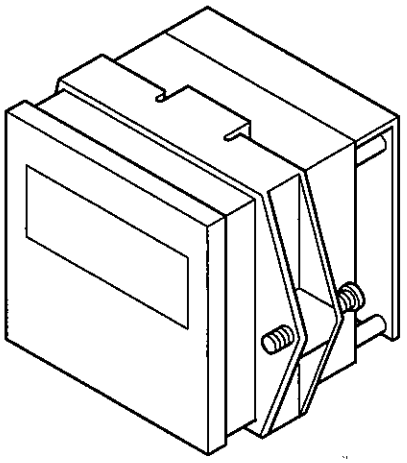
TOADKK

INSTRUCTION MANUAL

FLUORIDE ION MONITOR

MODEL FBM-100A

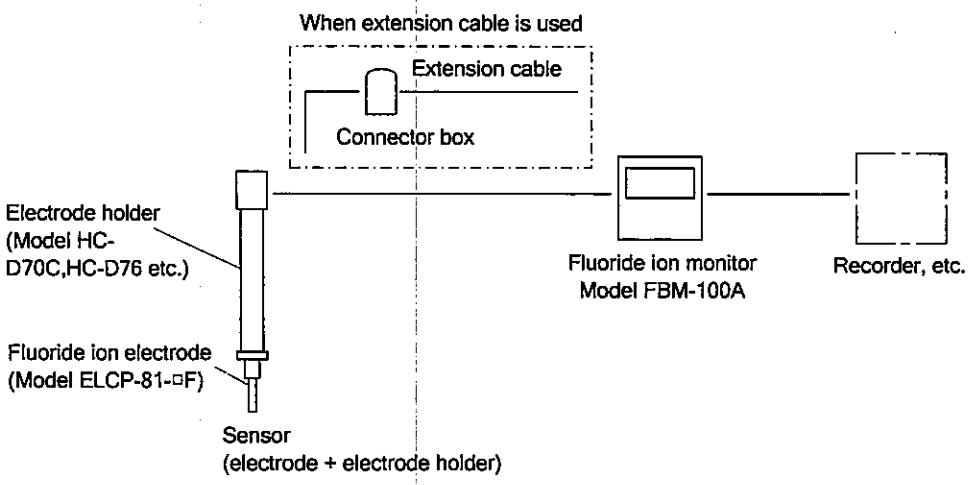


- Please keep this instruction manual close at hand of the persons who are in charge of the operation of this product.
- Before operating this product, please read this instruction manual carefully for its correct handling.

No.FBM-IB51602E

Introduction

(a) Thank you for purchasing a Model FBM-100A Fluoride Ion Monitor. The Model FBM-100A Fluoride Ion Monitor (hereafter called the product) can continuously monitor the free fluoride ion concentration (activity) in a solution. The Model FBM-100A is the analyzer of this monitoring system.



Example of Measurement System

(b) An adjustment function, wash control function, signal contact output function, calibration history function, and a variety of other functions are provided, making it suitable for process monitoring (monitor) in waste water processing processes and final discharge water or in semiconductor manufacturing processes and other plants which use hydrogen fluoride.

(c) The measurement system is the "fluoride ion electrode method" which uses an electrode which detects the fluoride ions immersed in the sample. The electrode has a built-in comparison electrode of the non-replenished internal liquid type and uses porous fluoride resin as the liquid part.

(d) This product detects free fluoride ions (F^-) in water, but does not detect all fluorides. In addition, the conditions are the pH4 to 9 range, but for more stable measurements, use in the pH5 to 8 range is recommended. Since at pH4 or less fluorine exists as non-ionized molecules, it cannot be detected by this product. At pH9 and greater, the effect of OH^- becomes large and an abnormally high value is indicated. Besides at pH2 or less, sensitive membrane separation, etc. may occur. In addition, calcium, aluminum, iron, etc. combine with fluorine and form compounds having different characteristics than fluoride ions. Since such compounds cannot be detected by the fluoride ion electrode, a lower value different from the JIS method is indicated.

(e) The temperature circuit of this product is 10kΩ/25°C or 1kΩ/0°C. Combine it with fluoride ion electrode (hereafter called electrode) containing a 10kΩ or 1kΩ temperature sensor (temperature measuring resistor). The standard combination electrode Model ELCP-81-□F is10kΩ/25°C.

(f) The measuring range (measured value output range) is arbitrarily set, but its setting range is different depending on the "display range" of the ordered specifications. On the other hand, when the display range must be changed, please contact your authorized distributor or the DKK-TOA Technical Service Department. The entire temperature measuring range is 0 to 50°C. The electrode voltage is 90 to 264VAC. For other specifications, please see par. 6. Specifications and Operation Explanation.

Display Range and Measuring Range (Measured Value Output Range) Setting Range

Display range	Measurement range (measured value output range) setting range	Measuring range at the factory (measured value output range) Set value (Specified when ordering)
1(0.0 to 99.9mg/L)	0.0 to 10.0 to 0.0 to 99.9 mg/L	0.0 to 20.0 mg/L etc.
2(0 to 999 mg/L)	0 to 100 to 0 to 999 mg/L	0 to 200 mg/L etc.
3(0 to 9990 mg/L)	0 to 1000 to 0 to 9990 mg/L	0 to 2000 mg/L etc.

(g)A wash type sensor or a pulse air jet wash type sensor such as optional water jet (or chemical liquid) can be combined with the electrode holder.

- Water jet wash sprays a water jet against the end of the electrode and uses its pressure to wash the dirt from the electrode. The higher the solubility in dirty water and the higher the wash water pressure within the 0.05 to 0.5MPa range, the higher the effect.
- Pulse air jet wash uses the high-speed water flow produced when compressed air is suddenly expanded in the sample to clean the electrode.
- These sensors are operated by the wash power supplied from the product. Therefore, the wash interval, wash time, etc. are set at the product.

(h)An abnormal measured value may be indicated or output by the following causes. Build a system such that related facilities are not damaged.

- 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

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

(j) 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 minor 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 such as to prevent damage to the product main body, prevent data destruction, prevent wasting time, and maintain performance.
[NOTE]	Indicates comments, reasons, background information, a case example and other items to help the reader understand the meaning.
▻	Indicates reference items.
①, ②, ③	Indicates item numbers such as the ones used in operations.

(2) Safety compliance items

⚠ WARNING

Hazardous Gasses

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

Electric Shock

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

Hazardous substances

- Wear protective gear when preparing the fluoride ion standard solution and handling the fluoride ion standard undiluted solution and fluoride ion standard solution used at calibration. Also always check the Material Safety Data Sheet (MSDS).
- Wear protective gear when handling the calcium nitrate and sodium nitrate used to manufacture the PH5-AB buffering solution. Also always check the Material Safety Data Sheet (MSDS).

⚠ CAUTION

Automatic wash at automatic return

- When maintenance and inspection work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function (⊳3.3(16) "Changing measurement mode automatic return"). If this function is on, the monitor will automatically return to the measurement mode after 2 hours has elapsed and if the wash control function is enabled, automatic wash by set interval will begin and is dangerous.

Disassembly and Modification

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

Warning Label Lost

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

Disposal

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

(3) Notes on use of the instruction manual

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

(a) The instruction manual is required not only at the start of operation but also required when maintenance is performed or in case a failure occurs. Please keep the manual at hand all the time so that the operator who actually operates the product can read the manual at any time.

(b) If the manual is lost or too smeared to read, please order a new copy through your local sales agent or directly from our sales office.

(c) Some of the diagrams used in the manual or on product labels may be modified with part of their shapes or displays omitted or they may be described in abstract form. In addition, numbers etc. shown on the screen example are just examples for such cases.

(d) The contents of the manual may be changed without prior notice for reasons such as to improve performance.

(e) Intellectual property right of the manual belongs to DKK-TOA. All or part of the manual must not be reproduced without permission.

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.

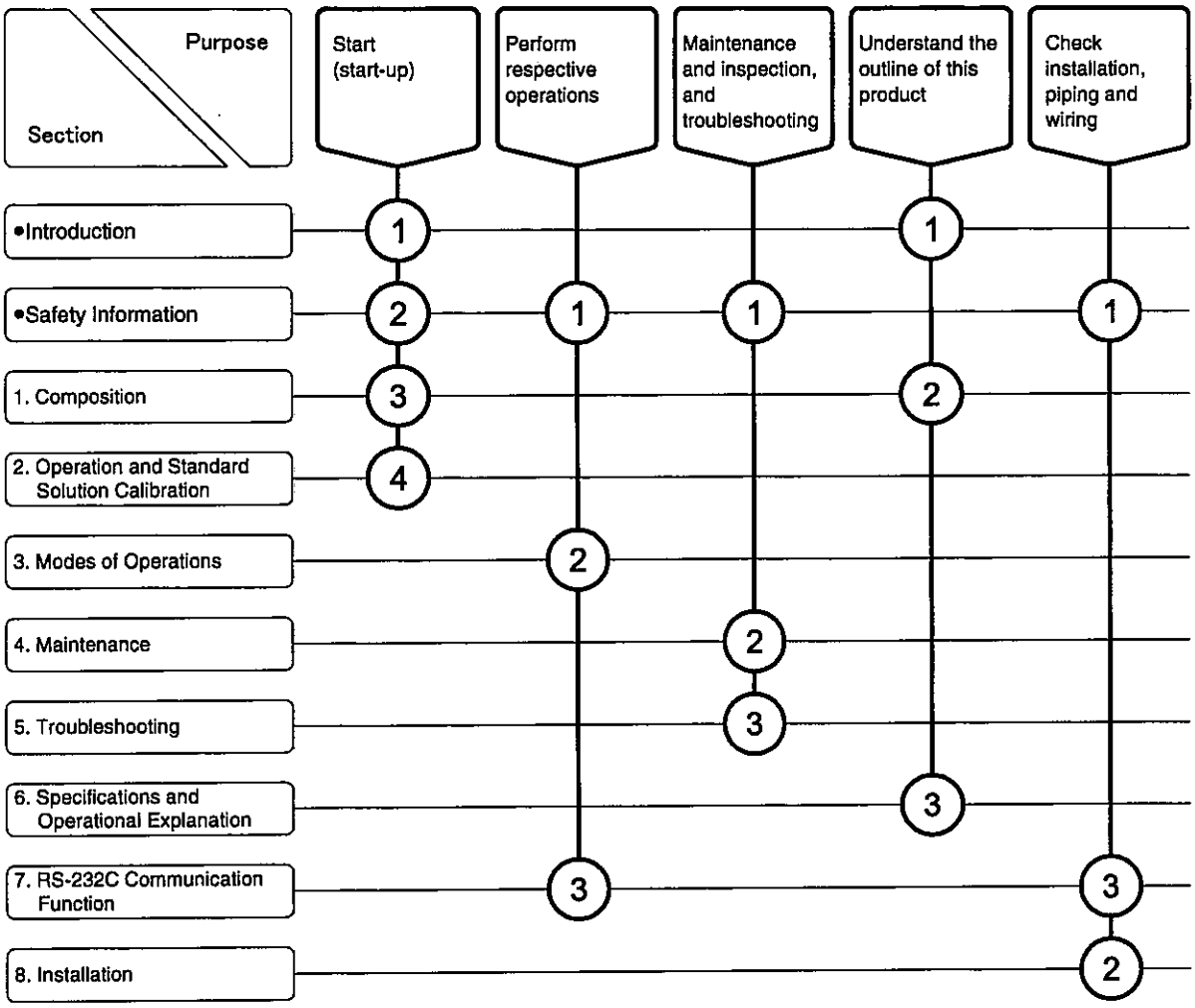
*1: Warranties for products from other companies must be maintained by the user.

*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.



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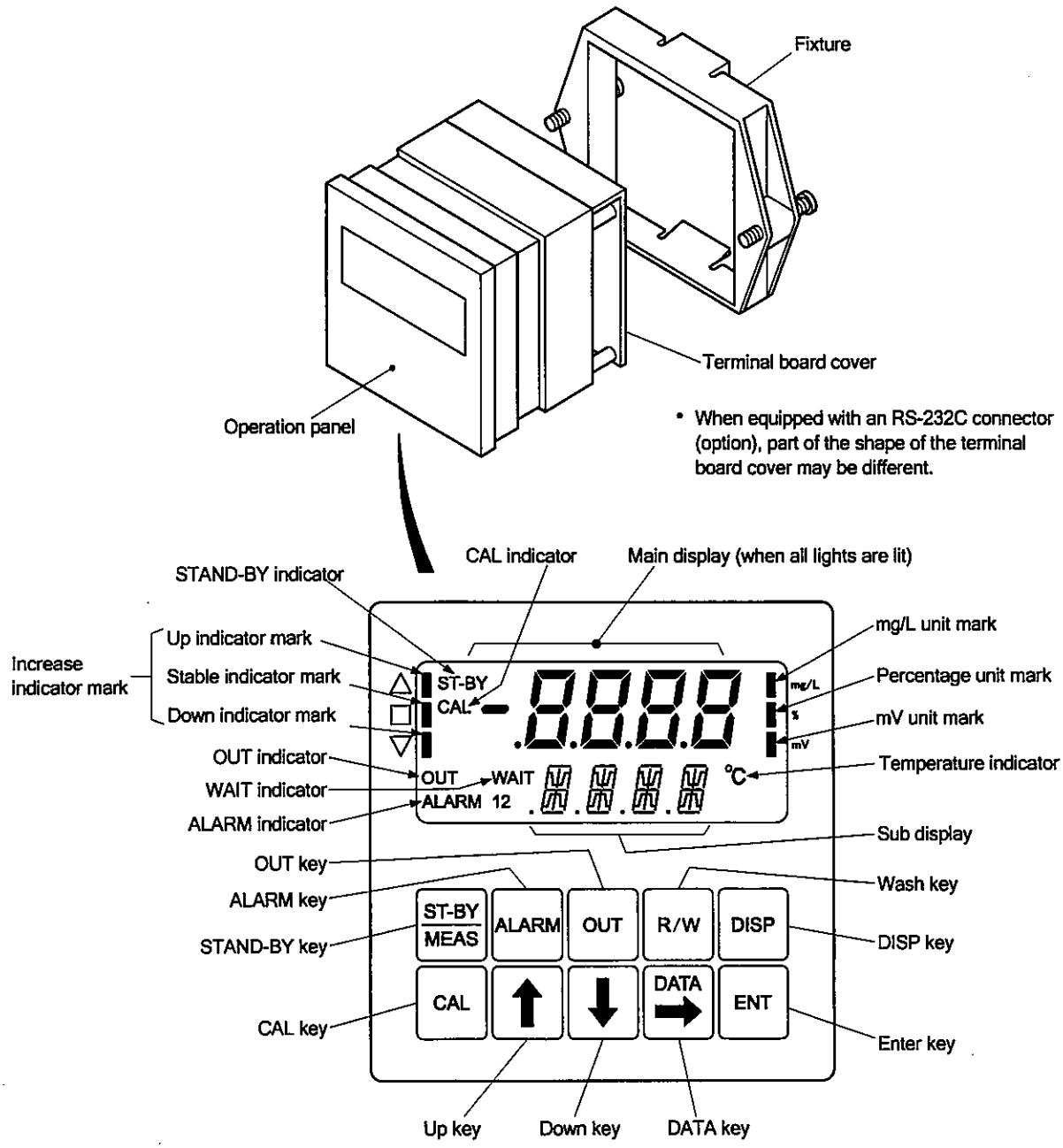
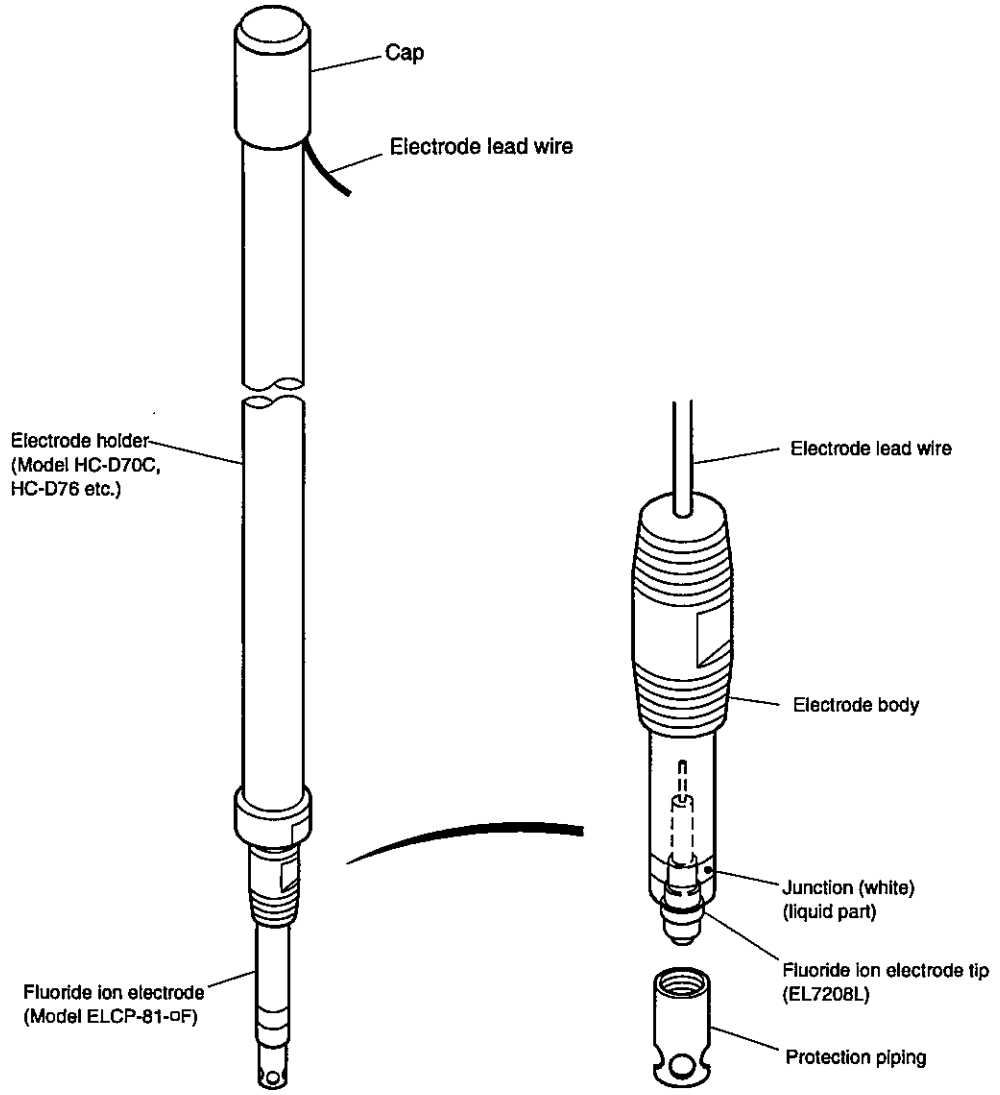
1. Composition

(1) Names of main components



Names of Main Components



Names of Sensors

〔NOTE〕 • For the name of spare parts, refer to 4.2 "Annual Spare Parts".

(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 4 seconds or more in the measurement mode changes the screen to the "Setting Mode F^- Concentration Measured Value" screen (initial screen of setting mode). • Pressing this key for 4 seconds or more in the setting mode returns the screen to the "F^- Concentration Measured Value" screen (initial screen of measurement mode). • Pressing this key for about 1 second during wash operation (while "WASH" of the sub display is blinking) stops the wash operation and displays the "Setting Mode F^- Concentration Measured Value" screen (initial screen of setting mode).
CAL key CAL ([CAL])	• Pressing this key when a screen in the measurement mode measured value screen group is displayed switches the screen to the standard solution display screen group. Pressing this key again and the "F^- Concentration Measured Value" screen appears. • Pressing this key for 4 seconds or more when a screen in the setting mode measured value screen group is displayed switches the screen to the standard solution calibration auxiliary screen group. • Pressing this key when a screen in the setting mode measured value screen group is displayed switches the screen to the calibration mode standard solution calibration 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 measurement mode and setting mode measured value screen group is displayed switches the screens in that group. • Pressing this key for 4 seconds or more when a screen in the setting mode measured value screen group is displayed switches the screen to the F^- concentration/temperature shift and correction screen group.
Alarm key ALARM ([ALARM])	• Pressing this key when a screen in the measurement mode measured value screen group is displayed switches the screen to the alarm display screen group. When this key is pressed repeatedly, the screens of this group are switched and the screen finally returns to the "F^- Concentration Measured Value" screen. • Pressing this key for 4 seconds or more when a screen in the setting mode measured value screen group is displayed switches the screen to the alarm screen group.
OUT key OUT ([OUT])	• Pressing this key when a screen in the measurement mode measured value screen group is displayed switches the screen to the measuring range display screen group. When this key is pressed repeatedly, the screens of this group are switched and the screen finally returns to the "F^- Concentration Measured Value" screen. • Pressing this key for 4 seconds or more in the measurement mode switches the mode to the transmission adjustment mode. Pressing this key for 4 seconds or more in the transmission adjustment mode returns the screen to the "F^- Concentration Measured Value" screen. • Pressing this key for 4 seconds or more in the setting mode measured value screen group is displayed switches the screen to the measuring range screen group.

