the surrounding object. Maintenance work can be performed easily.

(d) Install the analyzer correctly in vertical position.

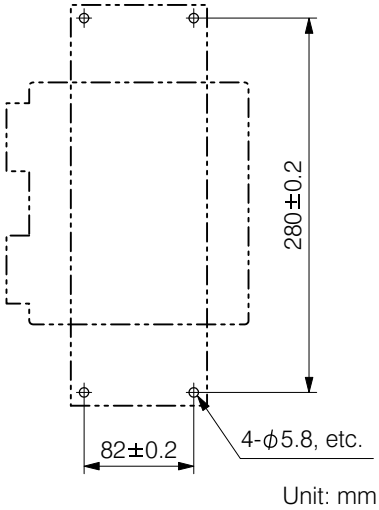
(e) For installation of the sensor, refer to the instruction manual attached to the sensor.



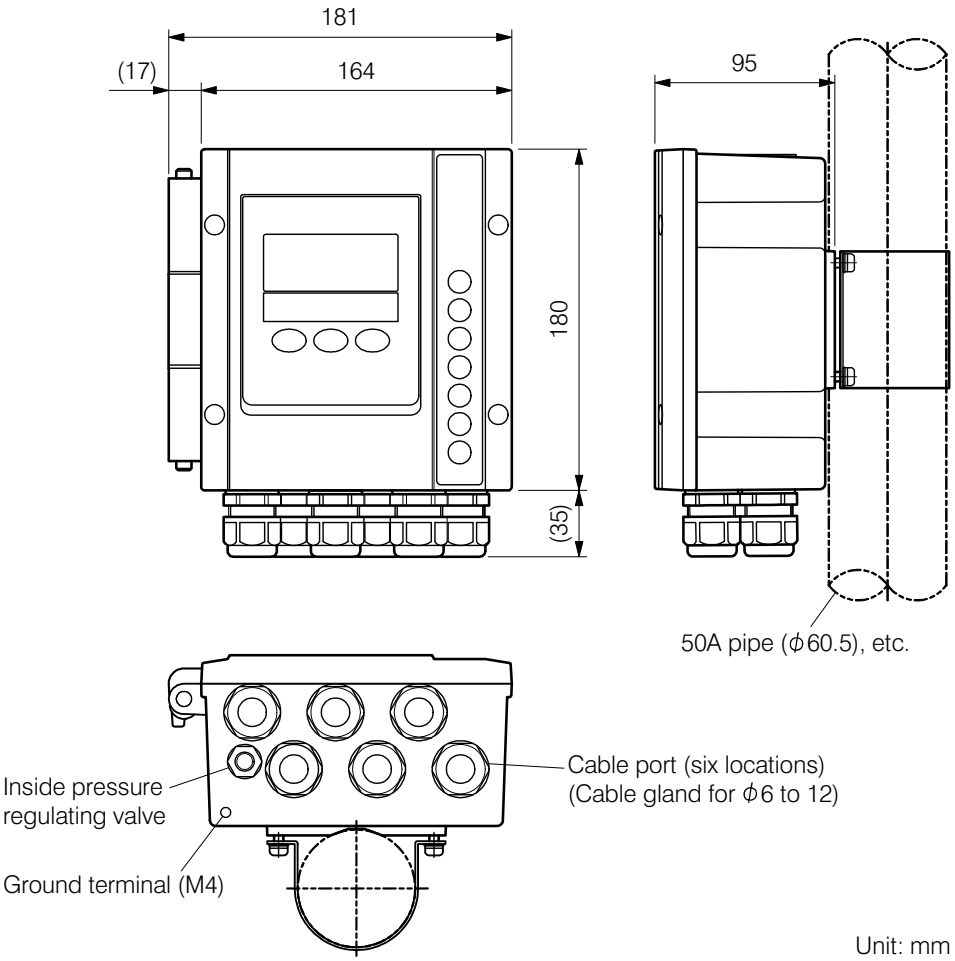
Pipe Mounting Method



Wall Mounting Method



Hole Positions of Wall Mounting Plate