(To be continued)

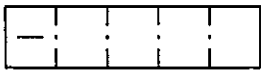
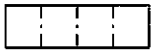
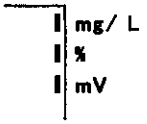
(Continued from previous page)

Operation key (notation in the text)	Function
Wash key  ([R/W])	• Pressing this key when a screen in the measurement mode measured value screen group is displayed switches the screen to the wash function display screen group. When this key is pressed repeatedly, the screens of this group are switched and the screen finally returns to the "F⁻ Concentration Measured Value" screen. • Pressing this key for 4 seconds or more when a screen in the setting mode measured value screen group is displayed switches the screen to the wash function screen group. • When combined with a sensor with wash function (option); set in accordance with 3.3(8) "Changing the wash control 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. • Pressing this key when a screen in the calibration mode standard solution calibration screen group is displayed switches to fluoride ion concentration, electrode potential, and temperature. • Pressing this key when a screen in the measurement mode calibration history data display screen group is displayed switches the calibration history time series.
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. • Pressing this key when a screen in the calibration mode standard solution calibration screen group is displayed switches to fluoride ion concentration, electrode potential, and temperature. • Pressing this key when a screen in the measurement mode calibration history data display screen group is displayed switches the calibration history time series.
DATA key  ([DATA/→])	• Pressing this key when a screen in the measurement mode measured value screen group is displayed switches the screen to the other set value display screen group. When this key is pressed repeatedly, the screens of this group are switched and the screen finally returns to the "F⁻ Concentration Measured Value" screen. • Pressing this key for 4 seconds or more when a screen in the measurement mode measured value screen group is displayed switches the screen to the calibration history data display screen group. When this key is pressed repeatedly (about 1 second); the screens in this group are switched. Pressing this key for 4 seconds or more at any screen returns the screen to the "F⁻ Concentration Measured Value" screen. • Pressing this key for 4 seconds or more when a screen in the setting mode measured value screen group is displayed switches the screen to the other screen group. • Pressing this key in the setting mode or calibration mode moves "digit" of the number to be set to the right. • Pressing this key when a screen in the measurement mode calibration history data screen group is displayed switches the calibration history data item. • Turning on the power while pressing this key sets the monitor to the service mode.

[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".

Functions of indicators

Functions of indicators	Function
Main display 	• Displays mainly the measured value in the measurement mode. • Displays set value contents, selection items, etc. in the setting mode and in the transmission adjustment mode. • Displays the calibration method, calibration value, etc. in the calibration mode.
Sub display 	• Displays the contents of the main display and the electrode potential, temperature, etc. in the measurement mode. • Displays set value contents, selection items, etc. in the setting mode and in the transmission adjustment mode. • Displays the calibration execution status, etc. in the calibration 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	• When this indicator is lit, the monitor is in the setting mode, calibration mode, transmission adjustment mode or during wash operation. • When this indicator blinks, the monitor is in the service mode.
CAL indicator CAL	• Indicates that the monitor is in the transmission adjustment mode or calibration mode. • Indicates that the screen is related to standard solution calibration.
OUT indicator OUT	•"OUT" indicates that the screen is related to the fluoride ion concentration measured value output. Blinking indicates that the fluoride ion concentration is outside the measuring range (measured value output range).
ALARM indicator ALARM1 ALARM2 ALARM 3 ALARM 4	• Indicates that the screen is related to the alarm output. • "ALARM1", "ALARM2", "ALARM3", and "ALARM4" correspond to Alarm 1, Alarm 2, Alarm 3, and Alarm 4 respectively. • Blinking indicates that the corresponding alarm has occurred.
WAIT indicator WAIT	• Blinking indicates that the monitor is in the process of stability check at the time of calibration.
Up/down indicator marks 	• The up/down indicator has 3 marks indicating increasing, decreasing and stable. The state of the fluoride ion concentration measured value is indicated by lighting or blinking of these marks as follows: • Up indicator mark (△ position) Lit (continuous).....Measured value is increasing considerably Fast blink.....Measured value is increasing Slow blink.....Measured value is increasing slightly • Stable indicator mark (□ position) Lit or blink.....Measured value is almost stable • Down indicator mark (▽ position) Slow blink.....Measured value is decreasing slightly Fast blink.....Measured value is decreasing Lit (continuous).....Measured value is decreasing considerably

2. Operation and Standard Solution Calibration

2.1 Operation Start Procedure

Follow the procedure below. The measurement system including the monitor enters the normal operation state.

①Check the installation condition. ····· Check that necessary installation work is completed, which is described in 8. "Installation" (mounting, connection).

⚠WARNING

Toppling

- When working near the measurement reservoir, wear a safety belt or other toppling prevention equipment. Besides, to prevent injury, wear a helmet, life jacket, safety boots, etc.

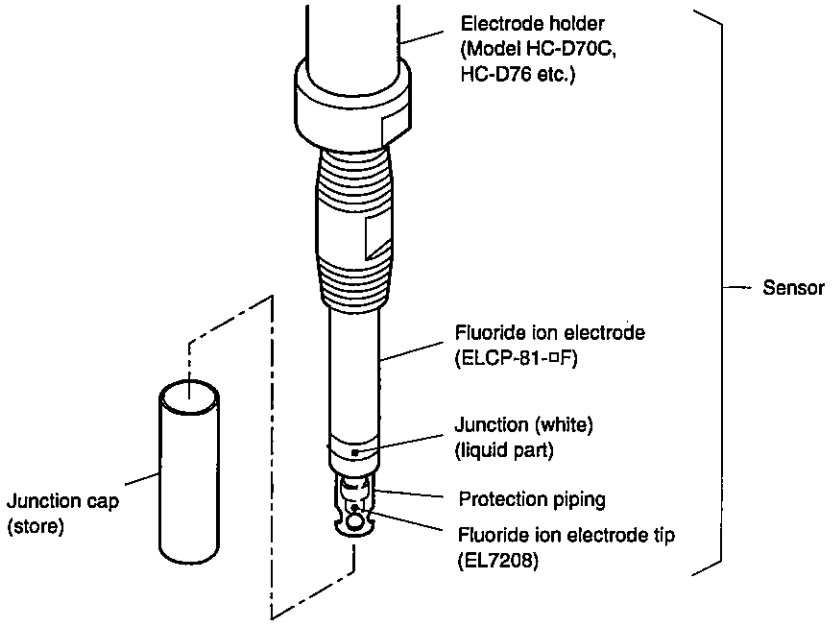
⚠CAUTION

Mixing in

- Do not drop tools, etc. into the measurement reservoir.

②Prepare for the sensor. ·····After referring to 4.3(2) "Removing the sensor" and pulling up the sensor from the measurement point, check that the junction cap is removed from the electrode at the end of the sensor.

- If the junction cap is installed, remove and store it.



Check removal of the electrode junction cap

[IMPORTANT]
- Do not touch the junction (fluoride resin body) of the electrode. If strong force is applied, the bonded part may separate.
- Do not expose the junction of the electrode to the air for a long time. If the junction gets dry, immerse it into a saturated potassium chloride solution until its characteristics are recovered.
- Be careful not to touch the sensitive membrane at the tip. If the sensitive membrane (lanthanum fluoride single crystal membrane) is scratched by a brush, etc., electrode performance may be lost.

③Check the warm-up time of electrode. ····· Immerse the electrode in pure water for 30 minutes or more.
- Carry out this condition until step ⑪ "Perform calibration" is started. This is the time required for the characteristic to stabilize.

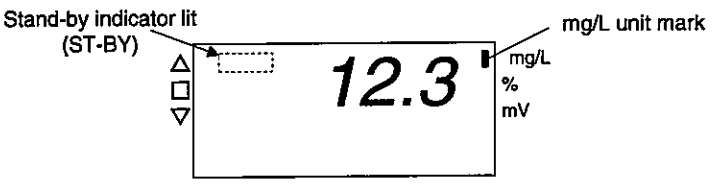
④Supply power. ····· Check the power to be supplied to the product is 90 to 264VAC and turn on power at the power source side.

⚠WARNING

Electric Shock
- Do not touch the rear panel terminal board while power is supplied. Touching the terminals may cause electric shock.

[IMPORTANT]
- The power supply voltage of the monitor is 90 to 264VAC. If a voltage higher than this is supplied, the monitor may be damaged.
- When connecting a sensor with wash function and wash power output is necessary; always comply with the power requirement specifications (100VAC±10%, etc.) of the sensor with wash function. If a voltage higher than this is supplied, a step-down transformer is always necessary between the monitor and sensor with wash function.

⑤Check the indication. ····· When the power is supplied to the product "F^- Concentration Measured Value" screen, the initial screen of the measurement mode, appears and the fluoride ion concentration measured value is shown on the main display and the mg/L unit mark lights. The stand-by indicator (ST-BY) is unlit.



F^- Concentration Measured Value Screen Example

[NOTE] •If an error message such as "E-12" appears on the main display, take necessary actions.
⇨5.1 "Error Message"

⑥Set the clock. ····· When using the product for the first time, or when the power has been off for 1 week or more, set the clock. ▻ 3.3(15) "Changing the date and time (clock setting)"

⑦Check the measuring ranges. ····· Check the fluoride ion concentration measuring range and check if it is appropriate for fluoride ion concentration of sample water. If necessary, change these ranges. ▻ 3.2(4) "Checking the fluoride ion concentration measuring range", 3.3(6) "Changing the fluoride ion concentration measuring range (measured value output range)"

⑧Check the alarm function settings. ····· Check the alarm value and other alarm function settings, and if signal contact output is used, check the settings, and change them as required. ▻ 3.2(3) "Alarm check", 3.3(5) "Changing the alarm settings

⑨Check the wash control function settings. ····· When controlling a sensor with wash function (option), check that the wash control function is enabled (on or P.on) and check the wash interval, etc.

- When the sensor with wash function (built-in timer type) has a control function, and when using a sensor without wash function, check that the wash control function is disabled (oFF).
- Change the settings as required. ▻ 3.2(5) "Checking the wash control function", 3.3(7) "Changing the wash control function"

⑩Check other settings. ····· Check the setting items set at the time of factory shipment such as "Hold" type and change them as required. ▻ 3.2(6) "Checking other set values", 3.3(9) "Changing the electrode characteristics data" to 3.3(16) "Changing measurement mode automatic return".

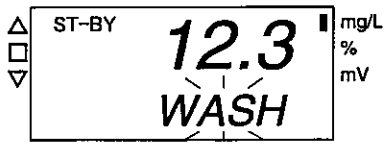
⑪Perform calibration. ····· ▻ 2.2 "Calibration and Fluoride Ion Standard Solution"

- After the end of calibration, return the sensor to the original measurement point. ▻ 4.3(3) "Installing the sensor"

⑫Select a screen of the measurement mode. ····· ▻ 3.2(1) "Measured value screen selection and operation display"

⑬Check that wash operation is started. ····· When the wash control function was enabled (on or p.on) at step ⑨, set the wash interval to the shortest time (▻ 3.3(7) "Changing the wash control function") and check that "WASH" (blinking) is displayed on the sub display when the wash time arrives.

- "WASH" (blinking) also appears on the sub display when checking by interrupt wash from the outside.
- After checking that the wash operation starts, return the wash interval to the original time.



Example of F^- Concentration Measured Value Screen at Wash Operation

[NOTE] •The wash operation can be stopped by pressing ST-BY/MEAS for about 1 second during automatic wash.

The measurement system is now in the normal measurement condition.

2.2 Calibration and Fluoride Ion Standard Solution

(1) Standard solution calibration overview

(a) The electrical characteristics of the electrode and this product must be adjusted in advance by always performing standard solution calibration before the start of measurement so that the monitor indication will always correctly correspond to the ion concentration (activity) of the sample. In addition, since this monitor system is a simple type and does not have automatic calibration and other functions, when the electrode or other part has been changed, or when the product has been used continuously for a long time, standard solution calibration is necessary.

(b) There are two ways to perform standard solution calibration. 2-point calibration method uses 2 types of fluoride ion standard solutions with different concentrations and matches the indication of this product to the concentration. Simple 1-point calibration method is performed with 1 type of fluoride ion standard solution. 2-point calibration is the official calibration method used after electrode replacement, etc.

(c) Take the quality, etc. of the sample into account and in the beginning perform calibration frequently to decide a suitable calibration interval which will keep the error within the tolerance range. If the electrode is extremely dirty, shorten the calibration interval.

(d) When measuring a sample having a different liquid organization than the fluoride ion standard solution prepared at 2.2(4) "Preparing the fluoride ion standard solution", prepare a standard solution whose fluoride ion concentration, temperature and other conditions match those of the sample, or perform 2-point calibration and then manually analyze the sample and adjust the indication by changing the calibration curve coefficient. ⊳ 3.3(4) "Changing the calibration curve coefficient"

[NOTE] • To stop standard solution calibration, press ST-BY/MEAS (for about 1 second). The "Setting Mode F^- Concentration Measured Value" screen appears. In this case, the calibration curve cannot be rewritten unless calibration, including stability checking, has ended.

(2) 2-point calibration

①Check the standard solution concentration setting. ····· Display the "Standard Solution Display" screen (2P.Z⇔2P.S) by pressing CAL in the measurement mode, and check the standard solution concentration setting value.

Display range 1(0 to 99.9mg/L) specifications factory setting example: 20mg/L (depends on the ordered specifications)

[NOTE] • The standard solution concentration set value can be changed. ⊳ 3.3(2) "Changing the standard solution concentration"

②Preparations

(a) Commercial 500ml polyethylene beaker ····· 2 (Used to hold the standard solution and immerse the electrode)

(b) 1/10 standard solution ····· Prepare a 2mg/L standard solution having the standard solution concentration indicated at the main display (1/10 concentration of span standard solution) when the sub display at step ① indicates "2P.Z". ⊳ 2.2(4) "Preparing the fluoride ion standard solution"

(c) Span standard solution ····· Prepare a standard solution having the standard solution concentration indicated at the main display when the sub display at step ① indicates "2P.S". ⊳ 2.2(4) "Preparing the fluoride ion standard solution"

(d) Pure water for electrode washing (city water can also be used)

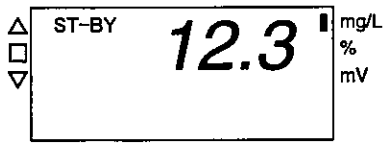
(e) Magnetic stirrer and stirring bar

⚠ WARNING

Hazardous substances

- Wear protective gear when preparing the fluoride ion standard solution and handling the fluoride ion standard undiluted solution and fluoride ion standard solution used at calibration. Also always check the Material Safety Data Sheet (MSDS).

③Set the product to the setting mode. ····· If the product is in the measurement mode ("ST-BY" off), press ST-BY/MEAS for 4 seconds or more. "ST-BY" lights and the "Setting Mode F^- Concentration Measured Value" screen appears.



Setting Mode F^- Concentration Measured Value Screen Example

⚠ WARNING

Toppling

- When working near the measurement reservoir, wear a safety belt or other toppling prevention equipment. Besides, to prevent injury, wear a helmet, life jacket, safety boots, etc.

⚠ CAUTION

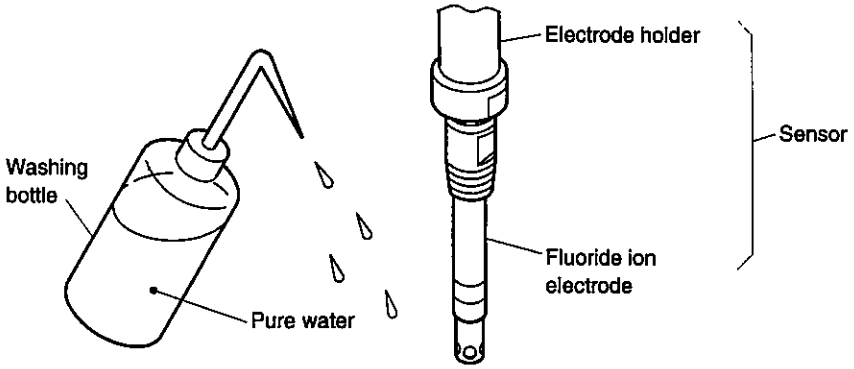
Mixing in

- Do not drop tools, etc. into the measurement reservoir.

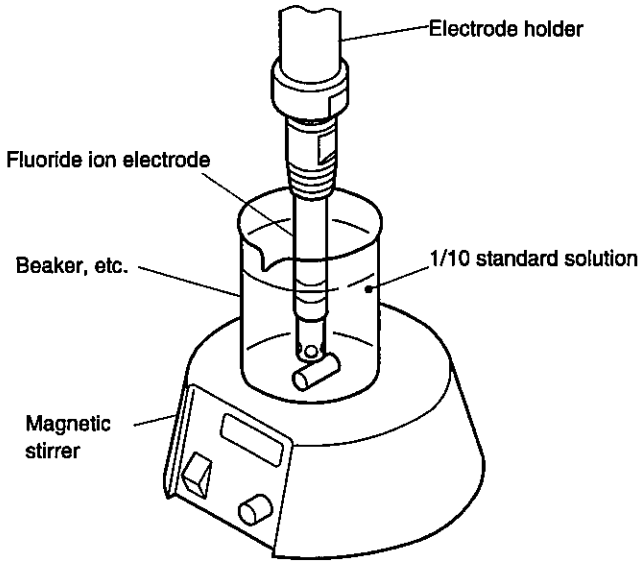
Automatic wash at automatic return

- When maintenance and inspection work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function (▷3.3(16) "Changing measurement mode automatic return"). If this function is on, the monitor will automatically return to the measurement mode after 2 hours has elapsed and if the wash control function is enabled, automatic wash by set period will begin and is dangerous.

④Immerse the electrode into the 1/10 standard solution. ····· After referring to ② to ④ of 4.3(2) "Removing the sensor" and pulling up the sensor from the measurement point, wash the electrode with pure water, wipe off the water remaining on the electrode, then immerse the electrode into the 1/10 standard solution (for 1st point).



Washing the Electrode



Immersing Electrode into 1/10 Standard Solution

⑤Start the stirrer. ····· Check that the product power switch is ON. Also turn on the stirrer switch.

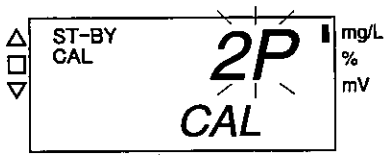
[IMPORTANT] • For standard solution calibration, always use a stirrer to mix the standard solution. If calibration is performed without using a stirrer, the correct measured value may not be obtained.

⑥Wait until the indication stabilizes. ····· Wait until the measured value on the display panel stabilizes (about 5 to 10 minutes).

[NOTE] • When the measured value stabilizes, the stable indicator mark of the up/down indicator marks will light steadily or blink.

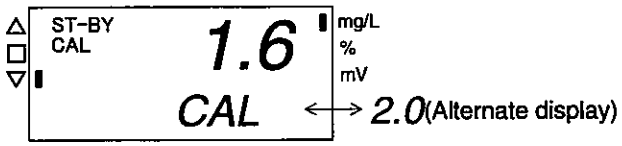
⑦Display a standard solution calibration screen group screen. ····· Press CAL one time (about 1 second).

- The calibration display (CAL) lights and the "Calibration Method Selection" screen (CAL), the initial screen of the calibration mode standard solution calibration screen group, appears.
- The initial value of the "Calibration Method Selection" screen (CAL) is "2P" for main display and 2-point calibration is selected.



(2-point calibration)
Calibration Method Selection Screen Example

⑧Select the "1st Point Calibration" screen. ····· Check that the main display indicates "2P" (2-point calibration), and press [ENT] one time. The "1st Point Calibration "screen (CAL.A) appears.



1st Point Calibration Screen Example

⑨Start 1st point calibration. ····· When the indication becomes almost stable, press [ENT] one time.

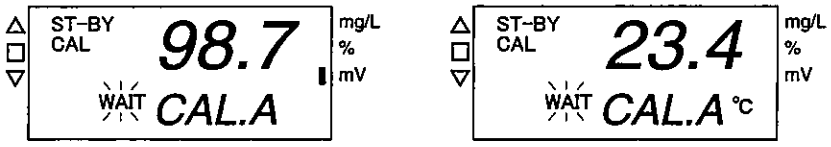
- The wait mark (WAIT) begins to blink, calibration of the 1st point by 1/10 standard solution starts, and checking is indicated.

[NOTE] • When interval of the stability checking for calibration conditions is set to 0 second (disabled), stability checking is not performed and calibration ends immediately after the stability checking start time (standard 15 seconds) has elapsed.

• When the measured value stabilizes, the stable indicator mark of the up/down indicator marks will light steadily or blink.

(Fluoride ion concentration display)
1st Point Calibration Screen Example

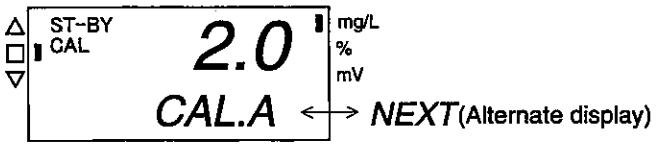
- The main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key during calibration.



(Electrode potential display) **(Temperature display)**
1st Point Calibration Screen Example

⑩Check that 1st point calibration has ended. ····· Check that the wait mark (WAIT) is off and the screen was switched to the "1st Point Calibration End" screen (CAL.A ⇔ NEXT).

- The fluoride ion concentration measured value after calibration is displayed on the main display. 1st point calibration has ended.

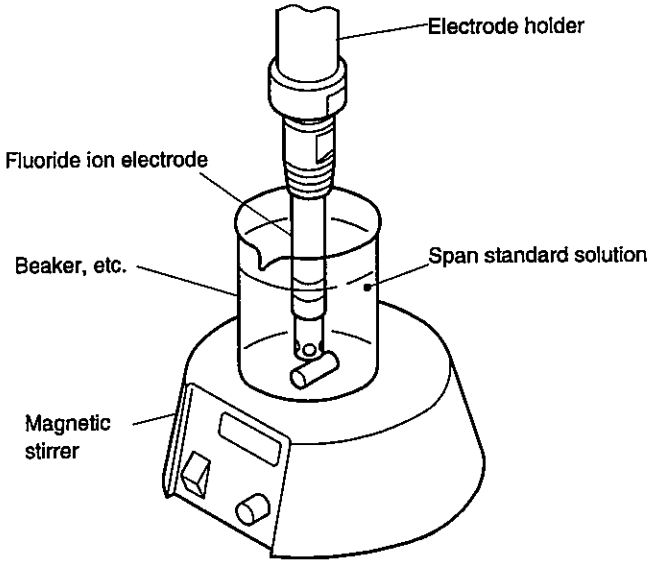


(Fluoride ion concentration display)
1st Point Calibration End Screen Example

- After the end of calibration, the main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key, the same as step ⑨.