Unit: mm

Dimensions

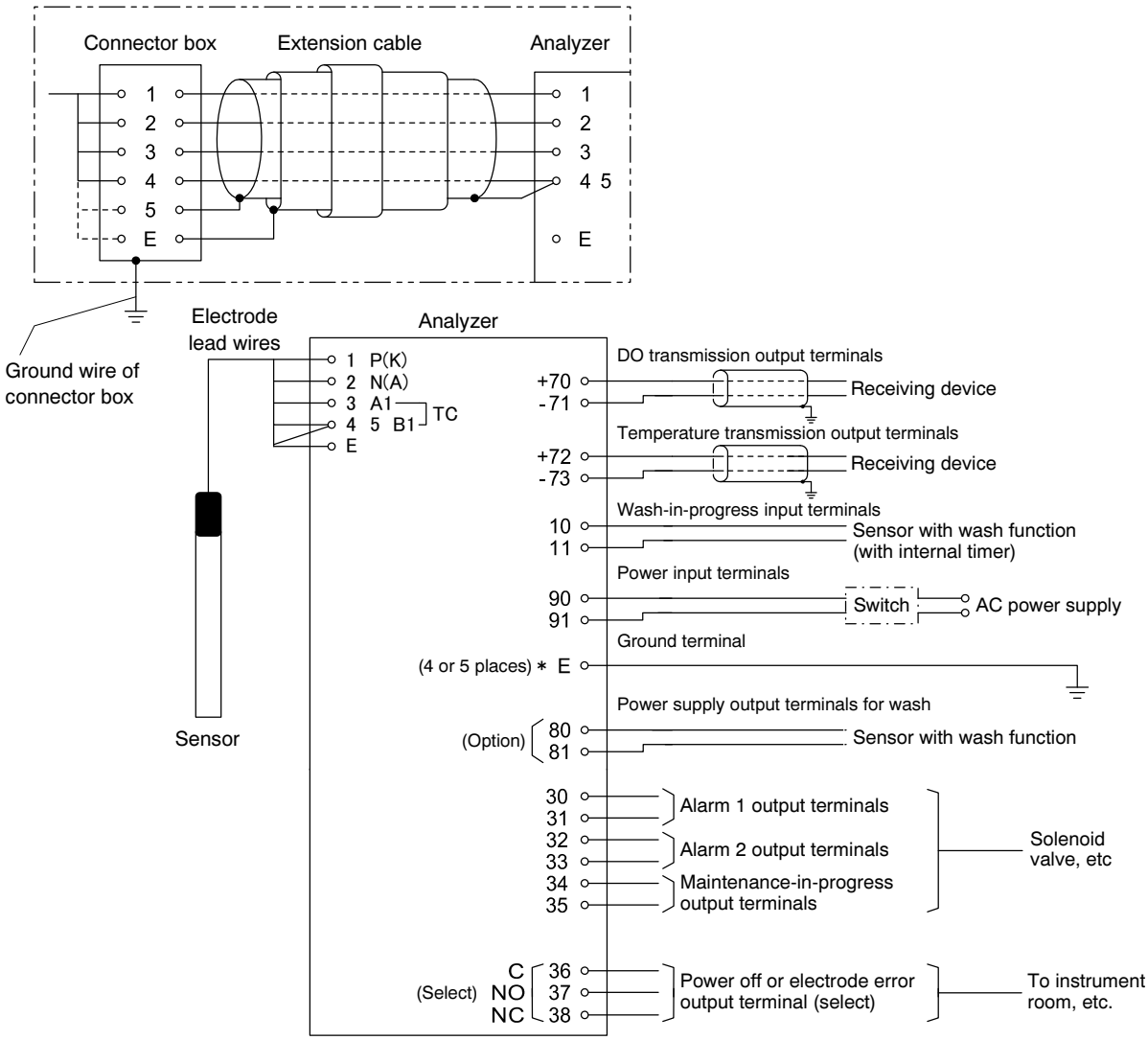
8.2 Wire Connection

(1) Wire Connection Diagram

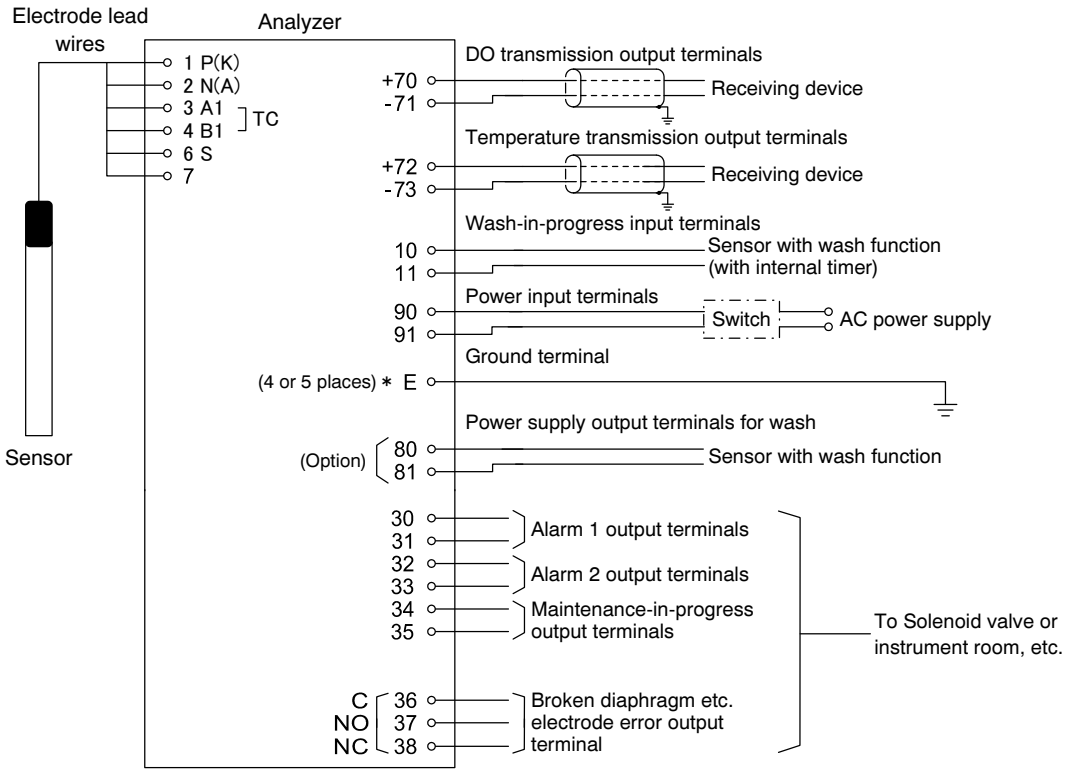
⚠ WARNING

Electric Shock

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



Wire Connection Diagram (When ELW-032 cable (standard) is used)



* When broken diaphragm detection function is provided, connector box cannot be used.