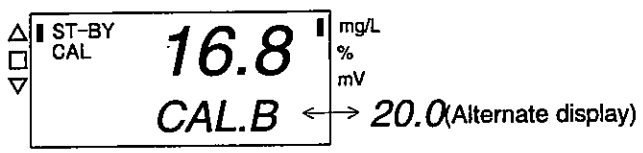
[NOTE] • If an "E - - 1" to "E - - 5" error message appeared on the main display during calibration, see 5.1(1) "Error messages for calibration and necessary actions", and after taking appropriate action, repeat calibration.

⑪Immerse the electrode into the span standard solution. ····· Wash the electrode with pure water, wipe off the water remaining on the electrode, then immerse the electrode into the span standard solution (for 2nd point).



Immersing Electrode into Span Standard Solution

⑫Select the "2nd Point Calibration" screen. ····· Press [ENT] one time. The "2nd Point Calibration" screen (CAL.B) appears.



2nd Point Calibration Screen Example

⑬Start 2nd point calibration. ····· When the indication becomes almost stable (stable indicator mark changes from blinking to steady light), press [ENT] one time.

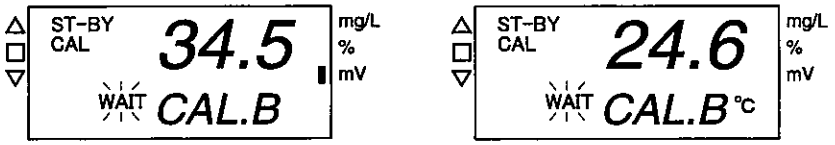
- The wait mark (WAIT) begins to blink, calibration of the 2nd point by span standard solution starts, and checking is indicated.

[NOTE] • When interval of the stability checking for calibration conditions is set to 0 second (disabled), stability checking is not performed and calibration ends immediately after the stability checking start time (standard 15 seconds) has elapsed.

• When the measured value stabilizes, the stable indicator mark of the up/down indicator marks will light steadily or blink.

(Fluoride ion concentration display)
2nd Point Calibration Screen Example

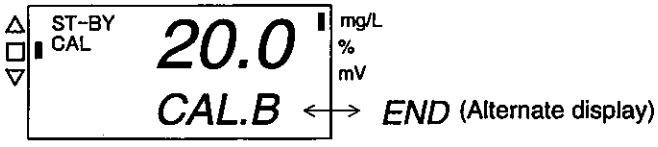
- The main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key during calibration.



(Electrode potential display) **(Temperature display)**
2nd Point Calibration Screen Example

⑭Check that span standard solution calibration has ended. ····· Check that the wait mark (WAIT) is off and the screen was switched to the "Span Standard Solution Calibration End" screen (CAL.B ⇔ END).

- The fluoride ion concentration measured value after calibration is displayed on the main display and shows that span standard solution calibration has ended.



(Fluoride ion concentration display)
2nd Point Calibration End Screen Example

- After the end of calibration, the main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key, the same as step ⑬.

[NOTE] • If an "E - - 1" to "E - - 5" error message appeared on the main display during calibration, see 5.1(1) "Error messages for calibration and necessary actions", and after taking appropriate action, repeat calibration.

⑮**Return to the measurement state.** ····· After turning off the stirrer switch and washing the electrode with pure water, return the sensor to the measurement point. ▷ 4.3(3) "Installing the sensor"

⑯**Return to the setting mode.** ····· Press ST-BY/MEAS one time (about 1 second).

- "CAL" goes off and the "Setting Mode F^- Concentration Measured Value" screen appears.

⑰**Set the product to the measurement mode.** ····· Press ST-BY/MEAS for 4 seconds or more.

- "ST-BY" goes off and the "F- Concentration Measured Value" screen appears.

[IMPORTANT] • Do not return the used fluoride ion standard solution (1/10 standard solution, span standard solution) to their original container. Store them in a separate sealed container. Even used ion standard solution can be reused within the same day, but we recommend that new fluoride ion standard solution be used.

(3) 1-point calibration

One-point calibration is simple calibration performed using one kind of standard solution. The concentration of the standard solution can be arbitrarily set, but calibration is performed using either 1/10 standard solution or span standard solution.

①Preparations

(a)Commercial 500ml polyethylene beaker ····· 1 (Used to hold the standard solution and immerse the electrode)

(b)Standard solution ····· Prepare span standard solution or standard solution having a 10% concentration of span standard solution.
▷ 2.2(4) "Preparing the fluoride ion standard solution"

(c)Pure water for electrode washing (city water can also be used)

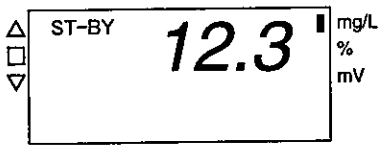
(d)Magnetic stirrer and stirring bar

⚠ WARNING

Hazardous substances

● Wear protective gear when preparing the fluoride ion standard solution and handling the fluoride ion standard undiluted solution and fluoride ion standard solution used at calibration. Also always check the Material Safety Data Sheet (MSDS).

②**Set the product to the setting mode.** ····· If the product is in the measurement mode ("ST-BY" off), press ST-BY/MEAS for 4 seconds or more. "ST-BY" lights and the "Setting Mode F^- Concentration Measured Value" screen appears.



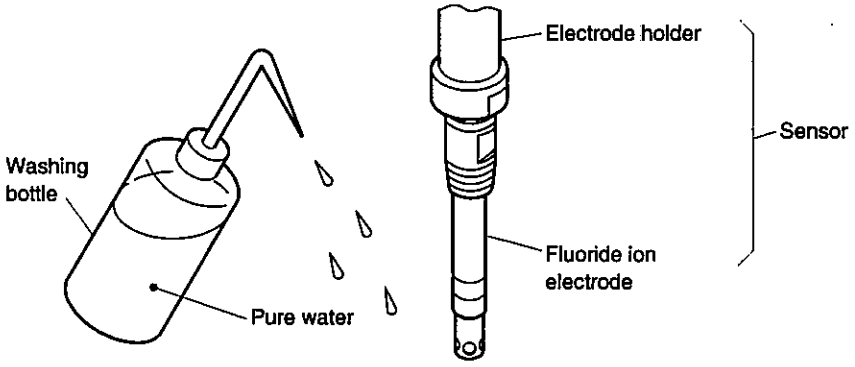
F^- Concentration Measured Value Screen Example

⚠ CAUTION

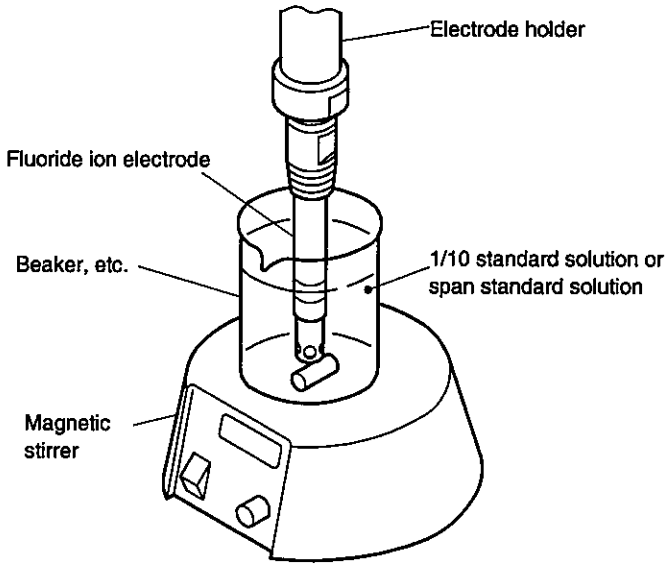
Automatic wash at automatic return

- When maintenance and inspection work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function (⇨3.3(16) "Changing measurement mode automatic return"). If this function is on, the monitor will automatically return to the measurement mode after 2 hours has elapsed and if the wash control function is enabled, automatic wash by set period will begin and is dangerous.

③Immerse the electrode into standard solution. ····· After referring to ② to ④ of 4.3(2) "Removing the sensor" and pulling up the sensor from the measurement point, wash the electrode with pure water, then immerse the electrode into the span standard solution or 1/10 standard solution prepared in step ①.



Washing the Electrode



Immersing Electrode into Standard Solution

④Start the stirrer. ····· Check that the product power switch is ON. Also turn on the stirrer switch.

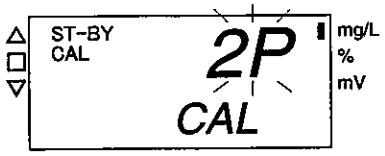
[IMPORTANT] • For standard solution calibration, always use a stirrer to mix the standard solution. If calibration is performed without using a stirrer, the correct measured value may not be obtained.

⑤Wait until the indication stabilizes. ····· Wait until the measured value on the display panel stabilizes (about 5 to 10 minutes).

[NOTE] • When the measured value stabilizes, the stable indicator mark of the up/down indicator marks will light steadily or blink.

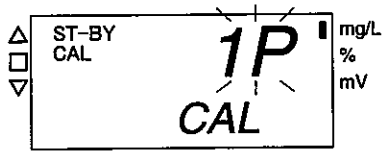
⑥Display a standard solution calibration screen group screen. ····· Press [CAL] one time (about 1 second).

- The calibration display (CAL) lights and the "Calibration Method Selection" screen (CAL), the initial screen of the calibration mode standard solution calibration screen group, appears.
- The initial value of the "Calibration Method Selection" screen (CAL) is "2P" for main display and 2-point calibration is selected.



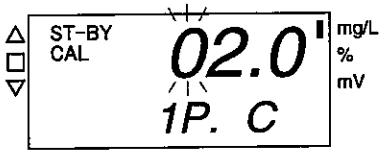
(2-point calibration)
Calibration Method Selection Screen

⑦Select 1-point calibration. ····· Switch the main display to "1P" (1-point calibration) using the [↑] or [↓] key.



(1-point calibration)
Calibration Method Selection Screen

⑧Set the concentration at the "Standard Solution Concentration Setting" screen. ····· Press [ENT] one time. The 1-point calibration "Standard Solution Concentration Setting" screen (1P. C) appears and the previously set standard solution concentration is displayed (blinks) on the main display.

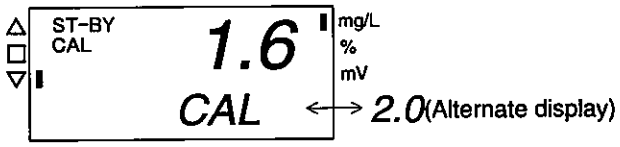


Standard Solution Concentration Setting Screen Example

- Raise and lower the value of the blinking digit using the [↑] or [↓] key, move the digit using the [DATA/→] key, input a concentration of 10 to 100% of full scale within the measuring range (measured value output), and enter the data using the [ENT] key.

[NOTE] • The standard solution concentration can be set within a range of 1 to 100% of display range full scale (99.9mg/L, etc.).

• The "Calibration" screen (CAL⇔Standard solution set concentration) appears.



Calibration Screen Example

⑨Start calibration. ····· When the indication becomes almost stable, press [ENT] one time.

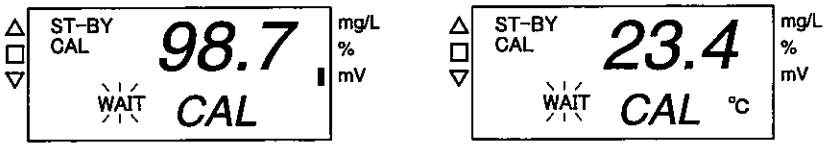
• The wait mark (WAIT) begins to blink, calibration by standard solution prepared in step ① starts, and checking is indicated.

[NOTE] • When interval of the stability checking for calibration conditions is set to 0 second (disabled), stability checking is not performed and calibration ends immediately after the stability checking start time (standard 15 seconds) has elapsed.

• When the measured value stabilizes, the stable indicator mark of the up/down indicator marks will light steadily or blink.

(Fluoride ion concentration display)
Calibration Screen Example

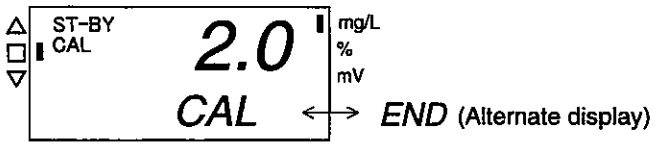
• The main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key during calibration.



(Electrode potential display) **(Temperature display)**
Calibration Screen Example

⑩Check that calibration has ended. ····· Check that the wait mark (WAIT) is off and the screen was switched to the "Calibration End" screen (CAL ⇔ END).

• The fluoride ion concentration measured value after calibration is displayed on the main display. Calibration has ended.



(Fluoride ion concentration display)
Calibration End Screen Example

- After the end of calibration, the main display can be switched from "Fluoride ion concentration" to "Electrode potential" or "Temperature" measured value by pressing the [↑] or [↓] key.

[NOTE] • If an "E - - 0", "E - - 4", or "E - - 5" error message appeared on the main display during calibration, see 5.1(1) "Error messages for calibration and necessary actions", and after taking appropriate action, repeat calibration.

⑪ **Return to the measurement state.** ····· After turning off the stirrer switch and washing the electrode with pure water, return the sensor to the measurement point. ▷ 4.3(3) "Installing the sensor"

⑫ **Return to the setting mode.** ····· Press [ST-BY/MEAS] one time (about 1 second).

- "CAL" goes off and the "Setting Mode F^- Concentration Measured Value" screen appears.

⑬ **Set the product to the measurement mode.** ····· Press [ST-BY/MEAS] for 4 seconds or more.

- "ST-BY" goes off and the "F^- Concentration Measured Value" screen appears.

[IMPORTANT] • Do not return the used fluoride ion standard solutions to their original container. Store them in a separate sealed container. Even used fluoride ion standard solution can be reused within the same day, but we recommend that new fluoride ion standard solutions be used.

(4) Preparing the fluoride ion standard solution

(a) When performing 2-point calibration, prepare 2 kinds of fluoride ion standard solution; "1/10 standard solution" and "span standard solution". When performing 1-point calibration, prepare the fluoride ion standard solution of either "1/10 standard solution" or "span standard solution".

(b) When all the fluoride ion standard undiluted solution and the pH5-AB buffering solution are used up, prepare more by referring to the next item.

▷ 2.2(4) (d) "Preparing the fluoride ion standard undiluted solution"

▷ 2.2(4) (e) "Preparing the pH5-AB buffering solution"

⚠ WARNING

Hazardous substances

- Wear protective gear when preparing the fluoride ion standard solution and handling the fluoride ion standard undiluted solution and fluoride ion standard solution used at calibration. Also always check the Material Safety Data Sheet (MSDS).

(a) Concentration of standard solution used

(i) The concentration of the standard solution used can be checked at the main display of the measurement mode "Standard Solution Concentration Display" screen (2P.Z⇔2P.S). The standard solution concentration set at the factory is matched to the "display range" and "measuring range" (measured value output range) specified when ordering.

Display Range and Factory Standard Solution Concentration Setting

Display range (specified when ordering)	Factory standard solution concentration setting example (differs depending on the span standard solution concentration and measuring range (measured value output range))	1/10 standard solution concentration example
Display range 1 (0.0 to 99.9mg/L)	20.0mg/L (when measuring range 0 to 20.0mg/)	2.0 mg/L, etc.
Display range 2 (0 to 999mg/L)	200mg/L (when measuring range 0 to 200 mg/L)	20 mg/L, etc.
Display range 3 (0 to 9990mg/L)	2000mg/L (when measuring range 0 to 2000 mg/L)	200 mg/L, etc.

(ii) The 1/10 standard solution is a fluoride ion standard solution having a 10% concentration of the span standard solution. The analyzer performs "1/10 standard solution calibration" at a concentration of 10% of the set standard solution concentration set value. Therefore, always prepare a standard solution having a concentration of 10% of the standard solution concentration set value.

(iii) When using a standard solution having a concentration different from that of the "Display Range and Factory Standard Solution Concentration Setting" table, change the standard solution concentration set value (▷ 3.3(2) "Changing the standard solution concentration"). In this case, prepare the standard solution in compliance with this item.

(iv) The standard solution concentration and "fluoride ion standard undiluted solution" collection quantity are shown in the table below.

Standard solution concentration and "fluoride ion standard undiluted solution" collection quantity

Concentration of standard solution to be prepared (mgF^-/L)	1	2	5	10	20	50	100	200
Fluoride ion standard undiluted solution" collection quantity(mL)	0.5	1.0	2.5	5.0	10	25	50	100

(b) Preparing the 1/10 standard solution

①Collect the standard undiluted solution. ……Using a pipette, collect the necessary quantity of fluoride ion standard undiluted solution into a 500ml measuring flask. The collection quantity for $2mgF^-/L$ is 1.0mL as previously mentioned.

②Add the buffering solution. ……Add 5mL of buffering solution (pH5-AB) to the solution of ①.

③Add pure water. ……Make the total quantity 500mL by adding pure water to the solution of ②.

④Stir ……Thoroughly mix the solution of ③ and transfer it to a beaker.

(c) Preparing the span standard solution

①Collect the standard undiluted solution. ·····Using a pipette, collect the necessary quantity of fluoride ion standard undiluted solution into a 500ml measuring flask. The collection quantity for 20mgF-/L is 1.0mL as previously mentioned.

②Add the buffering solution. ·····Add 5mL of buffering solution (pH5-AB) to the solution of ①.

③Add pure water. ·····Make the total quantity 500mL by adding pure water to the solution of ②.

④Stir ·····Thoroughly mix the solution of ③ and transfer it to a beaker.

(d) Preparing the fluoride ion standard undiluted solution

①Dry special class sodium fluoride. ·····Dry a suitable amount of special class sodium fluoride (NaF, molecular weight 41.99) at 110°C for 2 to 3 hours.

②Cool in the open. ·····Place the reagent of ① in a desiccant and cool it in the open.

③Use pure water to increase the quantity to 1L. ·····Measure 2.210g of the reagent of ② and make it 1L by adding pure water.

- The fluoride ion standard undiluted solution (1,000mgF⁻/L) is made.

(e) Preparing the pH5-AB buffering solution

①Prepare pure water. ·····Collect 600mL of pure water into a 1L beaker.

②Dissolve sodium acetate and potassium nitrate. ·····While heating the pure water of ①, add and dissolve 200g of sodium acetate (Trihydrate)(CH_3, COONa, $3H_2O$) and 100g of potassium nitrate (KNO_3).

⚠WARNING

Hazardous substances

- Wear protective gear when handling the calcium nitrate and sodium nitrate used to manufacture the PH5-AB buffering solution. Also always check the Material Safety Data Sheet (MSDS).

③Add acetic acid. ·····When completely dissolved, add 37mL of acetic acid (CH_3COOH).

④Use pure water to increase the quantity to 1L. ·····Add pure water to the solution of ③ to make it 1L.

2.3 Stopping Operation

(1) Stopping operation for a short time

(a) To stop operation for an interval short enough that there is no danger of the electrode getting dirty, for instance 1 to 3 days, turn off the product power switch.

(b) When stopping operation of only the sensor with wash function (option), turn off the wash function at the product side. In addition, when the product is combined with a built-in timer type sensor with wash function, turn off the power switch of the sensor with wash function.
⇨ 3.3(7) "Changing the wash control function"

(2) Stopping operation for a long time

When stopping operation for other than a short time, perform the following operations:

①**Maintenance preparations**····· After referring to 4.3(2) "Removing the sensor" and turning off the power supply to the monitor, pull up the sensor from the measurement point and wash the sensor.

- When the product is combined with a built-in timer type sensor with wash function, turn off the power switch of the sensor with wash function.

②**Wash the sensor.** ····· Pull up the sensor, including the electrode holder, from the sample and wash the sensor.

③**Install a junction cap.** ····· Install a junction cap to the tip of the electrode so that the electrode will not get dry.

【IMPORTANT】 • Do not dry the junction at the tip of the electrode.

〔NOTE〕 • The junction cap prevents the liquid part from drying.

• When the junction cap is not installed, or when there is no danger of the electrode getting dirty, immerse the electrode in pure water.

④**Store the product.** ····· Disconnect the piping and wiring and store the product away from direct sunlight.

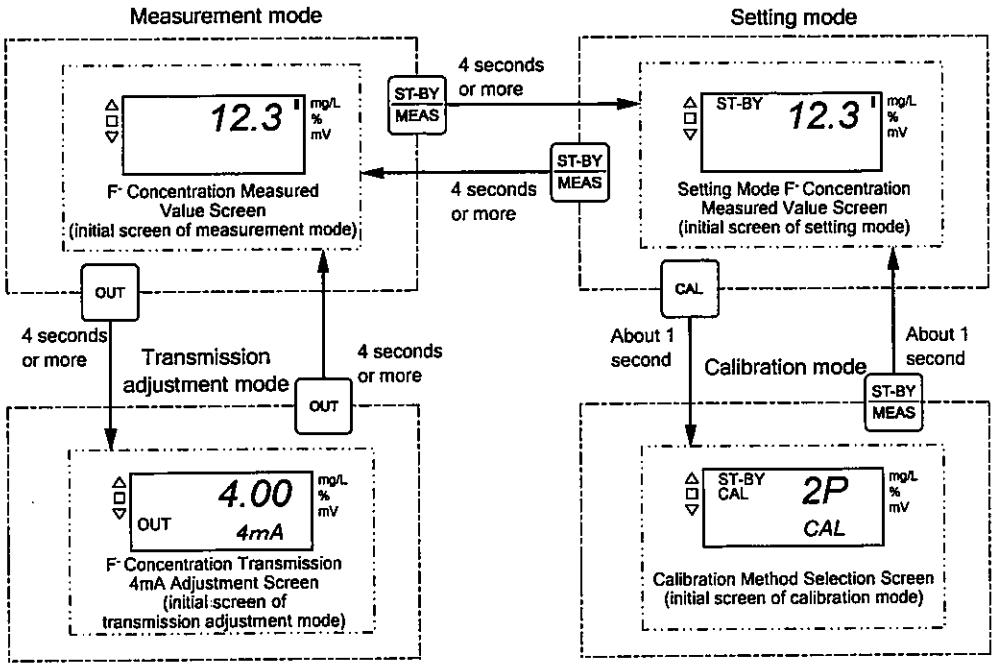
〔NOTE〕 • When restarting operation, proceed in accordance with 2.1 "Operation Start Procedure".