Wire Connection Diagram (When broken diaphragm detection function is provided or ELW-067 cable (option) is used)

(a) Normally connect electrode lead wires directly to the analyzer. However, if the analyzer is installed in a location far from the sensor, wiring shall be connected via connector box and extension cable. >> 8.3 “Extension by Cable”

(b) Wiring method differs depending on the combination of a sensor provided with wash control output terminals and a sensor with power-off output terminals.

(c) To control a sensor with wash function using the analyzer’s wash control function (option), it is necessary to connect the sensor to the power supply output terminals for wash (80 and 81).

【IMPORTANT】 • When you connect a sensor with wash function to the power supply output terminals for wash, the power supply must be 100VAC ±10%.

(d) When a sensor with wash function containing its own internal timer is used without using the analyzer’s wash control function, a wash-in-progress signal can be connected from the sensor to the wash-in-progress input terminals (10 and 11), which can be used for hold operation.

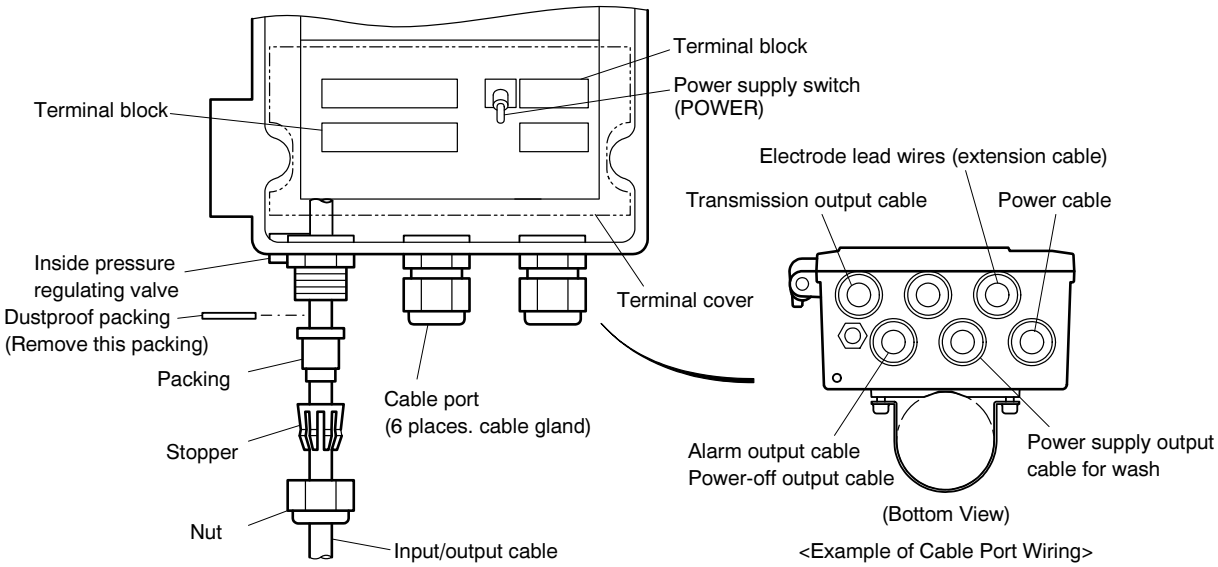
(e) For connection to each terminal, refer to 8.2(3) “Terminal diagram of external input/output”

(f) For the wiring to the RS-232C communication terminals, refer to 7(3) “RS-232C Wiring”

(2) Cable ports

Install each cable to the inside of the analyzer by putting it through a cable gland (for ϕ6 to 12) of cable ports at the bottom of the analyzer.

【IMPORTANT】
- Use a cable with outer diameter fit for the size of the cable gland. If it is not fit, airtight condition in the analyzer cannot be maintained and humidity inside the analyzer increases and this causes deterioration of insulation.
- To maintain airtight condition, tighten all of the nuts when wiring is completed. In addition, do not remove the dustproof packing from the ports not used.



Cable Ports

(3) Terminal diagram of external input/output

(a) Check that the power supply to the analyzer is off, open the terminal door of the analyzer and remove the terminal cover and then connect wires to each terminal. When wiring is completed, install the terminal cover in the same was as before.

(b) Six types of analyzers, type A to type D, are provided as shown below. These types can be identifiable by the terminal arrangement. Connect wiring correctly using an appropriate terminal diagram.