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 4 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). For example the setting mode is when the standby indicator lights. Note that during wash operation the standby indicator lights even in the measurement mode.

Indicator and the Current Mode

Mode name	Standby indicator (ST-BY)
Measurement mode	Unlit (lit during wash)
Setting mode or Calibration mode	Lit

(c) As shown in the diagram "Mode Switching," the mode can be changed by pressing ST-BY/MEAS for 4 seconds or more.

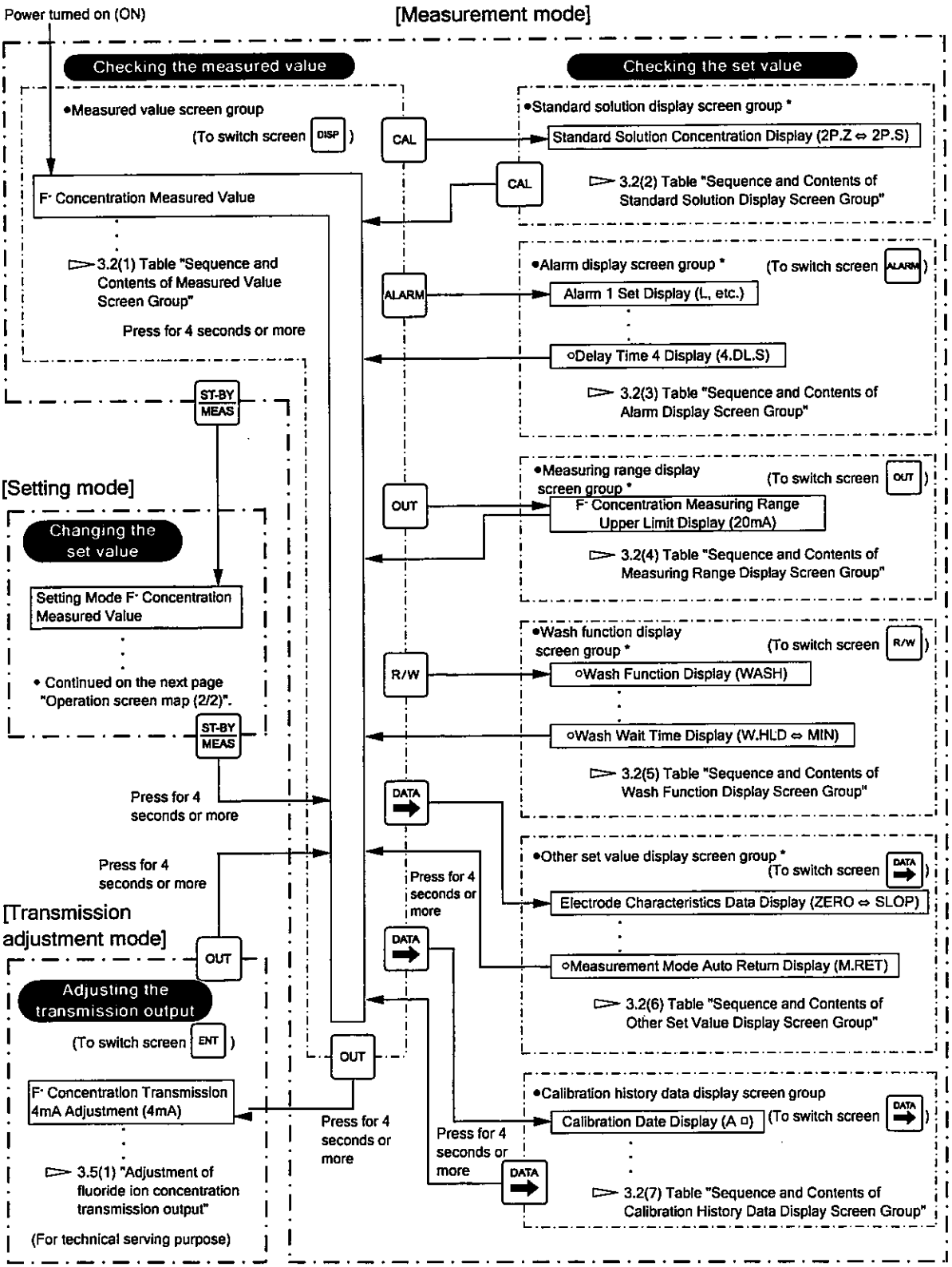
(d) When the mode is changed, the initial screen of the changed mode appears.

(e) When the monitor enters the setting mode or calibration mode or automatic wash, the fluoride ion concentration measured value output (terminals 70 and 71) automatically become "Hold" type displayed on the "Hold Display" screen (HOLD).

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

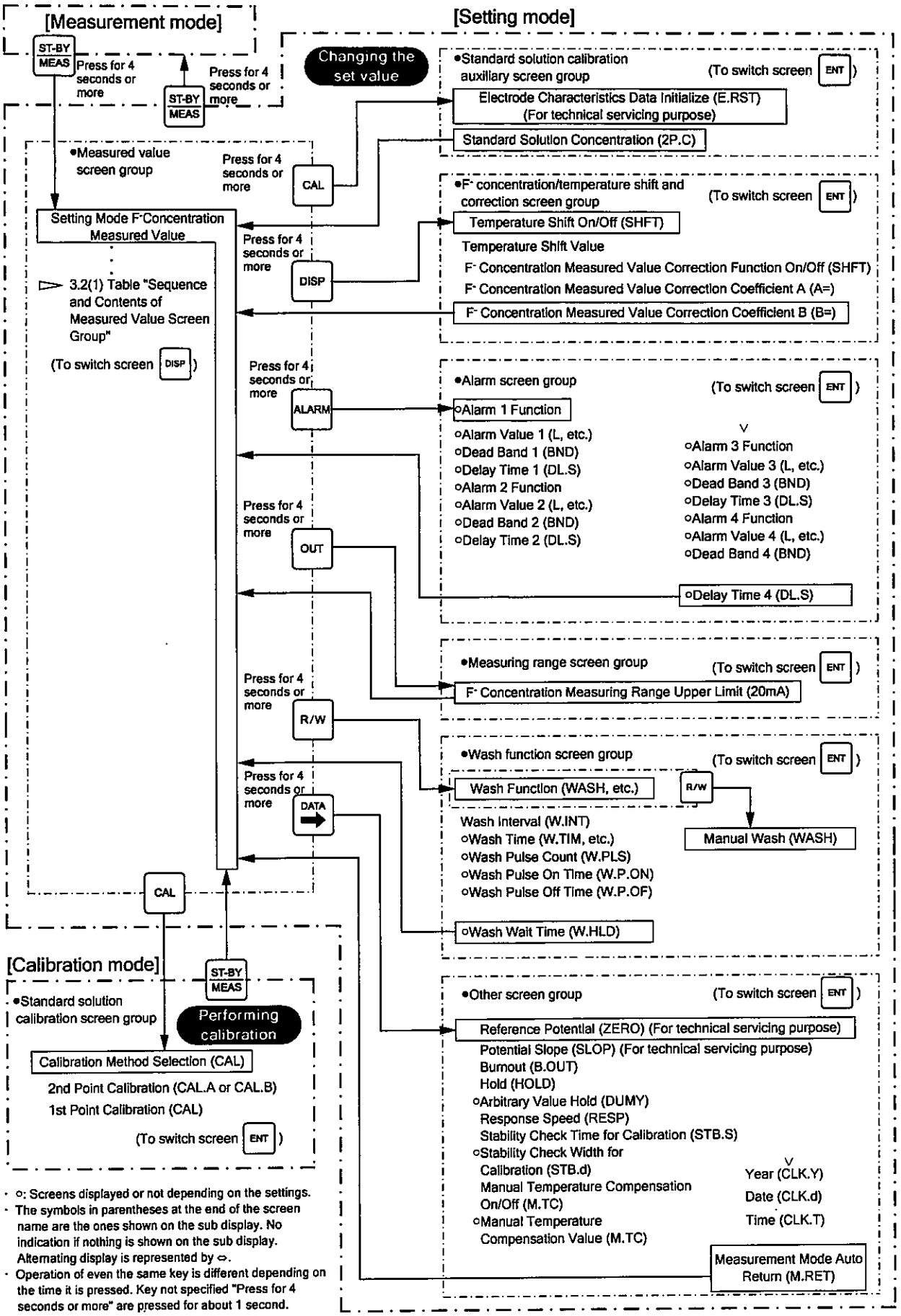
(g) If a specified key is pressed (such as DISP), that corresponds to each group in the measurement mode or in the setting mode, the screen goes to that group.

(2) Operation screen map



- ○: Screens displayed or not depending on the settings.
- *: When displayed for 20 seconds, the screen returns to the "F⁻ Concentration Measured Value" screen. When there is an * at the group name, all the screens in that group are the objective.
- 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. Alternating display is represented by ⇔.
- Operation of even the same key is different depending on the time it is pressed. Key not specified "Press for 4 seconds or more" are pressed for about 1 second.

Operation Screen Map (1/2)



- ○: Screens displayed or not depending on the settings.
- 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. Alternating display is represented by ⇔.
- Operation of even the same key is different depending on the time it is pressed. Key not specified "Press for 4 seconds or more" are pressed for about 1 second.

Operation Screen Map (2/2)

3.2 Measurement Mode Operation

(1) Measured value screen selection and operation display

(a) The screens shown in the table below are provided in the measured value screen group. Each time DISP is pressed, the fluoride ion concentration measured value, temperature measured value, and other desired screens can be checked. These screens are used in normal measurement state.

[NOTE] • The measured value screen group can be checked even in the setting mode ("ST-BY" lit), the same as the measurement mode.

(b) When power is turned on, the "F⁻ Concentration Measured Value" screen, the initial screen of this group, appears. This screen appears when the screen returns from the display screen group of the measurement mode or from the setting mode.

(c) Twenty seconds after displaying the "Temperature Measured Value" screen (M.TC, etc.), "Electrode Potential" screen (EMF), "Clock" screen (Year⇔Date), and "F⁻ Concentration Measured Value Correction Coefficient" screen (A=⇔B=), the screen automatically returns to the "F⁻ Concentration Measured Value" screen.

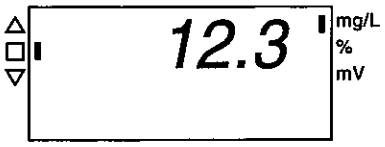
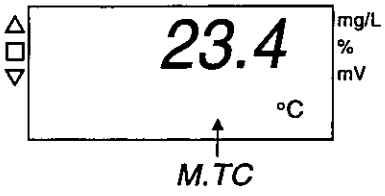
(d) The fluoride ion concentration measured value output is unrelated to the displayed screen and is corresponded to the fluoride ion concentration measured value.

(e) In the measured value screen group, the operation display by wash control function and alarm function can be checked at the screen. ⇨ Following table "Operation Display Screens in Measured Value Screen Group by Wash Control Function and Alarm Function"

(f) When the fluoride ion concentration measured value goes outside the alarm 1 to 4 upper limit alarm (H) or lower limit alarm (L) alarm value, an alarm is generated and the alarm operation display appears the screen as shown below. When the ion concentration value returns to within the alarm value, this alarm operation display goes off.

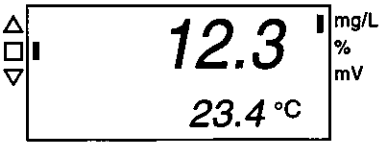
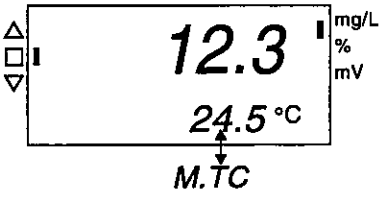
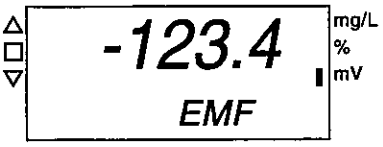
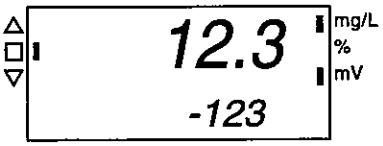
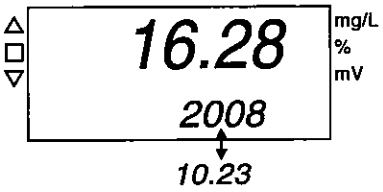
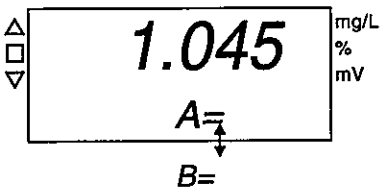
- Alarms 1 and 2..... ALARM1 and ALARM2 blink at each screen of the measured value screen group.
- Alarms 3 and 4..... ALARM3 and ALARM4 blink at the "F⁻ Concentration Measured Value" screen of the measured value screen group.

Sequence and Contents of Measured Value Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: DISP)
①	F⁻ Concentration Measured Value Screen		• Main display ... Fluoride ion concentration measured value
②	Temperature Measured Value Screen		• Main display ... Temperature measured value • Sub display ... Displays "M.TC" for manual temperature compensation. • Returns to the "F⁻ Concentration Measured Value" screen approximately after 20 seconds.

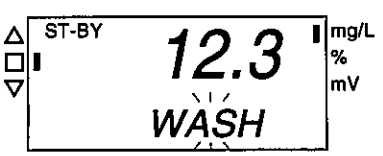
(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
③	F^- Concentration and Temperature Screen		• Main display ... Fluoride ion concentration measured value • Sub display ... Temperature measured value ("Temperature measured value" and "M.TC" are displayed alternately for manual temperature compensation.)
	Manual temperature compensation		
④	Electrode Potential Screen		• Main display ... Electrode potential • Sub display ... "EMF" • Returns to the "F^- Concentration Measured Value" screen approximately after 20 seconds.
⑤	F^- Concentration and Electrode Potential Screen		• Main display ... Fluoride ion concentration measured value • Sub display ... Electrode potential
⑥	Clock Screen		• Main display ... Time (decimal point blinks) • Sub display ... Year and date are displayed alternately. • Returns to the "F^- Concentration Measured Value" screen approximately after 20 seconds.
⑦	○F^- Concentration Measured Value Correction Coefficient Screen		• Main display ... Correction coefficient A (slope) or correction coefficient B (cutoff) • Sub display ..."A=" and "B=" are displayed alternately. • Not displayed when the measured value correction coefficient function is off (invalid). • Returns to the "F^- Concentration Measured Value" screen approximately after 20 seconds.
	Returns to step ①.		

○: Screens displayed or not depending on the settings.
• In the setting mode, "ST-BY" lights at each of the screens above.

Operation Display Screens in Measured Value Screen Group by Wash Control Function and Alarm Function

No.	Screen name	Screen example	Contents
	* (Wash control function (valid) wash-in-progress screen)		
	○"F^- Concentration Measured Value" screen, etc.		• Main display ... Fluoride ion concentration measured value • Sub display ... Blinking of "WASH" shows that the washing operation is being performed. When wash ends, "WASH" goes off and the screen returns to the "F^- Concentration Measured Value" screen.

(To be continued)

(Continued from previous page)

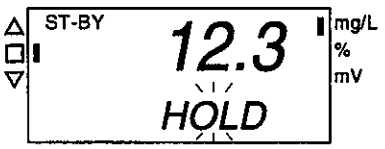
No.	Screen name	Screen example	Contents

〔NOTE〕 •To stop automatic wash, press [ST-BY/MEAS] for about 1 second. Washing operation stops and the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.

【IMPORTANT】 • Automatic wash can also be stopped by pressing [ST-BY/MEAS] for 4 seconds or more. However, for a chemical wash type sensor, switching to the measurement mode may cause the measured value immediately after washing is stopped to be abnormal.

*Wash control function (invalid) screen external holding

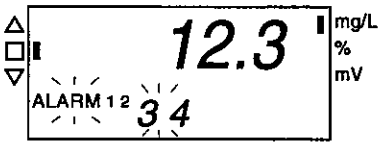
○"F⁻ Concentration Measured Value" screen, etc.



- Main display ... Fluoride ion concentration measured value
- Sub display ... Blinking of "HOLD" shows that transmission output is being held by hold command signal from the outside. At the end of external hold, "HOLD" goes off and the screen returns to the "F⁻ Concentration Measured Value" screen.

*(Upper/lower limit alarm operation indication by alarm function screen)

○"F⁻ Concentration Measured Value" screen, etc.



- Main display ... Fluoride ion concentration measured value
- Sub display ... Blinking of "ALARM1" to "ALARM4" shows that the corresponding alarm was generated.

○: Screens displayed or not depending on the settings.

(2) Checking standard solution for calibration

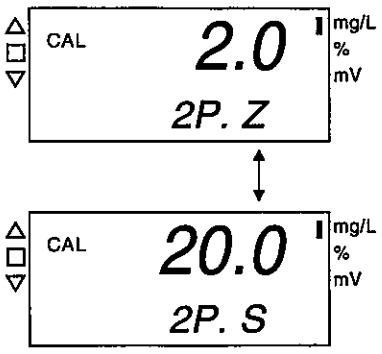
(a)The standard solution display screen group contains only "Standard Solution Display" screen (2P.Z⇔2P.S). The two types of standard solutions set for 2-point calibration can be checked.

(b)Pressing [CAL] in the measurement mode selects this screen and pressing the same key again brings you back to the "F⁻ Concentration Measured Value" screen.

(c)The screen automatically returns to "F⁻ Concentration Measured Value" screen 20 seconds after it is displayed.

(d)The set values of this screen can be changed using the "Standard Solution Concentration" screen (2P.C) of the standard solution calibration auxiliary screen group in the setting mode. ▷ 3.3(2) "Changing the standard solution concentration"

Sequence and Contents of Standard Solution Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: CAL)
①	Standard Solution Concentration Display Screen 1/10 standard solution concentration Span standard solution concentration		• Main display ... Displays concentration of the set fluoride ion concentration standard solution. • When 2P.Z is indicated on the sub display, the main display shows the 1st point standard solution concentration. • When 2P.S is indicated on the sub display, the main display shows the 2nd point standard solution concentration. • 1st point standard solution has a 1/10 concentration of 2nd point standard solution. • "CAL" lights.
	Returns to the "F⁻ Concentration Measured Value" screen.		

(3) Alarm check

(a) The settings for alarms 1 to 4 can be checked at the alarm display screen group.

(b) Pressing ALARM in the measurement mode enters this group and pressing the same key again changes to the next screen. Pressing the same key while the last screen of this group is displayed exits this group and brings you back to the "F⁻ Concentration Measured Value" screen.

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

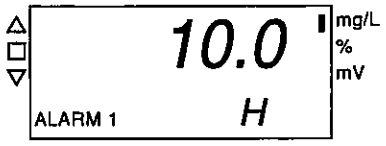
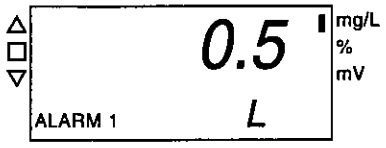
(d) The set values of these screens can be changed using the screens of the alarm screen group in the setting mode.
⇨ 3.3(5) "Changing the alarm settings"

(e) The alarm set-point is an fluoride ion concentration where the alarm function works and an alarm condition is activated. When the dead band is zero, if the measured value exceeds this value, an alarm condition will be activated.

(f) The dead band is the range of fluoride ion concentration used to slow down the timing to go into an alarm condition.
⇨ 3.3(5) "Changing the alarm settings"

(g) A "Wash-in-progress" signal, "Maintenance-in-progress" signal, and abnormal signal, in addition to upper/lower limit alarm signal, can be output by the signal contact output function by using alarm output terminals. The state of the set signal contact outputs can be checked at the "Alarm 1 Display" screen to "Alarm 4 Display" screen.

Sequence and Contents of Alarm Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: ALARM)
①	Alarm 1 Display Screen		• Main display ... Set condition of Alarm 1 oFF (Off): Alarm 1 is invalid (factory setting). Main display when sub display is H (High) or L (Low): Alarm 1 set value C1 (Contact 1) to C3 (Contact 3): When the signal contact output function is selected.
	Alarm 1 off		
	Alarm 1 upper limit alarm		• Sub display ... Alarm 1 upper/lower limit alarm, or signal contact output indication H (High): Upper limit alarm L (Low): Lower limit alarm (factory setting) WSH(Wash): Wash-in-progress signal MNT (Maintenance): Maintenance-in-progress signal ABN (Abnormal): Abnormal signal
	Alarm 1 lower limit alarm		
	Wash-in-progress signal		• "ALARM 1" lights.
	Maintenance-in-progress signal		* When the main display is set to oFF, the 5 screens from sub display H to ABN are not displayed.
	Abnormal signal		
②	○ Dead Band 1 Display Screen		• Main display ... Dead band 0 (%FS) • Factory setting ... 0 (%FS) • "ALARM 1" lights. * Displayed when the sub display at step ① is H or L.
③	○ Delay Time 1 Display Screen		• Main display ... Delay time (s) • Factory setting ... 0 (s) • "ALARM 1" lights. * Displayed when the sub display at step ① is H or L.

(To be continued)

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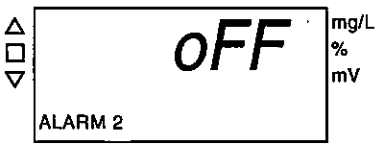
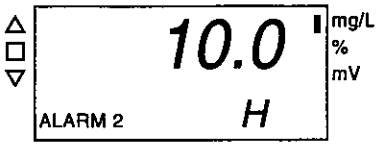
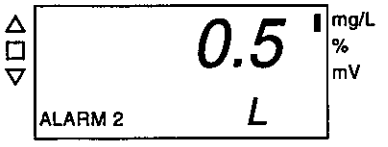
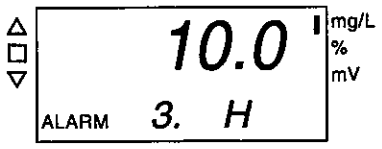
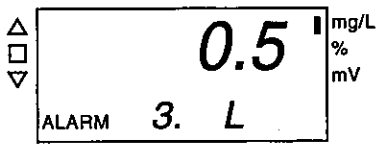
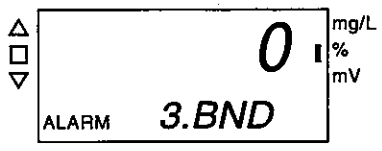
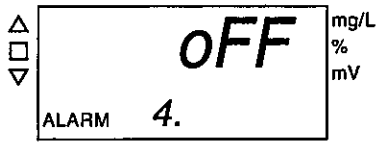
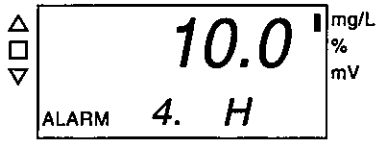
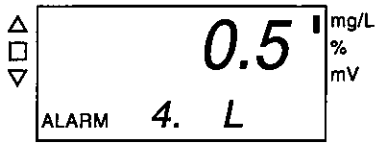
No.	Screen name	Screen example	Contents
④	Alarm 2 Display Screen Alarm 2 off		• Main display ... Set condition of Alarm 2 oFF (Off): Alarm 2 is invalid (factory setting). Main display when sub display is H (High) or L (Low): Alarm 2 set value C1 (Contact 1) to C3 (Contact 3): When the signal contact output function is selected.
	Alarm 2 upper limit alarm		• Sub display ... Alarm 2 upper/lower limit alarm, or signal contact output indication H (High): Upper limit alarm (factory setting) L (Low): Lower limit alarm WSH (Wash): Wash-in-progress signal MNT (Maintenance): Maintenance-in-progress signal ABN (Abnormal): Abnormal signal
	Alarm 2 lower limit alarm		
	Wash-in-progress signal		• "ALARM 2" lights.
	Maintenance-in-progress signal		* When the main display is set to oFF, the 5 screens from sub display H to ABN are not displayed.
	Abnormal signal		
⑤	○Dead Band 2 Display Screen		• Main display ... Dead band 0 (%FS) • Factory setting ... 0 (%FS) • "ALARM2" lights. * Displayed when the sub display at step ④ is H or L.
⑥	○Delay Time 2 Display Screen		• Main display ... Delay time (s) • Factory setting ... 0 (s) • "ALARM 2" lights. * Displayed when the sub display at step ④ is H or L.

(To be continued)

(Continued from previous page)

No.	Screen name	Screen example	Contents
⑦	Alarm 3 Display Screen Alarm 3 off		• Main display ... Set condition of Alarm 3 oFF: Alarm 3 is invalid (factory setting). Main display when sub display is 3.H (High) or 3.L (Low): Alarm 3 set value C1 (Contact 1) to C3 (Contact 3): When the signal contact output function is selected. • Sub display ... Alarm 3 upper/lower limit alarm, or signal contact output indication 3.H (High): Upper limit alarm (factory setting) 3.L (Low): Lower limit alarm 3.WSH (Wash): Wash-in-progress signal 3.MNT (Maintenance): Maintenance-in-progress signal 3.ABN (Abnormal): Abnormal signal • "ALARM " lights. * When the main display is set to oFF, the 5 screens from sub display 3.H to 3.ABN are not displayed.
	Alarm 3 upper limit alarm		
	Alarm 3 lower limit alarm		
	Wash-in-progress signal		
	Maintenance-in-progress signal		
	Abnormal signal		
⑧	○Dead Band 3 Display Screen		• Main display ... Dead band 0 (%FS) • Factory setting ... 0 (%FS) • "ALARM" lights. * Displayed when the sub display at step ⑦ is 3.H or 3.L.
⑨	○Delay Time 3 Display Screen		• Main display ... Delay time (s) • Factory setting ... 0 (s) • "ALARM" lights. * Displayed when the sub display at step ⑦ is 3.H or 3.L.
⑩	Alarm 4 Display Screen Alarm 4 off		• Main display ... Set condition of Alarm 4 oFF: Alarm 4 is invalid (factory setting). Main display when sub display is 4.H (High) or 4.L (Low): Alarm 4 set value C1 (Contact 1) to C3 (Contact 3): When the signal contact output function is selected. • Sub display ... Alarm 4 upper/lower limit alarm, or signal contact output indication 4.H (High): Upper limit alarm (factory setting) 4.L (Low): Lower limit alarm 4.WSH (Wash): Wash-in-progress signal 4.MNT (Maintenance): Maintenance-in-progress signal 4.ABN (Abnormal): Abnormal signal
	Alarm 4 upper limit alarm		
	Alarm 4 lower limit alarm		

(To be continued)

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No.	Screen name	Screen example	Contents
	Wash-in-progress signal	C1 mg/L % mV ALARM 4. WSH	• "ALARM" lights. *When the main display is set to oFF, the 5 screens from sub display 4.H to 4.ABN are not displayed.
	Maintenance-in-progress signal	C2 mg/L % mV ALARM 4. MNT	
	Abnormal signal	C3 mg/L % mV ALARM 4. ABN	
⑪	○Dead Band 4 Display Screen	0 mg/L % mV ALARM 4. BND	• Main display ... Dead band 0 (%FS) • Factory setting ... 0 (%FS) • "ALARM" lights. * Displayed when the sub display at step ⑩ is 4.H or 4.L.
⑫	○Delay Time 4 Display Screen	0 mg/L % mV ALARM 4. DL.S	• Main display ... Delay time (s) • Factory setting ... 0 (s) • "ALARM" lights. * Displayed when the sub display at step ⑩ is 4.H or 4.L.
	Returns to the "F^- Concentration Measured Value" screen.		

○: Depending on the settings, screens may be displayed or hidden.

(4) Checking the fluoride ion concentration measuring range

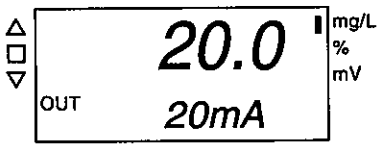
(a) The measuring range display screen group contains the screens shown in the following table. The upper limit of the fluoride ion concentration measuring range can be checked.

(b) Pressing [OUT] in the measurement mode enters this group and pressing the same key again changes to the next screen. Pressing the same key while the last screen of this group is displayed exits this group and brings you back to the "F^- Concentration Measured Value" screen.

(c) Any screen in this group returns automatically to the "F^- Concentration Measured Value" screen 20 seconds after it is displayed.

(d) The set values of these screens can be changed by using the screens of the measuring range screen group in the setting mode.
⊳ 3.3(6) "Changing the fluoride ion concentration measuring range (measured value output range)"

Sequence and Contents of Measuring Range Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: OUT)
①	F^- Concentration Measuring Range Upper Limit Display Screen		• Main display ···· Set fluoride ion concentration measuring range upper limit (when transmission output is 20mA) • Corresponds to the measured value output terminals 70 and 71. • Factory setting ... 20.0 (mg/L, etc.)
	Returns to the "F^- Concentration Measured Value" screen.		

(5) Checking the wash control function

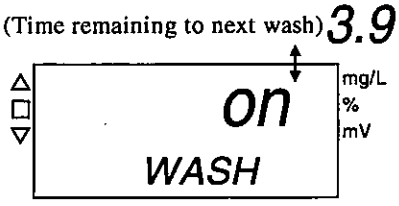
(a) When a sensor with wash function (option) combined with this product is controlled, each set value related to the wash control function can be checked at the wash control display screens shown in the table below. The combined sensor with wash function (option) may use a general water jet or other wash system or a pulse air jet wash system (washes the electrode by creating a high-speed water flow by suddenly expanding compressed air in the sample).

(b) Pressing R/W in the measurement mode enters this group and pressing the same key again changes to the next screen. Pressing the same key while the last screen of this group is displayed exits this group and brings you back to the "F^- Concentration Measured Value" screen.

(c) Any screen in this group returns automatically to the "F^- Concentration Measured Value" screen 20 seconds after it is displayed.

(d) The set values of these screens can be changed using the screens of the wash function screen group in the setting mode. ⇨ 3.3(7) "Changing the wash control function"

Sequence and Contents of Wash Function Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: R/W)
①	Wash Function Display Screen Wash control function off		• Main display ... Symbol indicating the set wash control function • oFF (Off) ···· Wash control function is invalid (factory setting)
	Wash control function on (water jet, etc. wash)		on (On): Wash control function for sensor with water jet and other wash function is valid. P.on (Pulse on): Wash control function for sensor with pulse air jet wash function is valid. * When "oFF", the screen of ② and subsequent screens are not displayed. • When "on" or "P.on", displayed alternately with time (h) remaining to next wash.

(To be continued)

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No.	Screen name	Screen example	Contents
		(Time remaining to next wash) 3.9 P.on WASH mg/L %mV	
	Wash control function on (pulse air jet wash function)		
②	○ Wash Interval Display Screen	1.0 W.INT HOUR mg/L %mV	• Main display ... Set wash interval time (h) • Factory setting ... 1.0 (h) * Displayed when the main display at ① is "on" or "P.on".
③	○ Wash Time Display Screen	60 W.TIM SEC mg/L %mV	• Main display ... Set wash time (min) • Factory setting ... 60 (s) * Displayed when the main display at ① is "on".
④	○ Wash Pulse Count Display Screen	1 W.PLS PLS mg/L %mV	• Main display ... The number of times air jet is discharged (pulse count) • Factory setting ... 1 (times) * Displayed when the main display at ① is "P.on".
⑤	○ Wash Pulse On Time Display Screen	0.3 W.P.ON SEC mg/L %mV	• Main display ... Solenoid valve open time during pulse air jet wash (s) • Factory setting ... 0.3 (s) * Displayed when the main display at ① is "P.on".
⑥	○ Wash Pulse Off Time Display Screen	1.7 W.P.OF SEC mg/L %mV	• Main display ... Solenoid valve closed time during pulse air jet wash (s) • Factory setting ... 1.7 (s) * Displayed when the main display at ① is "P.on".
⑦	○ Wash Wait Time Display Screen	1.0 W.HLD MIN mg/L %mV	• Main display ... Set hold time after wash (min) • Factory setting ... 1.0 (min) * Displayed when the main display at ① is "on" or "P.on".
	Returns to the "F^- Concentration Measured Value" screen.		

○: Depending on the settings, screens may be displayed or hidden.

(6) Checking other set values

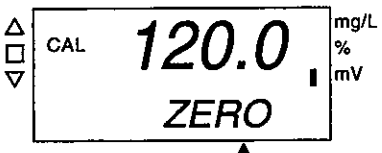
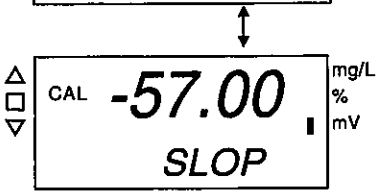
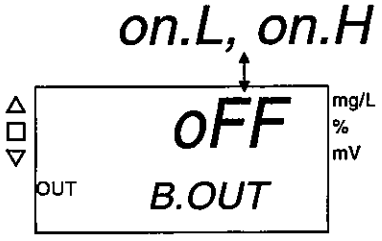
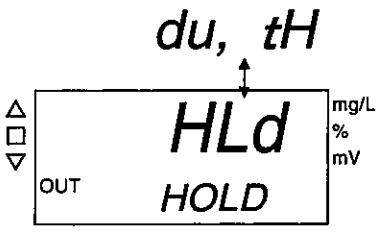
(a) The screens shown in the table below are provided in the other set value display screen group. Electrode characteristics data (represents the reference potential and potential slope) and other values and set contents can be checked.

(b) Pressing DATA/→ in the measurement mode enters this group and pressing the same key again changes to the next screen. Pressing the same key while the last screen of this group is displayed exits this group and brings you back to the "F^- Concentration Measured Value" screen.

(c) Any screen in this group returns automatically to the "F^- Concentration Measured Value" screen 20 seconds after it is displayed.

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

Sequence and Contents of Other Set Value Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen: DATA/→)
①	Electrode Characteristics Data Display Screen Reference potential		• Main display ... Reference potential: Electrode characteristic. Potential at isothermal intersection or full scale 1/10 concentration. • Factory setting ... 120.0 (mV)
	Potential slope		• Main display ... Potential slope: Electrode characteristic. Potential difference when fluoride ion concentration was increased 10 times. • Factory setting ... -57.00 (mV/decade) • Both are automatically rewritten during standard solution calibration. • To change... ⇨ 3.3(9) "Changing the electrode characteristics data"
②	○Burnout Display Screen		• Main display ... Selection of burnout function and direction of burnout swing-off. oFF (Off): Burnout function is invalid. on, L (On, Low): Transmission output is set to 3.8mA when an error occurs. on, H (On, High): Transmission output is set to 21mA when an error occurs. • Factory setting ... oFF (not displayed) • To change ... ⇨ 3.3(10) "Burnout changing"
③	Hold Display Screen		• Main display ... Symbol showing that hold is necessary in the set setting mode. HLd: Outputs the output value immediately before the mode is changed to the setting mode (factory setting). du: Outputs an arbitrary set output value (%). tH: The current fluoride ion concentration measured value and temperature measured value are not held, but are output as is, in the same way as in the measurement mode. • To change ... ⇨ 3.3(11) "Changing the hold output"

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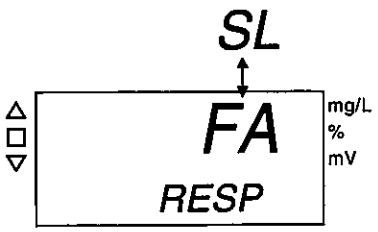
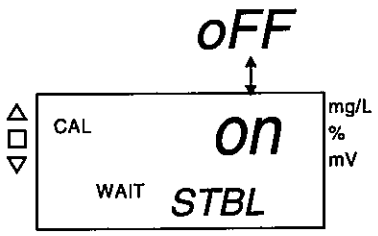
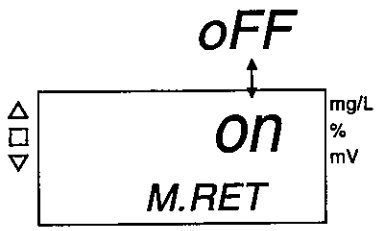
No.	Screen name	Screen example	Contents
④	○Arbitrary Value Hold Display Screen		• Main display ... Set arbitrary value (%). Percentage (%) of measuring range. • Factory setting ... 0 (%) • To change ... ▻ 3.3(11) "Changing the hold output" * Displayed when the main display at step ③ is "du".
⑤	Response Speed Display Screen		• Main display ... Symbol indicating the response speed FA (Fast): Response speed is fast (factory setting). SL (Slow): Response speed is slow. • To change ... ▻ 3.3(12) "Changing the response speed"
⑥	Calibration Stability Check Display Screen		• Main display ...Selection of stability check at the time of set fluoride ion concentration calibration on: Stability check is valid (factory setting). oFF: Stability check is invalid. • To change ... ▻3.3(13) "Changing the stability check for calibration conditions" * When a value of "1"or more is set at the "Stability check time for calibration" screen(STB. S) of "3.3(14)", this screen is turned on and when "0" is set, this screen is turned off.
⑦	○Measurement Mode Auto Return Display Screen		• Main display ... Selection of set measurement mode automatic return function on: Automatic return is valid (factory setting). oFF: Automatic return is invalid. • To change ... ▻ 3.3(16) "Changing measurement mode automatic return"

Returns to the "F⁻ Concentration Measured Value" screen.

○: Depending on the settings, screens may be displayed or hidden.

(7) Reading the calibration history data

(a)The calibration history data contains 8 items from A to L. Each of these items is assigned 10 data numbers from 0 to 9. The contents of data items A to L are shown in the table below. The data number shows the calibration data time series, with 0 being the newest data.

(b)If DATA/→ is pressed for 4 seconds or more in the measurement mode, this group appears and if the same key is then pressed 1 time (about 1 second), the next screen (next data item) is displayed. If DATA/→ is pressed for 4 seconds or more in this group, the screen returns to the "F⁻ Concentration Measured Value" screen.

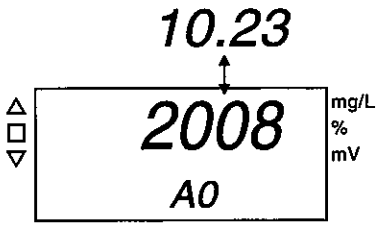
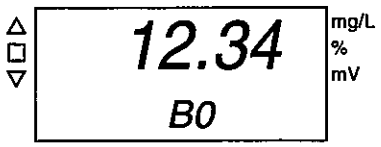
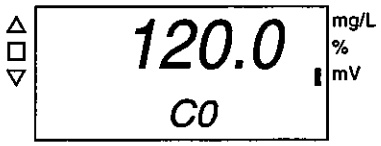
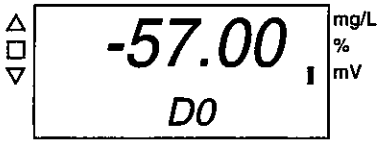
(c)The calibration history data display screen group contains the screens shown in the table below. The standard solution calibration data for up to 10 calibrations can be read. Checking the trend of change of the calibration data is a criteria for estimating the electrode replacement timing and deciding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

[NOTE] • If the date and time (clock setting) are not correctly set, the correct date or time will not be recorded.

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 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□	Reference potential	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9
	D□	Potential slope	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9
	E□	1/10 standard solution concentration	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9
	F□	Electrode potential at 1/10 calibration	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9
	G□	Temperature at 1/10 calibration	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9
	H□	Required time at 1/10 calibration	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
	I□	Standard solution concentration	I0	I1	I2	I3	I4	I5	I6	I7	I8	I9
	J□	Electrode potential at calibration	J0	J1	J2	J3	J4	J5	J6	J7	J8	J9
	K□	Temperature at calibration	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9
	L□	Required time at calibration	L0	L1	L2	L3	L4	L5	L6	L7	L8	L9

Sequence and Contents of Calibration History Data Display Screen Group

No.	Screen name	Screen example	Contents
			(To switch screen (data item): DATA/→)
①	Calibration Date Display Screen		• Main display ... Calibration 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 Screen		• 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	Reference Potential Display Screen		• Main display ... Reference potential (mV) history • Sub display ... C0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
④	Potential Slope Display Screen		• Main display ... Potential slope (mV/decade) history • Sub display ... D0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.

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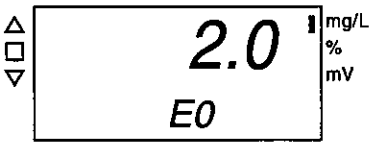
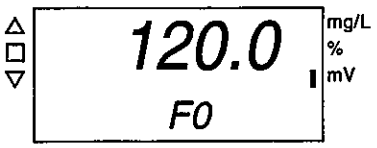
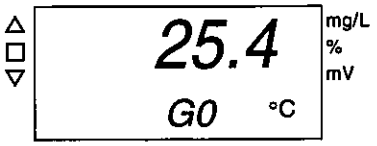
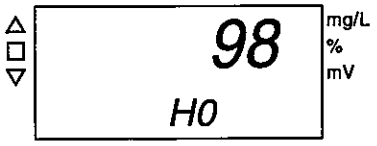
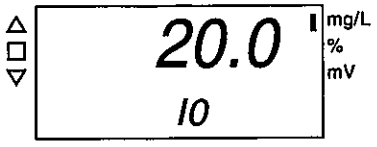
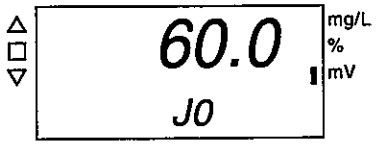
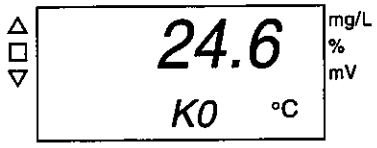
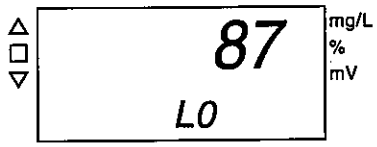
No.	Screen name	Screen example	Contents
⑤	1/10 Standard Solution Concentration		• Main display ... 1/10 standard solution concentration (mg/L) history • Sub display ... E0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑥	Electrode Potential at 1/10 Calibration		• Main display ... History of electrode potential (mV) at 1/10 calibration • Sub display ... F0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑦	Temperature at 1/10 Calibration		• Main display ... History of temperature (°C) at 1/10 calibration • Sub display ... G0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑧	Required Time at 1/10 Calibration		• Main display ... History of required time (s) at 1/10 calibration • Sub display ... H0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑨	Standard Solution Concentration		• Main display ... Standard solution concentration (mg/L) history • Sub display ... I0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑩	Electrode Potential at Calibration		• Main display ... History of electrode potential (mV) at calibration • Sub display ... J0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑪	Temperature at Calibration		• Main display ... History of temperature (°C) at calibration • Sub display ... K0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.
⑫	Required Time at Calibration		• Main display ... History of required time (s) at calibration • Sub display ... L0 (Newest data No.) • Switched to the last data No. using ↑ and switched to the next data No. using ↓.

(When DATA/→ is pressed for 4 seconds or more, the screen returns to the "F⁻ Concentration Measured Value" screen.

3.3 Setting Mode Operation

(1) Initializing electrode characteristics data

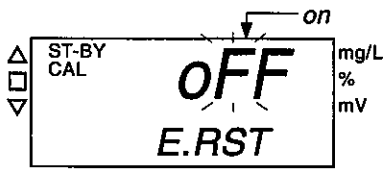
(a) The electrode characteristics data (representing the reference potential and potential slope) written by standard solution calibration can be initialized (returned to the factory setting). This function is used when checking monitor operation by equivalent input.

(b) This function is for technical service. Do not perform this function unless absolutely necessary.

【IMPORTANT】 • If initialization is performed even though it is not necessary, an appropriate measured value will not be obtained.

(c) When the electrode characteristics data was initialized as needed, always perform standard solution calibration. In addition, when standard solution calibration cannot be performed, the electrode characteristics data immediately before initialization can be written down and that value set. ▷ 3.2(6) "Checking other set values", 3.3(9) "Changing the electrode characteristics data"

Procedure for Initializing Electrode Characteristics Data

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Electrode Characteristics Data Initialize" screen. ..... 	When CAL is pressed for 4 seconds or more in the setting mode, the standard solution calibration auxiliary screen group appears. • Sub display becomes "E.RST". • Main display ... Set electrode characteristics data initialization function oFF ... Do not initialize on ... Initialize
③Initialize the electrode characteristics data.	Select on (on) at the main display using ↑ or ↓, and press ENT. • When on is selected, the next screen is displayed after initialization. • When off is selected and ENT is pressed repeatedly, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.....	Press ST-BY/MEAS for 4 seconds or more.