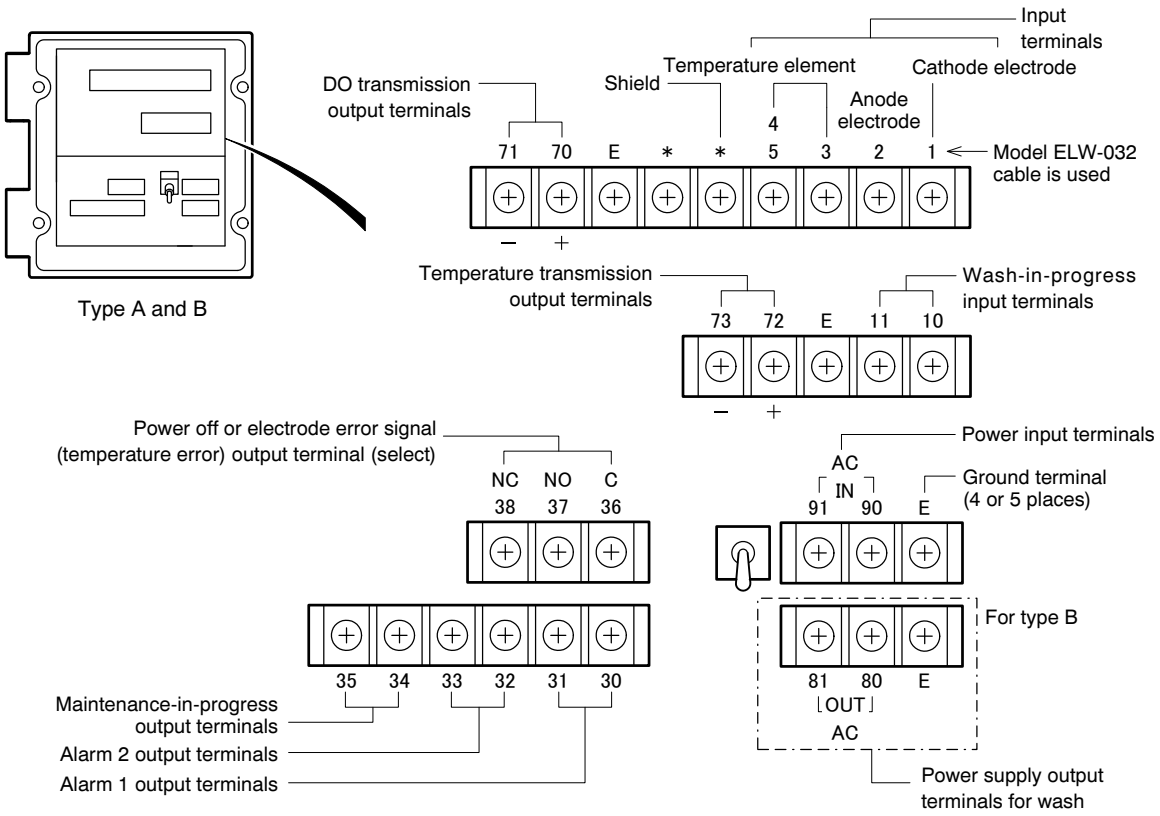
(c) Since the connection arrangement terminals are different for the ELW-032 and ELW-067 cables, the type A to D analyzers of the following table are available and can be identified by terminal arrangement. Correctly connect the cable in accordance with the applicable terminal diagram.

【IMPORTANT】
- The connection arrangement terminals are different for the ELW-032 and ELW-067 cables. Be careful. Use the ELW-067 cable only when the broken diaphragm detection function (option) is provided.