(2) Changing the standard solution concentration

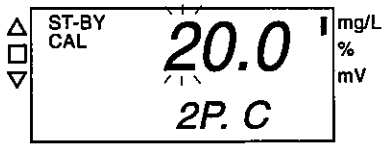
(a) The concentration of the standard solution used in 2-point calibration can be changed.

(b) Ordinarily, 2-point calibration is performed using a measuring range (measured value output range) full scale value span standard solution and a 1/10 full scale standard solution. Because the 1/10 standard solution has a concentration of 1/10 that of the span standard solution, set only the span standard solution concentration at this screen.

【IMPORTANT】 • The concentration of the 1/10 standard solution does not have to be set at this screen. If it was set by mistake, correct calibration will not be performed.

(c)For 1-point calibration, the concentration of the standard solution does not have to be set at this screen because it is set each time at the start of calibration.

Procedure for Changing the Standard Solution Concentration

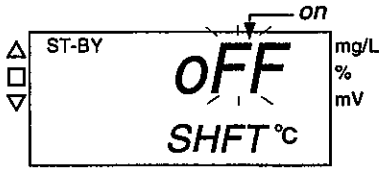
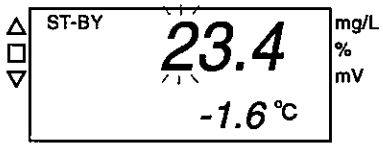
Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Standard Solution Concentration" screen. 	When [CAL] is pressed for 4 seconds or more in the setting mode, the standard solution calibration auxiliary screen group appears. • Press [ENT] until "2P.C" appears on the sub display. • Main display ... Set span standard solution concentration
③Change the span standard solution concentration.	Change the blinking number on the main display and press [ENT]. • Main display ... Set 2-point calibration use span standard solution concentration Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... Display range 1: 10.0 to 99.9 mg/L Display range 2: 100 to 999 mg/L Display range 3: 1000 to 9990 mg/L (Factory setting: Same as measuring range (measured value output range)) • After entry, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

(3) Changing temperature shift

(a)The current temperature measured value can be set to the value of other measuring instruments (standard thermometer, etc.). Change selection (valid, invalid) of this function and the value after shift (parallel shift).

(b)When the "Temperature Shift On/Off" screen (SHFT) is on (valid), compensation of the electrode EMF temperature characteristic, as well as the temperature measured value, are based on the temperature after this shift.

Procedure for Changing Temperature Shift

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Temperature Shift On/Off" screen. ..... 	When [DISP] is pressed for 4 seconds or more, the F^- concentration/temperature shift and correction screen group appears. • Sub display becomes "SHFT". • Main display ... Set temperature shift function on ... Temperature shift is valid. oFF ... Temperature shift is invalid (factory setting).
③Change the temperature shift selection.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • When on is selected, after entry, the "Temperature Shift Value" screen appears. • When off is selected, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Change the temperature shift value..... 	Change the blinking number on the main display and press [ENT]. • Sub display ... Shift value • Main display ... Temperature measured value after shift Number increment/decrement ... [↑][↓] Digit shift ... [DATA/→] Setting range ... Temperature measured value before shift ±9.9°C (factory setting: 0.0) • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
⑤Return to the "F^- concentration Measured Value" screen.....	Press [ST-BY/MEAS] for 4 seconds or more.

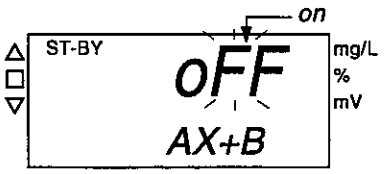
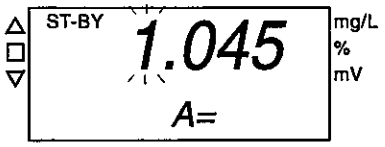
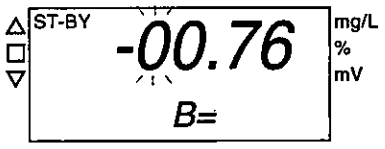
(4) Changing the calibration curve coefficient

(a) This is a correction function for matching the current fluoride ion concentration measured value to manual analysis. The coefficient of calibration curves "A" and "B" can be changed.

(b) Since all the fluorine in the sample water is not ionized due to the effect of calcium, etc., use this function when the gap between the total fluorine quantity and the free fluoride ion concentration (value measured by the monitor) has become large.

(c) At standard solution calibration, this function temporarily returns to the reference value (A=1, B=0).

Procedure for Changing the Calibration Curve Coefficient

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "F^- Concentration Measured Value Correction Function On/Off" screen. 	When [DISP] is pressed for 4 seconds or more, the F^- concentration/temperature shift and correction screen group appears. • Press [ENT] repeatedly until "AX+B" appears on the sub display. • Main display ... Set F^- concentration measured value correction function on ... Correction function is valid oFF ... Correction function is invalid (factory setting).
③Change selection of the correction function.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • When on is selected, after entry, the "F^- Concentration Measured Value Correction Coefficient A" screen appears. • When off is selected, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Change calibration curve coefficient A. 	Change the blinking number on the main display and press [ENT]. • Main display ... Calibration curve coefficient A value Number increment/decrement ... [↑][↓] Digit shift ... [DATA/→] Setting range ... 0.500 to 2.000 (factory setting: 1.000) • After entry, the "F^- Concentration Measured Value Correction Coefficient B" screen appears.
⑤Change calibration curve coefficient B. 	Change the blinking number on the main display and press [ENT]. • Main display ... Calibration curve coefficient B value Number increment/decrement ... [↑][↓] Digit shift ... [DATA/→] Setting range ... -99.99 to +99.99 (factory setting: 0.00) • After entry, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
⑥Return to the "F^- concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

(5) Changing the alarm settings

(a) The alarm function takes alarm 1 to alarm 4 alarm signals from their respective alarm output terminal. Valid/Invalid selection of this function, distinction between upper and lower limits, alarm values, and alarm dead band values can be changed.

(b)For operation of alarm function, when alarm output is set to On (valid) and L (lower limit alarm) or H (upper limit alarm) is selected and dead band is set to zero, if the fluoride ion concentration measured value exceeds the alarm value, the monitor goes to an alarmed condition. The corresponding contact signal of the alarm output terminals switches and the alarm display (ALARM1 to 4) at the measurement mode "F^- Concentration Measured Value" screen blinks. When the fluoride ion concentration measured value returns to within the alarm value, the alarm is reset.

(c)This alarm function will not be activated in any of the following conditions even if On (valid) is set.

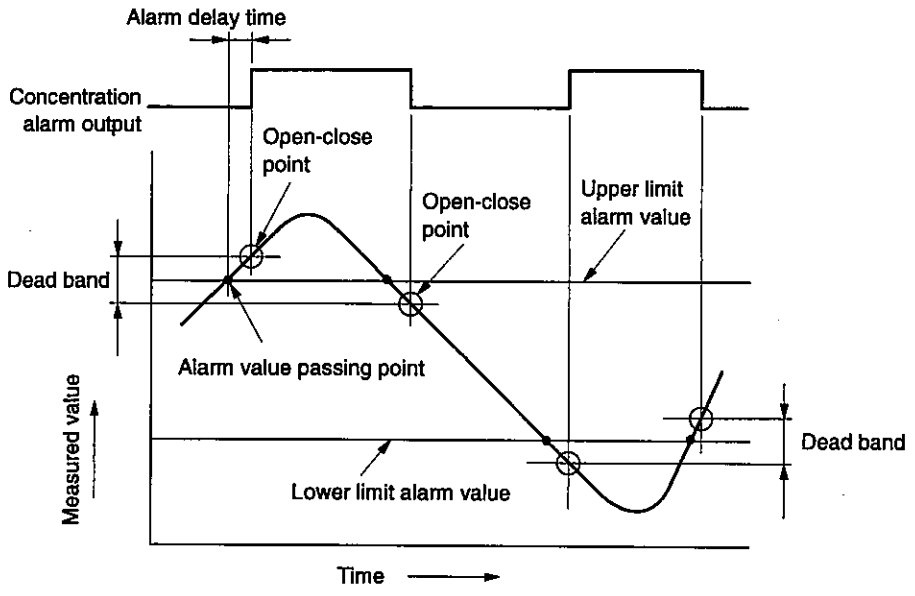
- In the setting mode.
- While the wash control function stays within the wash time or within the wait time after wash.
- At the time of power failure or power supply source is turned off.

(d)For alarm function, the timing to go into an alarm condition can be slowed down by setting a dead band value other than zero. The dead band is set by percentage (%FS) of fluoride ion concentration measuring range (measured value output range). Alarm operation when a dead band is set is as follows:

- Upper limit alarm .... When the measured value exceeds "alarm value + 1/2 dead band", an alarm is generated. When the measured value drops below "alarm value – 1/2 dead band", the alarm is reset.
- Lower limit alarm .... When the measured value drops below "alarm value – 1/2 dead band", an alarm is generated. When the measured value exceeds "alarm value + 1/2 dead band", the alarm is reset.
- When the "alarm value + 1/2 dead band" or "alarm value – 1/2 dead band" setting is outside the display range (0 to 99.9mg/L, etc.), alarm operation is performed normally because the measured value does not exceed this alarm point.

(e)The alarm state is not entered within the delay time even though the measured value exceeded the alarm point. The alarm state is entered for the first time when the measured value exceeds the alarm point even after the set delay time has elapsed. The same delay operation is performed even if the alarm is reset.

(f) When the alarm function is used to control reagent injection and the measured value changes sensitively at reagent injection and the amount of reagent consumed has increased, the alarm operation can be slowed down by making the dead band or delay time set value larger. In use, make these settings gradually larger until you find a suitable value.



Dead Band

(g)In addition to upper/lower limit alarm output, a wash-in-progress, maintenance-in-progress, and abnormal signal can be output by signal contact output function by using alarm output terminals. The kind of signal contact output can be changed at the "Alarm 1 Function" to "Alarm 4 Function" screens.

Types of Contact Signal Outputs Other than Upper/Lower Limit Output

Name	Screen display		Contents
	Main display	Sub display	
Wash-in-progress signal output	C1 (Contact 1)	WSH (Wash)	A closed contact signal is output during wash operation in the measurement mode.
Maintenance-in-progress signal output	C2 (Contact 2)	MNT (Maintenance)	In the setting mode, a closed contact signal is output.
Abnormal signal output	C3 (Contact 3)	ABN (Abnormal)	A closed contact signal is output when a memory element error (E-20), setting data error (E-21), or temperature element error (E-12) occurs.

〔NOTE〕 • An abnormal signal can also be output by using the burnout function which swings off the measured value output, in addition to the signal contact output function mentioned above. ⇨3.3(10) "Burnout changing"

(h)Each alarm output or signal contact output conforms to the alarm output terminals below.

Alarm Output Terminals

	Terminal No.	Alarm output circuit type
Alarm 1 output terminal	30, 31	Make contact (a contact)
Alarm 2 output terminal	32, 33	Make contact (a contact)
Alarm 3 output terminal	34, 35	Make contact (a contact)
Alarm 4 output terminal	36, 37	Make contact (a contact)

Procedure for Changing the Alarm Settings

Procedure and screen example	Operation
①Display the "Setting Mode F Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Alarm 1 Function" screen.	When ALARM is pressed for 4 seconds or more, the alarm screen group appears. • "ALARM1" lights.

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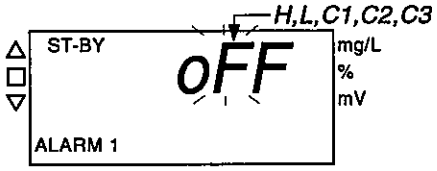
Procedure and screen example	Operation
③Change the alarm 1 function.....	Display the necessary item on the main display using ↑ or ↓ and press ENT. • Main display ... Set alarm 1 function • oFF ... Alarm 1 is invalid. (factory setting) • H ... Upper limit alarm L ... Lower limit alarm C1 ...Wash-in-progress signal output (WSH) C2 ... Maintenance-in-progress signal output (MNT) C3 ... Abnormal signal output (ABN) (Sub display when signal contact output function is selected: ▻ Table above ("Types of Contact Signal Outputs Other than Upper/Lower Limit Output") • When H and L are selected, after entry, the "Alarm Value 1" screen appears. • When C1 to C3 is selected, after entry, operation advances to step ⑦.
④Change the alarm value 1.	Change the number of the blinking digit on the main display and press ENT. • Main display ... Alarm value 1 (mg/L) Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... Set a number in the measuring range. • After entry, the "Dead Band 1" screen appears.



(Invalid)

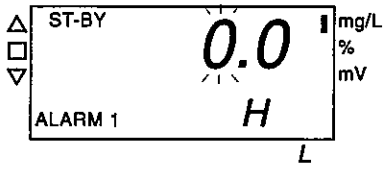
(Upper limit alarm)

(Lower limit alarm)

(Wash-in-progress signal output)

(Maintenance-in-progress signal output)

(Abnormal signal output)



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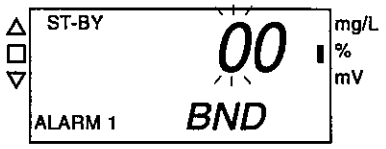
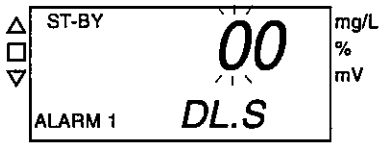
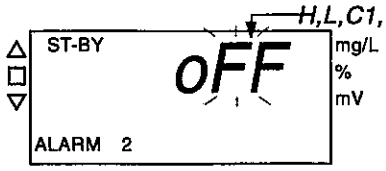
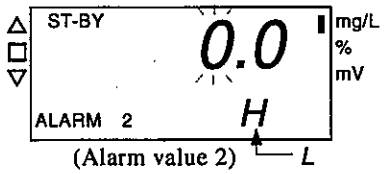
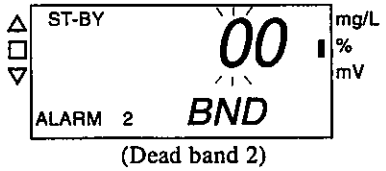
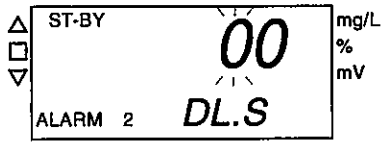
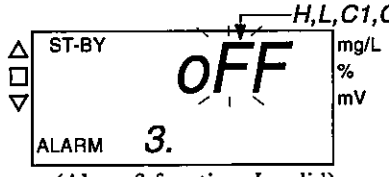
Procedure and screen example	Operation
⑤Change the dead band 1..... 	Change the number of the blinking digit on the main display and press [ENT]. • Main display ... Dead band 1 value (%FS) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0 to 50%FS (factory setting: 0) • After entry, the "Delay Time 1" screen appears.
⑥Change delay time 1..... 	Change the number of the blinking digit on the main display and press [ENT]. • Main display ... Delay time 1 value (s) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0 to 60s (factory setting: 0) • After entry, the "Alarm 2 Function" screen appears.
⑦Change each alarm 2 set value.....  (Alarm 2 function: Invalid)  (Alarm value 2)  (Dead band 2)  (Delay time 2)	Change the alarm 2 function, alarm value 2, dead band 2, and delay time 2 settings, the same as steps ③ to ⑥. • "ALARM2" lights. • Main display ... Set alarm 2 function • oFF ... Alarm 2 is invalid (factory setting) • H ... Upper limit alarm L ... Lower limit alarm C1 ... Wash-in-progress signal output (WSH) C2 ... Maintenance-in-progress signal output (MNT) C3 ... Abnormal signal output (ABN) (Sub display when signal contact output function is selected: ▻ Table above ("Types of Contact Signal Outputs Other than Upper/Lower Limit Output") • After entry, the "Alarm 3 Function" screen appears.
⑧Change each alarm 3 set value.....  (Alarm 3 function: Invalid)	Change the alarm 3 function, alarm value 3, dead band 3, and delay time 3 settings, the same as steps ③ to ⑥. • "ALARM3" lights. • Main display ... Set alarm 3 function • oFF ... Alarm 3 is invalid (factory setting) H ... Upper limit alarm L ... Lower limit alarm

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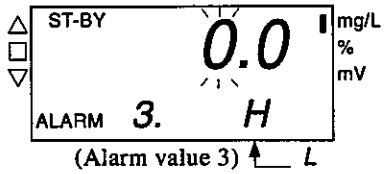
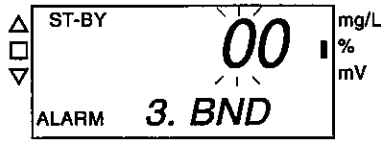
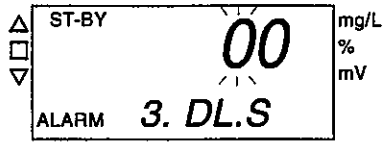
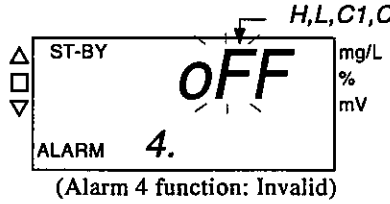
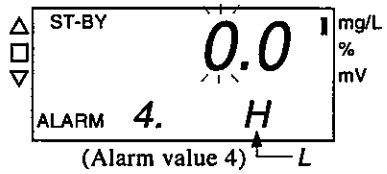
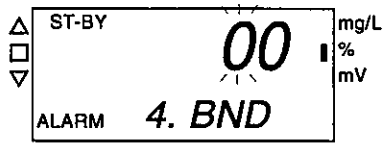
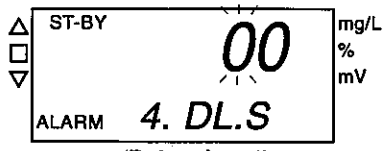
Procedure and screen example	Operation
 (Alarm value 3) H ⇄ L	C1 ... Wash-in-progress signal output (WSH) C2 ... Maintenance-in-progress signal output (MNT) C3 ... Abnormal signal output (ABN) (Sub display when signal contact output function is selected: ▷ Table above ("Types of Contact Signal Outputs Other than Upper/Lower Limit Output") • After entry, the "Alarm 4 function" screen appears.
 (Dead band 3)	
 (Delay time 3)	
⑨Change each alarm 4 set value.....  (Alarm 4 function: Invalid)	Change the alarm 4 function, alarm value 4, dead band 4, and delay time 4 settings, the same as steps ③ to ⑥. • "ALARM4" lights. • Main display ... Set alarm 4 function • oFF ... Alarm 4 is invalid (factory setting). • H ... Upper limit alarm L ... Lower limit alarm C1 ... Wash-in-progress signal output (WSH) C2 ... Maintenance-in-progress signal output (MNT) C3 ... Abnormal signal output (ABN) (Sub display when signal contact output function is selected: ▷ Table above ("Types of Contact Signal Outputs Other than Upper/Lower Limit Output") • After entry, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
 (Alarm value 4) H ⇄ L	
 (Dead band 4)	
 (Delay time 4)	
⑩Return to the "F⁻ Concentration Measured Value" screen.....	Press ST-BY/MEAS for 4 seconds or more.

(6) Changing the fluoride ion concentration measuring range (measured value output range)

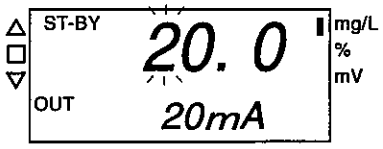
(a) The fluoride ion concentration measuring range (measured value output range) can be changed. This range corresponds to the measured value output (4 to 20mADC). The display panel shows the order specifications display range (0.0 to 99.9mg/L, etc.) set in the service mode regardless of the fluoride ion concentration measuring range setting.

(b) The lower limit (measured value output 4mA) of the fluoride ion concentration measuring range (measured value output range) is fixed at 0mg/L and cannot be changed. The upper limit (measured value output 20mA) can be set to a fluoride ion concentration (mg/L) within a range of 10% to full scale of the display range.

- Setting example .... Display range 1 (0.0 to 99.9mg/L): 0.0 to 10.0mg/L, 0.0 to 20.0mg/L, 0.0 to 50.0mg/L, 0.0 to 80.0mg/L, etc.

(c) When the fluoride ion concentration measured value moves outside the measuring range, "OUT 1" blinks. When it returns to within the measuring range, "OUT 1" goes off.

Procedure for Changing Fluoride Ion Concentration Measuring Range (Measured Value Output Range)

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "F^- Concentration Measuring Range Upper Limit" screen. 	When OUT is pressed for 4 seconds or more, the measuring range screen group appears. • The sub display becomes "20mA". • "OUT 1" lights. • Main display ... Upper limit fluoride ion concentration value of set measuring range.
③Change the upper limit value of the fluoride ion concentration measuring range.	Change the blinking number on the main display and press ENT. • Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... Fluoride ion concentration (mg/L) of 10% or more to full scale of display range. (factory setting: depending on the order specification) • After entry, the next screen is displayed. If ENT is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more.

(7) Changing the wash control function

(a) Turn the wash control function on (on/P.on) or off (oFF) at the "Wash Function" screen (WASH) matched to the sensor used as shown below.

- on (On) ..... Water jet (or chemical) or other general wash type sensor

- P.on (Pulse on) ..... Pulse air jet wash type sensor
- oFF (Off) ..... Sensor with built-in timer type wash function (sensor wash control function used) or sensor without wash function

(b) When the wash control function is set to on (on/P.on), the wash interval and wash time or number of wash pulses and wait time after wash must be set.

(c) The type and functions of the I/O signals are different as shown in the table below depending on the wash control function settings.

Wash Control Function Setting and I/O Signal Types, etc.

Wash control function setting	Power output terminals for wash (80, 81)	External control input terminals (10, 11)
Valid (on/P.on)	• AC power supply for sensor is output.	• External wash command is input.
Invalid (oFF)	• None	• External hold command is input.