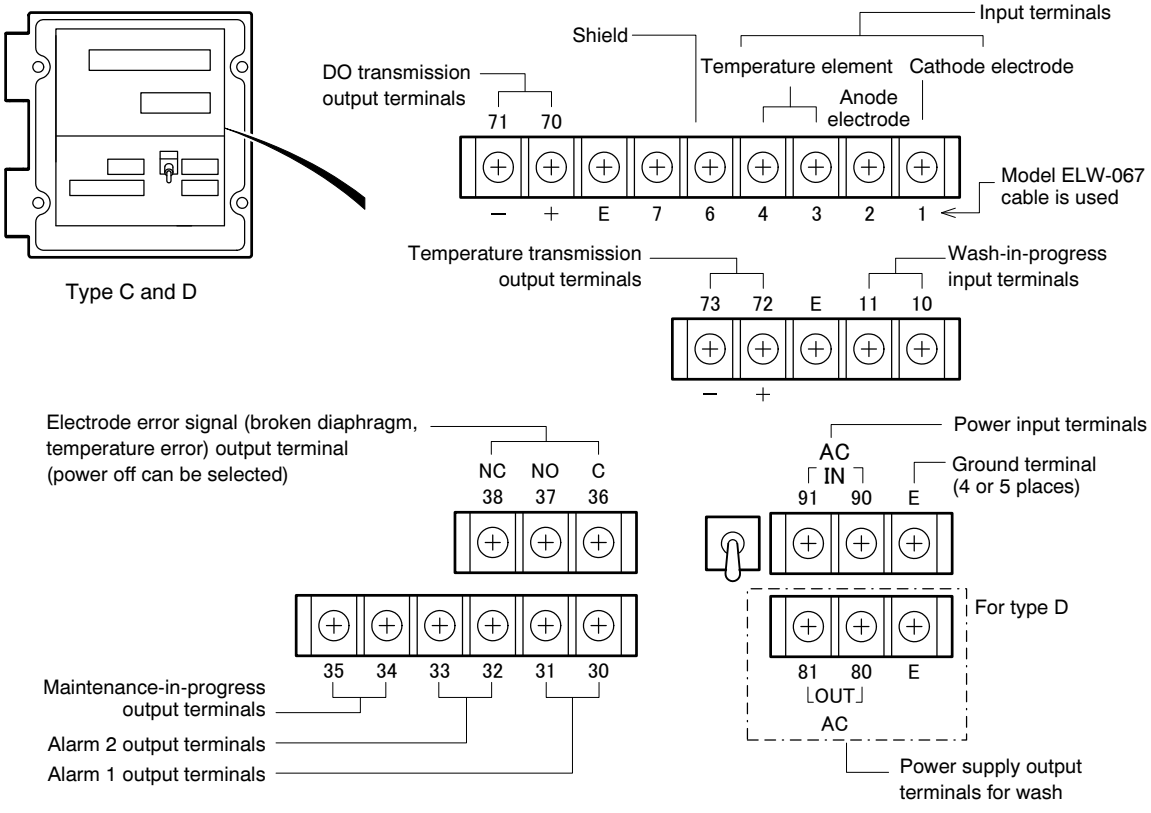
Analyzer Types

		Type of analyzer			
		A (standard)	B	C	D
Power supply output for wash (Option)	Not provided (standard)	○		○	
	Provided		○		○
Broken diaphragm detection output (Option)	Not provided (standard)	○	○		
	Provided			○	○

【IMPORTANT】
- Do not connect power supply terminals or alarm output terminals 1–2 to other terminals. The analyzer may be damaged.
- For reasons of safety, do not turn on power to the analyzer here. Turn on power in accordance with 2.1 “Starting the Operation.”



Terminal diagram of Types A and B



Terminal Diagram of Types C and D

(4) Electrode lead wires

(a) Do not secure the electrode lead wires near the sensor.

【IMPORTANT】 • Since the sensor may be lifted for the purpose of maintenance, do not secure the electrode lead wires near the sensor. If the wires are secured completely such as using metal conduit, maintenance may be difficult to perform.

〔NOTE〕 • Terminal number assignment

1 :	Detection part (cathode)
2 :	Counter electrode (anode)
3 , 4:	Temperature element (these terminals are not provided for electrode without temperature element)
5:	Shield (these terminals are not provided for electrode with broken diaphragm detection function)
6:	Broken diaphragm detection part (these terminals are not provided for electrode without broken diaphragm detection function)
7:	Shield (these terminals are not provided for electrode without broken diaphragm detection function)
E:	Ground (these terminals are not provided for electrode with broken diaphragm detection function)

• If terminals “3 and 4” are not provided for electrode lead wires (temperature element not provided), set “on” for manual temperature compensation and set the temperature. ＞＞ 3.3(17) “Manual temperature compensation”

• Terminals “5 and E” may not be provided depending on the type of electrode used.

(b) If it is necessary to install the analyzer in a location far from the sensor so that the electrode lead wires cannot be used, wiring between them shall be connected via an optional extension cable and a connector box. ＞＞ 8.3 “Extension by Cable (Option)”

(5) DO transmission output terminals

(a) The transmission output of the DO measured value corresponding to the measuring range can be taken from the terminals 70(+) and 71(−) of the terminal plate. Use a 2-core shielded cable to connect between these terminals and a receiving device (such as a recorder).

(b) The specifications of the transmission output are shown below (isolated type from ground):

Current output: 4 to 20mADC (load resistance 650Ω max.)

(6) Temperature transmission output terminals

(a) The transmission output of the sample water temperature can be taken from the terminals 72(+) and 73(−) of the terminal plate. Use a 2-core shielded cable to connect between these terminals and a receiving device (such as a recorder).

(b) The specifications of the transmission output are shown below (isolated type from ground):

Current output: 4 to 20mADC (load resistance 650Ω max.)

(7) Power input terminals

(a) Power supply of this analyzer is 100to240VAC±10%. Connect a 2-core cable to the terminals 90 and 91 of the terminal plate. However, when power supply output for wash is needed, power supply must be 100VAC ±10%.

【IMPORTANT】
- Do not apply voltage higher than 264VAC. The analyzer may be damaged.
- Do not connect power supply to terminals other than 90 and 91 erroneously. The analyzer may be damaged.
- For safety reasons, apply power to the analyzer or sensor with wash function in accordance with 2.1 “Starting the Operation.”
- If the analyzer is equipped with wash control function (option) and power supply output for wash is needed, be sure to use power supply of 100VAC ±10%. If a power voltage higher than 100VAC is applied, the sensor with wash function may be damaged.

(b) Provide a switch, etc. so that power supply can be turned off at the power source side.

(8) Ground terminal

(a) The ground terminal (E) of the terminal plate must be grounded using D type grounding method (ground resistance 100Ω max.). Avoid sharing the ground with power equipment to prevent noise.

(b) If the analyzer cannot be grounded near the installation site, it is possible to ground at the power supply side. Use a 3-core instrumentation type shielded cable for power cable and connect the core wire for ground to the ground terminal “E” of the terminal plate.

⚠ WARNING

Electric Shock

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

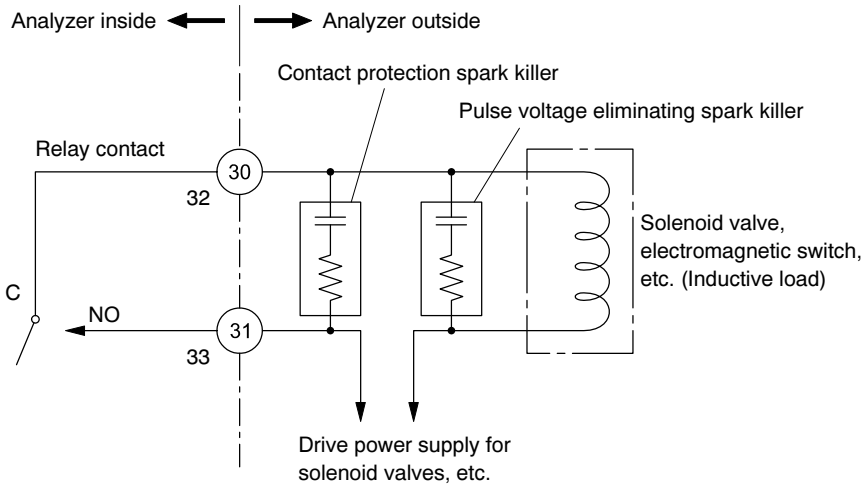
(9) Alarm output terminals

(a) An alarm output signal can be taken out from 2-circuit make contact (NO contact). Connect the contact to a solenoid valve, etc.

Alarm Output Terminals

Alarm 1 output terminal	Alarm 2 output terminal
“30, 31” Make contact (NO contact)	“32, 33” Make contact (NO contact)

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



Example of Protection against Noise for Alarm Circuits

(c) If an alarm condition occurs, the contact of the alarm output terminals closes and if the DO measured value returns to within the alarm set points, the contact opens. Contact capacity is 250VAC, 3A or 30VDC, 3A (resistive load). To turn on/off the current larger than this value, provide a power relay, etc. and use the alarm output signal to turn on/off this relay.

(d) Turning on/off each alarm, alarm values, distinction between high and low limits, dead band, etc. can be changed by key operation.

(10) "Maintenance in progress" output terminals

When the analyzer is switched to the maintenance-in-progress mode or a contact signal is input to the wash-in-progress input terminals (10, 11), the signal from the maintenance-in-progress output terminals (34, 35) is switched to "Closed". When the analyzer is reset from this state, the signal automatically returns to "Open". The contact capacity is 250VAC 3A or 30VDC 3A (resistive load).

When the wash function (option) is provided, if the washing operation is entered, the signal from the maintenance-in-progress output terminals (34, 35) is switched to "Closed". When the analyzer is reset from this state, the signal automatically returns to "Open".

(11) Power off, electrode abnormal output terminals (selected)

(a) When alarm 4 is set to power off (>> 3.3(4) "Alarms"), when the supply of power to the analyzer stops, the signal from the terminals (36, 37, 38) is switched to "Open". When the power is recovered, the signal automatically returns to "Open".

(b) When alarm 4 is set to electrode abnormal (>> 3.3(4) "Alarms"), when [E-04] or [E-05] is generated at the sensor, the signal from the terminals (36, 37, 38) is switched to "Closed".

(c) In the case of (b), if the broken diaphragm detection function (option) is provided, when [E-08] is generated at the sensor, the signal from the terminals (36, 37, 38) is switched to "Closed". When the analyzer is reset from the diaphragm abnormal or other state, the signal is automatically returned to "Open" The contact capacity is 250VAC 3A or 30VDC 3A (resistive load).

(12) Power output terminals for wash

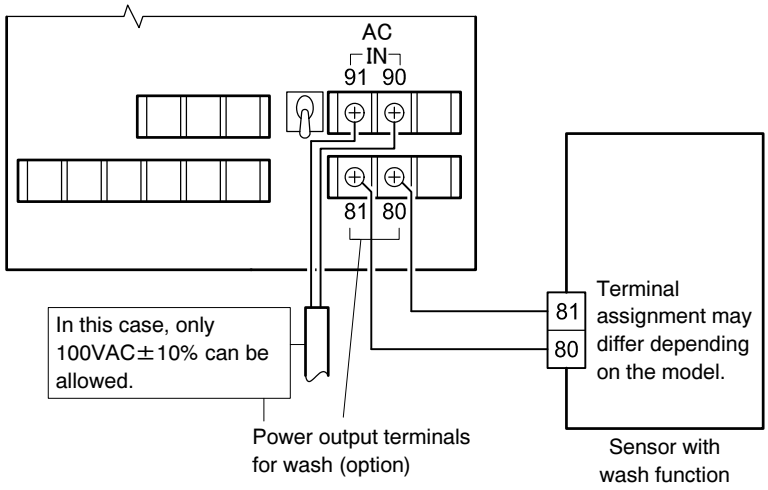
(a) When the analyzer is equipped with wash control function (option), as soon as the preset wash time comes, AC power for the sensor with wash function will be output from the power output terminals for wash (80 and 81).