(d) When the wash control function is set to on (on/P.on), AC power supply for sensor is output from the power output terminals for wash (80, 81) and wash is started according to the set wash interval.

- Wash is also started by external wash command input (external closed contact pulse of 0.1s or more) to the external control input terminals (10, 11).
- When the wash interval is set to other than "0.0h" at the "Wash Interval" screen (W.INT), operation is interrupted at the normal wash interval and wash is performed by external wash command. This wash has no effect on wash interval count.

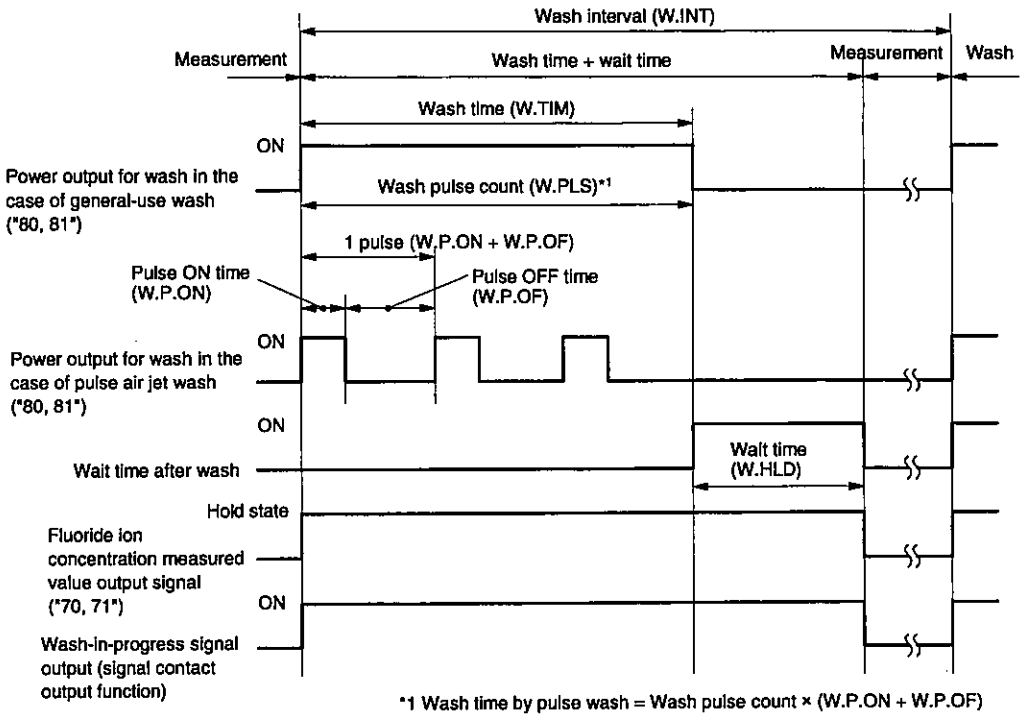
[NOTE] • When the power to the product is turned off (including power failure), the wash interval is not counted. Wash interval counting is restarted from the time the power is turned back on thereafter. Similarly, in the setting mode the wash interval time is not counted and counting is restarted when the product returned to the measurement mode.

- When the wash interval is set to "0.0h" at the "Wash Interval" screen (W.INT), wash is started only by external wash command.
- During wash by set interval and external wash command, the fluoride ion concentration and temperature measured value outputs are held and "WASH" (blink) appears on the sub display.
- When upper/lower alarm is in the alarm state, wash is not started by set wash interval, but is started immediately after the alarm state is reset. In addition, the external wash command input signal is not accepted. (In this case, wash is not started even after the alarm state is reset.) Conversely, during wash and during the wait time after wash, the upper/lower limit alarms do not operate.

(e) When the wash control function is set to off (oFF), the external control input terminals (10, 11) function as external hold command input, the fluoride ion concentration and temperature measured value outputs are held by wash-in-progress signal input of the sensor with built-in timer type wash function and "HOLD" (blink) appears on the sub display.

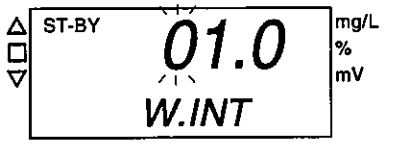
[NOTE] • During this external hold command input, the upper/lower alarms operate in accordance with the fluoride ion concentration measured value.

(f) When wash-in-progress signal output (C1) is selected by signal contact output function, a closed contact signal can be output during wash (including the wait time). In addition, there is no output for setting mode "Manual Wash". ⊳ 3.3(5) "Changing the alarm settings"



Wash Operation Sequence

Procedure for Changing the Wash Control Function

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Wash Function" screen..... 	When [R/W] is pressed for 4 seconds or more, the wash function screen group appears. • "WASH" appears on the sub display. • Main display ... Set wash function on (On) ... Water jet and other general wash type sensor wash control function is valid. P.on (Pulse on) ... Pulse air jet wash type sensor wash control function is valid. oFF (Off) ... Wash control function is invalid (factory setting).
③Change the wash function selection.....	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • When "on (on)" or pulse on (P.on)" is selected, after entry, the "Wash Interval" screen appears. • When "off (oFF)" is selected, after entry, operation advances to step ⑨.
④Change the wash interval. ..... 	Change the blinking number on the main display and press [ENT]. • Main display ... Wash interval time (h). Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ...0.0 to 48.0h in the unit of 0.1h (factory setting: 1.0)

(To be continued)

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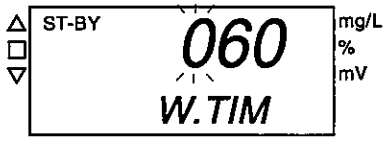
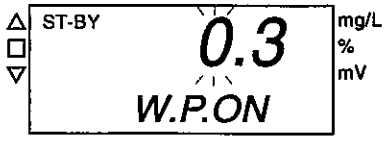
Procedure and screen example	Operation
	[IMPORTANT] • Make the wash interval longer than the total of the wash time (for pulse air jet, total of pulse on time and pulse off time × pulse count) and wait time after wash.
	• When set to 0.0h, only wash by external wash command is performed. Wash by set wash interval time is not performed. ▷ 8.2(8) "External control input terminals"
	• After entry, when on (on) is selected at the "Wash Function" screen, the "Wash Time" screen appears and operation advances to step ⑤-1. When pulse on (P.on) is selected, the "Wash Pulse Count" screen appears and operation advances to step ⑤-2.
⑤-1 Change the wash time.	Change the blinking number on the main display and press [ENT].
	• Main display ... Wash time (s) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 1 to 999s (factory setting: 60) • After entry, operation advances to step ⑧.
⑤-2 Change the wash pulse count.....	Change the blinking number on the main display and press [ENT].
	• Main display ... Number of wash pulses (air jet discharge) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 1 to 19 times (factory setting: 1) After entry, the "Pulse On Time" screen appears.
⑥Change the pulse on time.	Change the blinking number on the main display and press [ENT].
	• Main display ... Set pulse on (solenoid valve of pulse air jet washer open) time Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0.1 to 9.9s (factory setting: 0.3) [NOTE] • Pulse on time is set to within 0.5 seconds. Even if set to longer than this, since the electrode is enveloped by air bubbles and it not touched by the water flow, the wash effect is not raised. After entry, the "Pulse Off Time" screen appears.

(To be continued)

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Procedure and screen example	Operation
⑦Change the pulse off time. ..... 	Change the blinking number on the main display and press [ENT]. • Main display ... Set pulse off (solenoid valve of pulse air jet washer closed) time Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0.1 to 99.9s (factory setting: 1.7) • When the wash pulse count is set to 2 or more, the time which charges air to the air tank for the next discharge is set. • After entry, the "Wash Wait Time" screen appears.
⑧Change the wait time after wash. ..... 	Change the blinking number on the main display and press [ENT]. • Main display ... Set wait time after wash (min) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0.0 to 99.9min (factory setting: 1.0) • After entry, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
⑨Return to the "F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

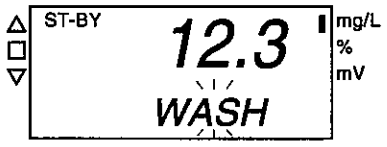
(8) Manual wash start procedure

(a) When the wash control function is on (on) or pulse on (P.on), manual wash can be started by key operation.

(b) When wash is being operated by manual wash start, the wash operation can be stopped by pressing [ST-BY/MEAS] for about 1 second and the screen returns to the "Wash Function" screen (WASH).

(c) Wash operation started by manual wash continues to operate for the set wash time or pulse count and then ends. ⊳3.3(7) "Changing the wash control function"

Manual Wash Start Procedure

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Wash Function" screen..... 	When R/W is pressed for 4 seconds or more, the wash function screen group appears. • "WASH" appears on the sub display. Main display ... Set wash function (blinks) on (On) ... Wash operation for general wash type sensor P.on (Pulse on) ... Wash operation for pulse air jet wash type sensor • When the display is oFF (off), set to on (on) or P.on (pulse on) in advance. ⇨3.3(7) "Changing the wash control function" • Do not press ENT while this screen is displayed. If pressed, the screen goes to "Wash Interval" (W.INT) screen, etc.
③Start wash operation. ..... 	When R/W is pressed, "WASH" blinks at the sub display and manual wash starts. • Main display ... Fluoride ion concentration measured value • After the end of wash, the screen returns to the "Wash Function" screen. • When ENT is pressed several times, the screen returns to the "Setting Mode Fluoride Ion Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.....	Press ST-BY/MEAS for 4 seconds or more.

(9) Changing the electrode characteristics data

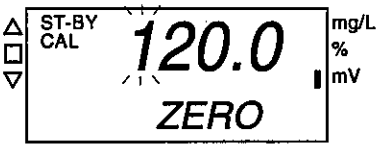
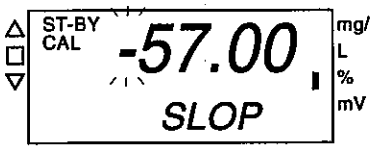
(a)This function is mainly used for technical service. Do not operate this function unless otherwise required.

[IMPORTANT] • If the set values are changed when not necessary, correct measured values become difficult to obtain. If this happens, perform standard solution calibration to set the values back to normal values.

(b)This operation intentionally changes the reference potential and potential slope of the electrode characteristics data. However, if standard solution calibration is performed, the data is returned to the electrode characteristics data of the electrode used.

〔NOTE〕 • The reference potential is the potential of the isothermal intersection point (1mg/L). In addition, the potential slope is the potential difference when the fluoride ion concentration was changed 10 times at 25°C.

Procedure for Changing the Electrode Characteristics Data

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Reference Potential" screen.	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • "ZERO" appears on the sub display. • Main display ... Set reference potential (mV)
	
③Change the reference potential.	Change the blinking number on the main display and press [ENT]. • Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ...0.0 to 240.0mV (factory setting: 120.0) • After entry, the "Potential Slope" screen appears.
④Change the potential slope.....	Change the blinking number on the main display and press [ENT]. • Main display ... Set potential slope (mV) Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 40.00 to 65.00mV/decade (factory setting: -58.00) • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
	
⑤Return to the "F^- Concentration Measured Value" screen.....	Press [ST-BY/MEAS] for 4 seconds or more.

(10) Burnout changing

(a) Burnout function is the function to swing off the measured value output when a problem such as a memory element error occurs. Function selection and the direction of burnout swing-off can be selected.

(b) The type of burnout can be selected from the following states:

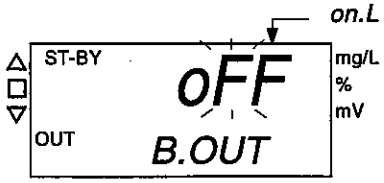
- Off (oFF) ..... No burnout (invalid)
- On Low (on.L) ..... Transmission output becomes 3.8mA when a problem occurs.
- On High (on.H) ..... Transmission output becomes 21mA when a problem occurs.

(c) Burnout function works when a certain condition occurs resulting in one or more of the following errors.

- Memory element error (E-20)
- Setting data error (E-21)
- Temperature measured value error (E-12)

(d) These errors can also be output using the alarm function abnormal signal (C3).
▷3.3(5) "Changing the alarm settings"

Burnout Change Procedure

Procedure and screen example	Operation
①Display the "Setting Mode F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Burnout" screen. ..... 	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • Press [ENT] repeatedly until "B.OUT" appears on the sub display. Main display ... Set burnout function oFF (Off) ... Burnout is invalid (factory setting). on.L (On Low) ... Burnout is valid and transmission output becomes 3.8mA. on.H (On High) ...Burnout is valid and transmission output becomes 21mA.
③Change the burnout selection.....	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
④Return to the "F⁻ Concentration Measured Value" screen.....	Press [ST-BY/MEAS] for 4 seconds or more.

(11) Changing the hold output

(a)This monitor recognizes the following states as "Hold required" states.

- When the wash control function is valid (on, P.on) and is within the wash time and the wait time after wash.
- When the wash control function is invalid (oFF) and a "Closed" signal is input at the external control input terminals (10, 11).
- When a setting mode ("ST-BY" lit) or calibration mode ("ST-BY", "CAL" lit) screen is displayed.

(b)When the analyzer enters a "Hold required" state, the measured value output is switched to the output format selected at the "Hold" screen (HOLD).

(c)At the "Hold" screen (HOLD) the output format can be selected from the following:

- Preceding value hold (Hld) ..... Holds and outputs the preceding value.
- Arbitrary value hold (du) ..... Holds and outputs an arbitrarily set value (dummy).
- Through (tH) ..... Outputs the measured value as usual.

(d)The arbitrary value (%) of arbitrary value hold can be converted to fluoride ion concentration using the following expression:

Fluoride ion concentration or temperature converted value =

$$\frac{\text{Arbitrary value}}{100} \times (\text{Maximum scale value of measuring range} - \text{minimum scale value of measuring range}) + \text{Minimum scale value of measuring range}$$

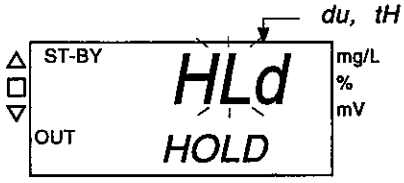
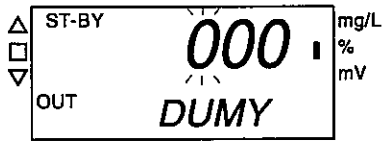
[NOTE] • For fluoride ion concentration, the minimum scale range of the measuring range is always "0".

(Ex) For arbitrary value 25%, fluoride ion concentration measuring range 0 to 20mg/L

$$\text{Fluoride ion concentration} = \frac{25}{100} \times (20-0)+0$$

$$= 5\ (\text{mg/L})$$

Procedure for Changing the Hold Setting

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Hold" screen. 	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • Press [ENT] repeatedly until "HOLD" appears on the sub display. • Main display ... Set output format for "hold required" state • HLd ... Preceding value hold (factory setting) du ... Arbitrary value hold tH ... Through
③Change the selected output format.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • When arbitrary value hold (du) is selected, after entry, the "Arbitrary Value Hold" screen appears. • When [ENT] is pressed repeatedly after preceding value hold (Hld) or through (tH) is selected, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Change arbitrary value hold. 	Change the blinking number on the main display and press [ENT]. • Main display ... Set arbitrary value Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... 0 to 100% (factory setting: 0) • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
⑤Return to the "F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for seconds or more.

(12) Changing the response speed

(a) The response speed measured from the time the output of the electrode is taken until the fluoride ion concentration measured value is displayed and the transmission output is sent can be selected from either of the following. In the case the fluoride ion concentration measured value oscillates intensively within a short time, it may be easier to control the system by slowing down the response speed.

- Fast (FA).....Fast (approx. 15 seconds/90%, using an equivalent input) (factory setting)
- Slow (SL) .....Slow (approx. 60 seconds/90%, using an equivalent input)

Procedure for Changing the Response Speed

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Response Speed" screen. 	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • Press [ENT] repeatedly until "RESP" appears on the sub display. Main display ... Set response speed FA (Fast) ... Fast (factory setting) SL (Slow) ... Slow
③Change the selected response speed.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

(13) Changing the stability check for calibration conditions

(a) Stability check for calibration is the function to automatically determine that the measured value is stabilized at the time of standard solution calibration and then takes in the calibration value. The time and width for checking the stability conditions of this function can be changed.

(b) When the check time is set to 1 or more, the stability check starts after 15 seconds the calibration start key is pressed and the measured value is taken in every second. When all the measured values for the check period are in the check width, calibration is judged to be stable and the measured value is taken in as the calibration value.

(c) When the check time is set to "0", the stable state cannot be automatically checked. Perform calibration after checking that the fluoride ion concentration measured value has stabilized and the stable indicator mark of the up/down indicator marks at the left side of the "Fluoride Concentration Measured Value" screen blinks or lights.

Procedure for Changing the Stability Check for Calibration Conditions

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.

(To be continued)

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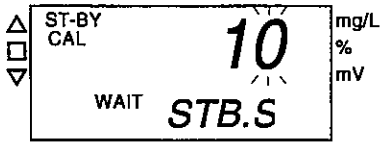
Procedure and screen example	Operation
②Display the "Stability Check Time for Calibration" screen.	When DATA/→ is pressed for 4 seconds or more, the other screen group appears. • Press ENT repeatedly until "STB.S" appears on the sub display. Main display ... Set stability check time for calibration
	
③Change the stability check time for calibration.	Change the blinking number on the main display and press ENT. Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... 0 to 60s (factory setting: 10) (0 second: Invalid) • When set to 1 or more, after entry, the "Stability Check Width for Calibration" screen appears. • When set to "0" second, stability check for calibration is invalid and the "Stability Check Width for Calibration" screen is not displayed. • When ENT is pressed repeatedly, the screen returns to the "Setting Mode F Concentration Measured Value" screen.
④Change the stability check width for calibration.....	Change the blinking number on the main display and press ENT. • Main display ... Set stability check width for calibration Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... 0.000 to 9.999mV (factory setting: 0.100) • After entry, the next screen is displayed. If ENT is pressed repeatedly here, the screen returns to the "Setting Mode F Concentration Measured Value" screen.
	
⑤Return to the "F Concentration Measured Value" screen.....	Press ST-BY/MEAS for 4 seconds or more.

(14) Changing the manual temperature compensation

(a)Normally, compensation of the ion electrode temperature characteristic is automatically performed using the temperature measured value by the temperature element built in the electrode. However, you can disconnect this temperature measured value and enter the temperature of the sample from the key board for temperature compensation.

(b)This function is useful when an electrode without a built-in temperature element is used or when the temperature element of the electrode is other than 10kΩ/25°C and 1kΩ/0°C.

(c)Manual temperature compensation value is the temperature of the current sample. Measurement using manual temperature compensation is useful when the temperature variation of the sample is small.

Procedure for Changing the Manual Temperature Compensation

Procedure and screen example	Operation
①Display the "Setting Mode F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Manual Temperature Compensation On/Off" screen.	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • Press [ENT] repeatedly until "M.TC" appears on the sub display. • Main display ... Set manual temperature compensation selection on (On) ... Manual temperature compensation is valid. oFF (Off) ... Manual temperature compensation is invalid (factory setting)
③Change the manual temperature compensation selection.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • When on (on) is selected, after entry, the "Manual Temperature Compensation Value" screen appears. • When off (oFF) is selected, when [ENT] is pressed repeatedly, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
④Change the manual temperature compensation value.	Change the blinking number on the main display and press [ENT]. • Main display ... Manual temperature compensation value Number increment/decrement ... [↑][↓] Digit shift ... [DATA/→] Setting range ... 0.0 to 40.0°C (factory setting: 25.0) • After entry, the next screen is displayed. If [ENT] is pressed repeatedly here, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
⑤Return to the "F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

(15) Changing the date and time (clock setting)

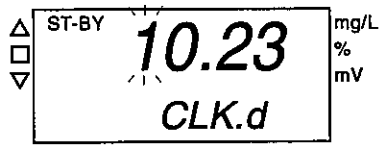
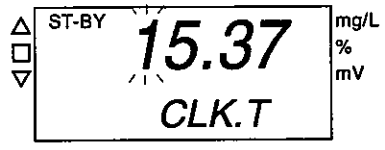
(a)The current date and time of the clock built into the product can be set. The internal clock is used to record the calibration history calibration date and time and for clock display.

(b)When this product has been in the power off state for 1 week or more, set the clock in accordance with the following procedure when restarting use.

【IMPORTANT】 • If a nonexistent date (ex: February 30, etc.) is set, normal clock operation will not be performed.

〔NOTE〕 • The set values and calibration data are not affected by power off because they are stored in an EEPROM (nonvolatile memory).

Procedure for Changing the date and time (clock setting)

Procedure and screen example	Operation
①Display the "Setting Mode F⁻ Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Date and Time Setting" screen.	When DATA/→ is pressed for 4 seconds or more, the other screen group appears. • Press ENT repeatedly until "CLK.Y" appears on the sub display. • Main display ... Set year
	
③Change the year.	Change the blinking number on the main display and press ENT. • Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... 08 to 99 (year 2008 to 2099) • After entry, the "Date" screen appears.
④Change the date.	Change the blinking number on the main display and press ENT. • Main display ... Set date Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... 01.01 to 12.31 (January 1 to December 31) • After entry, the "Time" screen appears.
	
⑤Change the time.	Change the blinking number on the main display and press ENT. • Main display ... Set time Number increment/decrement ... ↑ ↓ Digit shift ... DATA/→ Setting range ... 00.00 to 23.59 (0:00 to 23:59) • After entry, the next screen is displayed. If ENT is pressed repeatedly here, the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
	
⑥Return to the "F⁻ Concentration Measured Value" screen.	Press ST-BY/MEAS for 4 seconds or more.

(16) Changing 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 monitor so that the mode returns to the measurement mode without fail. This function can be turned on or off.

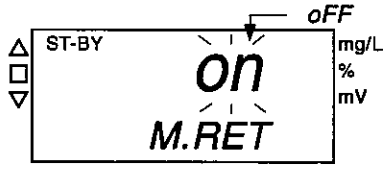
(b) The screen returns to the "F⁻ Concentration Measured Value" screen of the measured value screen group in the measurement mode.