(b) Use a 2-core cable to connect to the sensor with wash function.

(c) Since the sensor may be taken out from the installation location for maintenance, provide an extra length for the power output cable near the sensor.

(d) AC power supply connected to the power input terminals (90 and 91) will be used to output from the power output terminals for wash (80 and 81). Since power supply for the sensor with wash function of DKK-TOA is 100VAC, apply 100VAC±10% only for power input for the analyzer.

【IMPORTANT】 • In this case, make sure to use 100VAC±10% only for power supply. Applying voltage higher than that can damage the sensor with wash function.



Connection of Power Output Cable for Wash Function

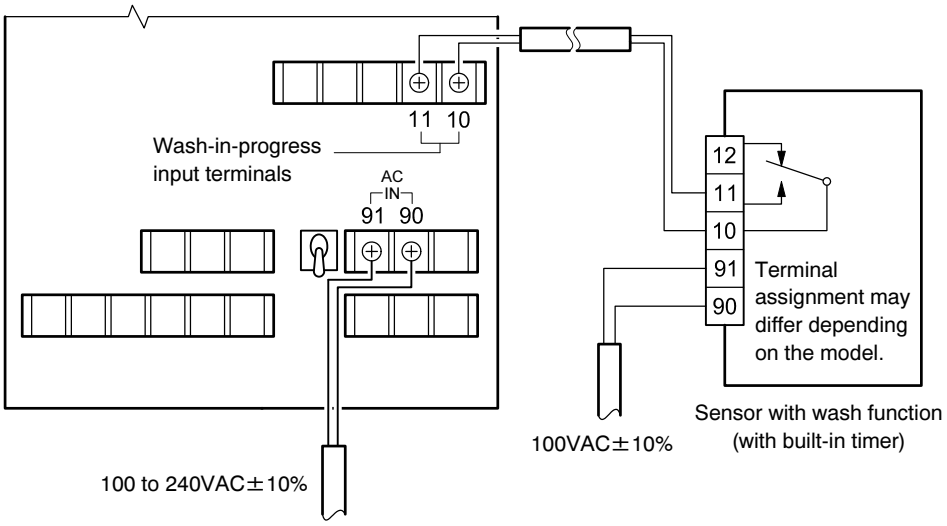
(13) "Wash in progress" signal input terminal

(a) When the analyzer's wash control function (option) is not used and a sensor with wash function containing its own internal timer is used, a wash-in-progress signal of the sensor can be input to the analyzer's wash-in-progress input terminals (10 and 11) as external hold signal.

【IMPORTANT】 • When a sensor with wash function containing its own timer is used, set the wash operation setting to off (oFF) and do not connect the sensor to the power supply output terminals for wash (terminals 80 and 81). >> Table "②" of 3.3(7) "Wash operation"

(b) If a wash-in-progress signal is input from outside, the analyzer goes to Hold state set at 3.3(13) "Hold type" and "HOLD" etc. appears on the sub display. This is used to prevent the effect of fluctuated indication during wash operation. If this signal is input, the alarm output will be turned off.

(c) Since the sensor with wash function may be taken out from the installation location for maintenance, provide an extra length for the signal cable.

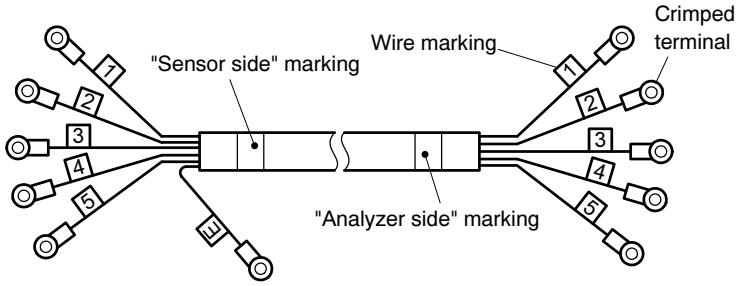


Connection of “Wash in progress” Signal Input Cable

8.3 Extension by Cable (Option, except broken diaphragm detection specification)

When the analyzer must be installed at a place the electrode lead wire (standard: 5m) cannot reach, extend the lead wire by using the attached cable (extension cable) and connector box according to the order specifications.

(1) Extension cable



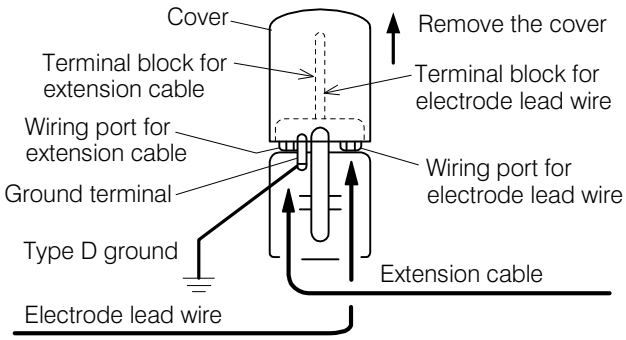
Extension Cable

(a) Connect the sensor side (marking: “TO DETECTOR” etc.) of the extension cable to the extension cable use terminal block of the connector box and connect the analyzer side (marking: “TO METER” etc.) to the input terminals (1 to 5, E) of the analyzer.

(b) Keep the terminals of the extension cable clean and wire the cable so that it is separated from power cables and other noise sources and does not sway.

【IMPORTANT】
- When the extension cable gets wet or dirty, dry it after wiping with alcohol, etc.
- When there is a noise source near the extension cable or the extension cable vibrates or sways, the indication will fluctuate.
- The extension cable cannot be spliced. Always use 1 cable (up to 100m).
- For terminal processing of the extension cable, request that the work be done by a technical services company. If terminal processing is incorrect, normal measurement cannot be made.

(2) Connector box



Connector Box Wiring

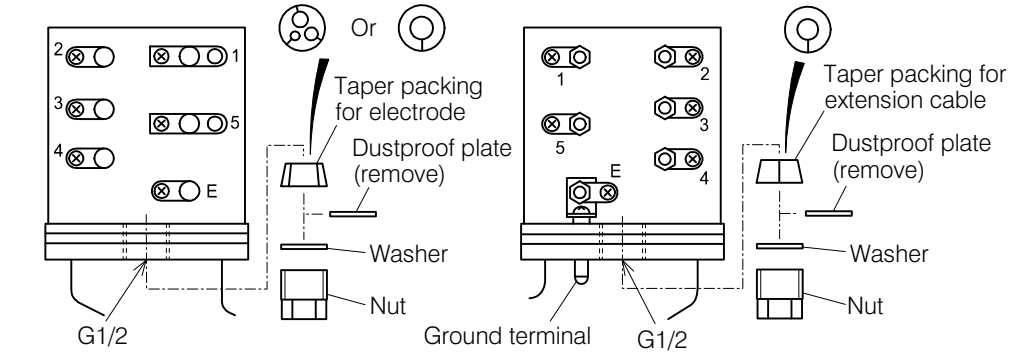
(a) Pass the following cables, etc. through each wiring port and wire them by matching the wire mark numbers and the terminal block numbers.

- Electrode lead wire ····· Pass through the wiring port (right side) for electrode lead wire and wire to the terminal block for electrode lead wire.
- Extension cable····· Pass through the wiring port (left side) for extension cable and wire to the terminal block for extension cable.

(b) Ground the connector box ground terminal by Type D grounding work (ground resistance value 100Ω or less).

(c) When the connector box cover is pulled upward it is separated from the connector box. At this time, if the nut of one of the wiring ports is loosened, air will enter the connector box and the cover will be easy to remove.

(d) The connector box terminal blocks conform to the following figure. As the dustproof plates are for shipping and storage, remove them.

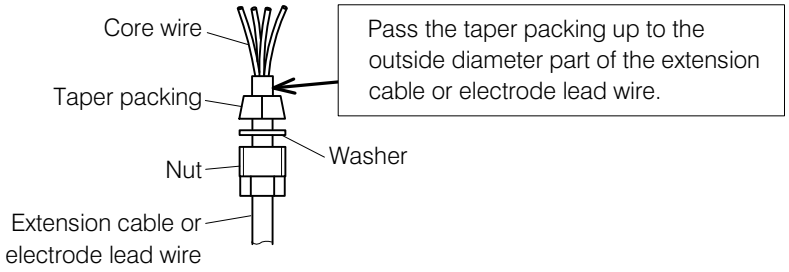


Connector Box Terminal Blocks

(e) When the taper packing for electrode has three holes, remove the rubber film of the hole matched to the thickness of the electrode lead wire and pass the lead wire through that hole.

【IMPORTANT】 • If a hole not matched to the outside diameter of the electrode lead wire is used, air tightness will not be maintained. In addition, do not remove the rubber film of unused holes.

(f) Pass the taper packing through the hole up to the outside diameter part of the extension cable or electrode lead wire. If the taper packing is placed at the core wires part and the nut is tightened, air tightness inside the connector box may not be maintained.



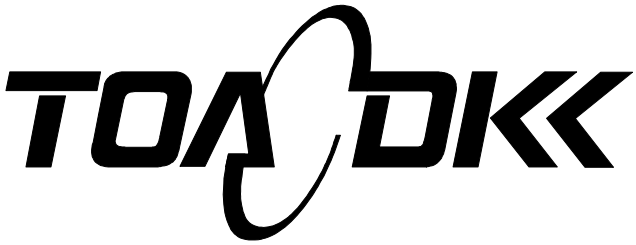
Position of Taper Packing

(g) When using conduit at the extension cable wiring, we recommend the method by which the nut, etc. are removed from the connector box wiring ports, a straight box connector (size: 17-16), etc. is screwed onto the parallel pipe thread (G1/2) at the bottom, and a flexible pipe (size: 17) is connected.

Revision History

Instruction Manual No. OBM-IB54801E	18/06/2013 (JJ)	New Version in English (RS2 M.Huruya, DEC H.Nakamura)

YTD



DKK-TOA CORPORATION
Head Office Address: 29-10, 1-Chome, Takadanobaba, Shinjuku-Ku, Tokyo, 169-8648 Japan
Telephone: +81-3-3202-0225 Facsimile: +81-3-3202-5685
URL http://www.toadkk.co.jp/