⚠ CAUTION

Automatic wash at automatic return

- When maintenance and inspection work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function with this screen. If this function is on, the monitor will automatically return to the measurement mode after 2 hours has elapsed and if the wash control function is enabled, automatic wash by set interval will begin and is dangerous.

Procedure for Changing Measurement Mode Automatic Return

Procedure and screen example	Operation
①Display the "Setting Mode F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Measurement Mode Auto Return" screen. 	When [DATA/→] is pressed for 4 seconds or more, the other screen group appears. • Press [ENT] repeatedly until "M.RET" appears on the sub display. • Main display ... Set measurement mode automatic return function on (On) ... Automatic return is valid (factory setting). oFF (Off) ... Automatic return is invalid.
③Change the automatic return selection.	Display the necessary item on the main display using [↑] or [↓] and press [ENT]. • After entry, the screen returns to the "Setting Mode F^- Concentration Measured Value" screen.
④Return to the "F^- Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more.

3.4 Calibration Mode Operation

(a) Since actual standard solution calibration operation is accompanied by fluoride ion standard solution preparation and sensor operation, follow the procedure described in 2.2 "Calibration and Fluoride Ion Standard Solution".

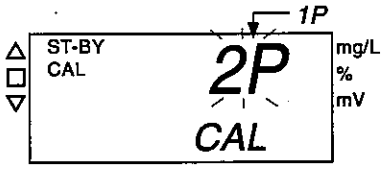
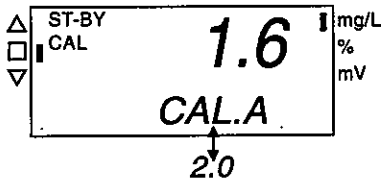
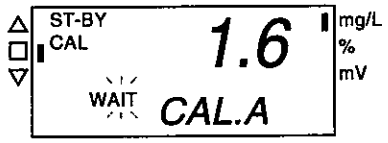
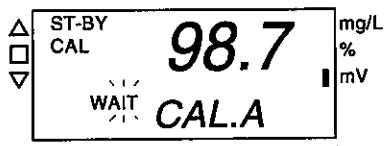
(b) The 2 kinds of fluoride ion standard solution used in standard solution calibration are set in advance, but can be changed. ⇨ 3.3(2) "Changing the standard solution concentration"

(c) While the standard solution calibration screen group is being displayed on the screen, the calibration curve coefficient correction function is automatically released. ⇨ 3.3(4) "Changing the calibration curve coefficient"

(1) Performing 2-point calibration

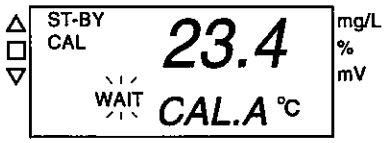
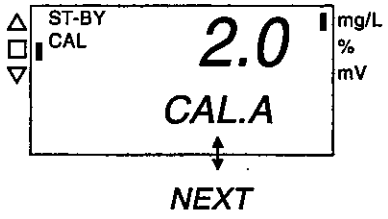
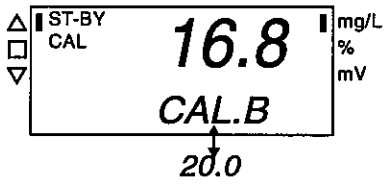
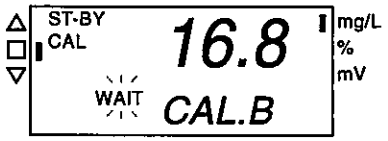
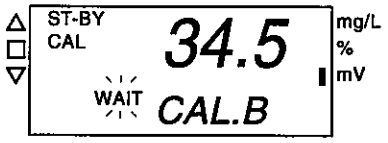
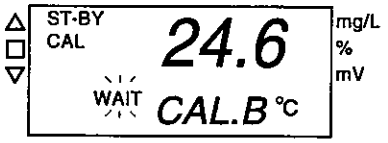
This section describes the 2-point calibration procedure centered about key operation.

2-point Calibration Key Operation Procedure

Procedure and screen example	Operation
①Display the "Setting Mode F⁻ Concentration Measured Value" screen	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Calibration Method Selection" screen. . 	When [CAL] is pressed (for about 1 second), the standard solution calibration screen group appears. • "CAL" (CAL indicator) lights. • "CAL" appears on the sub display. • Main display ... 2P or 1P (blinks). • The main display can be switched between 2-point calibration (2P) and 1-point calibration (1P) using [↑] or [↓].
③Select 2-point calibration. ..... 	Display 2-point calibration (2P) press [ENT]. • Main display ...Fluoride ion concentration measured value • Sub display ... "CAL.A" and concentration are displayed alternately.
④Start 1st point calibration. .....  (Fluoride ion concentration display)  (Electrode potential display)	Wash the tip of the electrode with pure water, and then immerse it into the 1st point fluoride ion standard solution (for instance, 2.0mg/L standard solution). • Wait for the measured value on the display panel to stabilize, and then press [ENT]. [NOTE] • When the measured value stabilizes. the stable indicator mark of the up/down indicator at the top left of the screen changes to blink or steady light. • The "1st Point Calibration" screen (CAL.A) appears, 1st point calibration starts, and "WAIT" blinks (during stability check).

(To be continued)

(Continued from previous page)

Procedure and screen example	Operation
 (Temperature display)	• When the indication stabilizes, 1st point calibration ends and "WAIT" goes off. • When the "Stability Check Time for Calibration" screen (STB.S) is off (invalid), 1st calibration is ended immediately. • During calibration, the measured value on the main display can be switched among fluoride ion concentration, electrode potential, and temperature using ↑ or ↓. • Sub display ... CAL.A
⑤Check the end of 1st point calibration.	• When 1st point calibration ends, "CAL.A" and "NEXT" are displayed alternately on the sub display. • After the end of calibration, the main display can be switched among fluoride ion concentration measured value, electrode potential, and temperature using ↑ or ↓. • When ST-BY/MEAS is pressed here, 2-point calibration stops and the screen returns to the "Setting Mode F⁻ Concentration Measured Value" screen.
	**【IMPORTANT】** • When calibration was stopped by pressing ST-BY/MEAS here, repeat operation from step ②
⑥Prepare for 2nd point calibration.	• Press ENT. • "CAL.B" and concentration are displayed alternately on the sub display. • Wash the tip of the electrode with water, then immerse the electrode into the 2nd point standard solution (for instance, 20.0mg/L standard solution).
	
⑦Start 2nd point calibration.	• Wait for the measured value on the display panel to stabilize, and then press ENT.
 (Fluoride ion concentration display)	[NOTE] • When the measured value stabilizes, the stable indicator mark of the up/down indicator at the top left of the screen changes to blink or steady light.
 (Electrode potential display)	• The "2nd Point Calibration" screen (CAL.B) appears, 2nd point calibration starts, and "WAIT" blinks (during stability check). • When the indication stabilizes, 2nd point calibration ends and "WAIT" goes off. • When the "Stability Check Time for Calibration" screen (STB.S) is off (oFF), 2nd point calibration is ended immediately. • During calibration, the main display can be switched among fluoride ion concentration measured value, electrode potential, and temperature using ↑ or ↓. • Sub display ... CAL.B
 (Temperature display)	

(To be continued)

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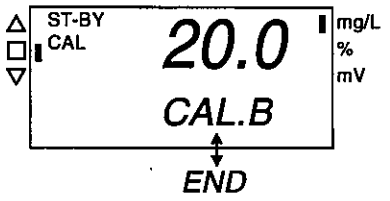
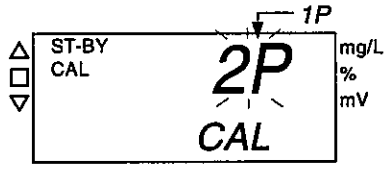
Procedure and screen example	Operation
⑧Check the end of 2nd point calibration. ..... 	• When 2nd point calibration ends, "CAL.B" and "END" are displayed alternately on the sub display. • After the end of calibration, the main display can be switched among fluoride ion concentration measured value, electrode potential, and temperature using [↑] or [↓]. • If error message "E - - 0" to "E - - 5" is displayed, see 5.1(1) "Error messages for calibration and necessary actions". After taking suitable action, repeat calibration beginning from step ②.
⑨Return to the "Setting Mode F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] (for about 1 second). • "CAL" (CAL indicator) goes off. • Wash the electrode with pure water and return it to the measurement point.
⑩Return to the "F⁻ Concentration Measured Value" screen.....	Press [ST-BY/MEAS] for 4 seconds or more.

(2) Performing 1-point calibration

This section describes the 1-point calibration procedure centered about key operation.

1-point Calibration Key Operation Procedure

Procedure and screen example	Operation
①Display the "Setting Mode F⁻ Concentration Measured Value" screen.	Press [ST-BY/MEAS] for 4 seconds or more in the measurement mode. • "ST-BY" lights.
②Display the "Calibration Method Selection" screen.. 	When [CAL] is pressed (for about 1 second), the standard solution calibration screen group appears. • "CAL" (CAL indicator) lights. • "CAL" appears on the sub display. • Main display ... 2P or 1P (blinks). • 2-point calibration (2P) and 1-point calibration (1P) can be switched using [↑] or [↓].
③Select 1-point calibration. ..... 	Display 1-point calibration (1P) and press [ENT].

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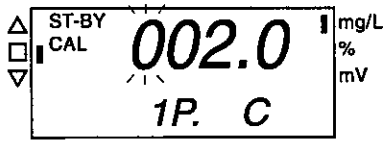
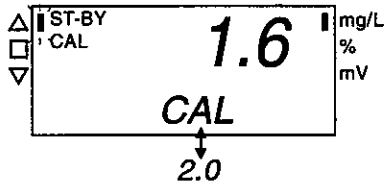
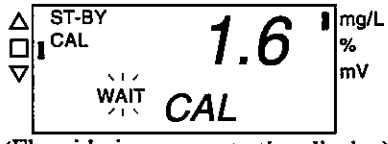
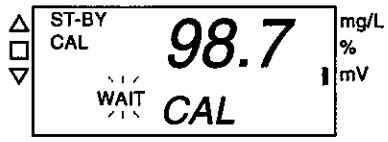
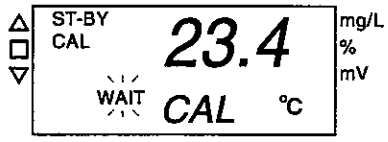
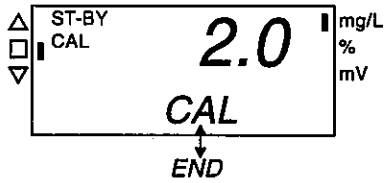
Procedure and screen example	Operation
④Set the 1-point calibration standard solution concentration..... 	Change the blinking number on the main display, display the 1-point calibration standard solution concentration, and press [ENT]. • Main display ... 1-point calibration standard solution concentration Number increment/decrement ... [↑] [↓] Digit shift ... [DATA/→] Setting range ... A range of 1% to full scale of the display range and 10% to 100% of the measuring range (measured value output range) is recommended.
⑤Prepare the electrode..... 	"CAL" and concentration are displayed alternately on the sub display. • Wash the tip of the electrode with pure water, then immerse the electrode into the fluoride ion concentration standard solution (for example, 2.0mg/L standard solution).
⑥Start 1-point calibration by standard solution. .....  (Fluoride ion concentration display)  (Electrode potential display)  (Temperature display)	Wait for the measured value on the display panel to stabilize, and then press [ENT]. 〔NOTE〕 • When the measured value stabilizes, the stable indicator mark of the up/down indicator at the top left of the screen changes to blink or steady light. • The "1-Point Calibration" screen (CAL) appears, calibration starts, and "WAIT" blinks (during stability check). • When the indication stabilizes, the calibration value is taken in, 1-point calibration ends, and "WAIT" goes off. • When the "Stability Check Time for Calibration" screen (STB.S) is off (invalid), 1-point calibration is ended immediately. • During calibration, the main display can be switched among fluoride ion concentration measured value, electrode potential, and temperature using [↑] or [↓]. • Sub display ... CAL
⑦Check the end of 1-point calibration..... 	• When calibration ends, "CAL" and "END" are displayed alternately on the sub display. • After the end of calibration, the main display can be switched among fluoride ion concentration measured value, electrode potential, and temperature using [↑] or [↓]. • If error message "E - - 0", "E - - 4", or "E - - 5" is displayed, see 5.1(1) "Error messages for calibration and necessary actions". After taking suitable action, repeat operation from step ②.

(To be continued)

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Procedure and screen example	Operation
⑧Return to the "Setting Mode F^- Concentration Measured Value" screen.	Press ST-BY/MEAS (for about 1 second). • "CAL" (CAL indicator) goes off. • Wash the electrode with pure water and return it to the measurement point.
⑨Return to the "F^- Concentration Measured Value" screen.....	Press ST-BY/MEAS for 4 seconds or more.

3.5 Transmission Adjustment Mode Operation

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

[IMPORTANT]
- If these set values are changed when not necessary, correct measured values become difficult to obtain. In this case, set the value back to the factory setting.
- In the transmission adjustment mode, 4mA or 20mA is output without regard to the fluoride ion concentration or temperature measured value. When using the transmission output in control, etc., switch to this mode after taking action (turning off the circuit, etc.) so that these controls are not executed erroneously.

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

Procedure for Adjusting the Fluoride Ion Concentration Transmission

Procedure and screen example	Operation
①Display the "F⁻ Concentration Transmission 4mA Adjustment" screen.	When [OUT] is pressed for 4 seconds or more in the measurement mode, the monitor enters the transmission adjustment mode. • "4mA" appears on the sub display. • "OUT " lights. • Main display ... Value near 4mA after the previous adjustment
②Adjust the 4mA value.	Using [↑] or [↓], adjust the receiver indication to 0mg/L and press [ENT]. • Number increment/decrement ... [↑][↓] (Output value changes about 3/1,000mA each time this key is pressed.) Setting range ... 3.00 to 5.00mADC (factory setting: 4.00) • After entry, the sub display changes to "20mA" and the "F⁻ Concentration Transmission 20mA Adjustment" screen appears.
③Adjust the 20mA value.	Using [↑] or [↓], adjust the receiver indication to the upper limit value (20.0mg/L, etc.) of the fluoride ion concentration measuring range and press [ENT]. • Main display ... Value near 20mA after the previous adjustment Number increment/decrement ... [↑][↓] (Output value changes about 3/1,000mA each time this key is pressed.) Setting range ... 19.00 to 21.00mADC (factory setting: 20.00) • After entry, the screen returns to the "F⁻ Concentration Transmission 4mA Adjustment" screen.

(To be continued)

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Procedure and screen example	Operation
④Repeat the adjustment.	Repeat the procedures in steps ② and ③ until the indicated values of 4mA and 20mA match.
⑤Return to the "F Concentration Measured Value" screen.....	Press OUT for 4 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) The "maintenance cycle" described in the following table "Standard Maintenance List" is based on the standard installation condition (condition that satisfies the items in 8.1(1) "Monitor installation location"). Depending on the condition, the maintenance cycle may differ. Modify the maintenance cycle based on the operating condition carried out more than several months.

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

(d) Since this monitor system is a simple type, there is no calibration equipment and preprocessing equipment and reproducibility is within ±30%FS. We recommend that it be used while periodically checking if the indicated value is appropriate by means of another analysis method.

(e) When starting operation, or when the sample composition, etc. was changed, consider the nature, etc. of the sample and perform maintenance and inspection comparatively frequently so that the error remains within the tolerance range.

Standard Maintenance List

No.	Subject	Contents	Maintenance cycle							Execution method. etc.
			Operation start	1 week	1 month	3 months	6 months	1 to 2 years	When needed	
1.	Electrode	(1) Wash			○					⊳ 4.4 "Washing the electrode"
		(2) Replace						○		⊳ 4.5(1) "Replacing the electrode"
2.	Electrode chip	Replace							○	⊳ 4.5(2) "Replacing the electrode tip"
3.	Standard solution calibration	2-point calibration (or 1-point calibration)	○		○					⊳ 2. "Operation and standard solution calibration"
4.	Indicated value	Check			○					Check that there is no large deviation by comparing the indicated value of the product with the indicated value obtained by another analysis method.

○.....Applicable maintenance cycle

⚠ CAUTION

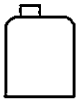
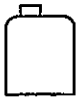
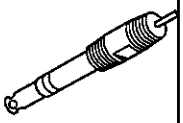
Automatic wash at automatic return

- When maintenance and inspection work in the setting mode exceeds 2 hours, always turn off the measurement mode automatic return function (⇨3.3(16) "Changing measurement mode automatic return"). If this function is on, the monitor will automatically return to the measurement mode after 2 hours has elapsed and if the wash control function is enabled, automatic wash by set interval will begin and is dangerous.

4.2 Annual Spare Parts

It is recommended that the following spare parts be prepared for use when trouble occurs. The annual spare parts vary depending on the specifications when ordering. In addition, the contents of the annual spare parts are subject to change without notice.

Annual spare parts

No.	Code No.	Part name	Sketch	Annual spare parts		Remarks
				Consumable	Spare part	
1	143F077	Fluoride ion standard undiluted solution ($1000mgF^-/L$)		1		500mL
2	143A053	pH5-AB buffering solution		1		500mL
3	ELCP81	Fluoride ion electrode Model ELCP-81-5F		1	1	
4	EL7208L	Fluoride ion electrode chip			1	
5	62443500	Electrode holder body for 0.5m			1 (One is selected)	For HC-D70C (Material: PVC)
	62443600	Electrode holder body for 1.0m				
	62443700	Electrode holder body for 1.5m				
	62443800	Electrode holder body for 2.0m				
	62444500	Electrode holder body for 0.5m				For HC-D76 (Material: PP)
	62444600	Electrode holder body for 1.0m				
	62444700	Electrode holder body for 1.5m				
	62444800	Electrode holder body for 2.0m				

4.3 Sensor Maintenance Preparations

(1) Important points when installing and removing the sensor

(a) The procedure for pulling up the sensor from the measurement point to perform maintenance work and the procedure up to return to the operating state are described.

⚠ WARNING

Toppling

- When working near the measurement reservoir, wear a safety belt or other toppling prevention equipment. Besides, to prevent injury, wear a helmet, life jacket, safety boots, etc.

⚠ CAUTION

Mixing in

- Do not drop tools, etc. into the measurement reservoir.

(b) Ordinarily, the electrode lead wire does not have to be disconnected.

(c) Handle the sensor so that the electrode incorporated into the sensor is not damaged and the electrode tip does not get dirty.

[IMPORTANT]
- Do not apply strong shock (bumping, dropping) or vibration to the electrode. The electrode may be damaged.
- Be sure that oil, stains, etc. do not get on the sensitive membrane of the electrode tip. They may cause the characteristics to deteriorate.
- Be sure that water, oil, strains, etc. do not get on the crimped terminals at the end of the electrode lead wire. They may cause insulation failure.

(2) Removing the sensor

The procedure for pulling out the sensor from the mounting bracket adapter to perform maintenance work, etc. is described.

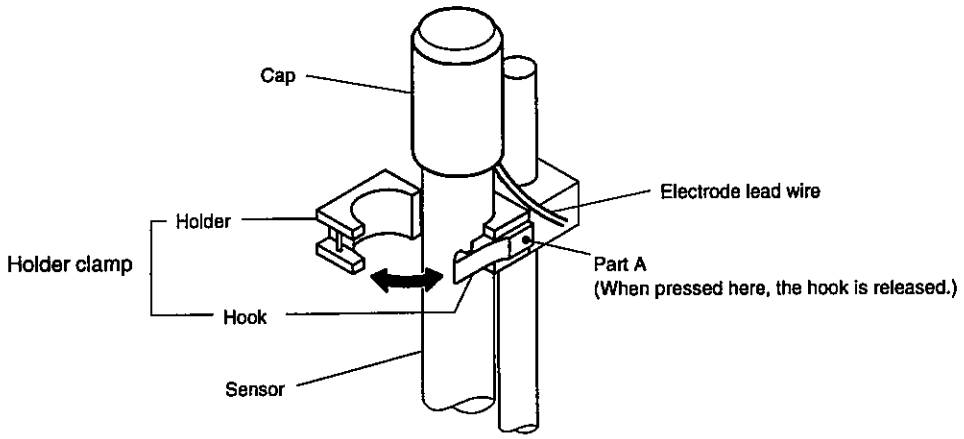
①Turn off the power supply. ····· Turn off the power supply to the monitor. At the same time, confirm that the power to the electric pump of the sensor is off.

⚠ WARNING

Electric Shock

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

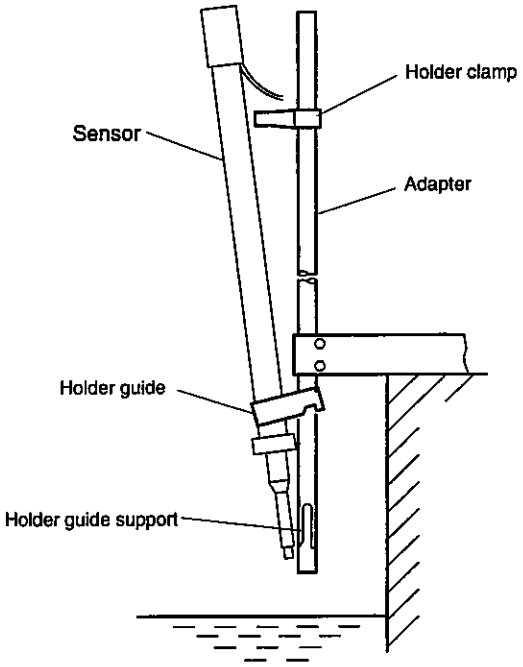
②Open the holder clamp. ·····While pressing part A of the holder clamp, open the holder.



Opening and closing the holder clamp

③Pull up the sensor. ·····Hold the top of the sensor and pull it upward from the measurement point along the adapter.

【IMPORTANT】 • Fold the electrode lead wire and avoid using it to pull up the sensor. If unreasonable force is applied to the electrode lead wire, the wire may break.



Pulling up the sensor

④Wash the sensor. ·····When the sensor is dirty, wash it with pure water.

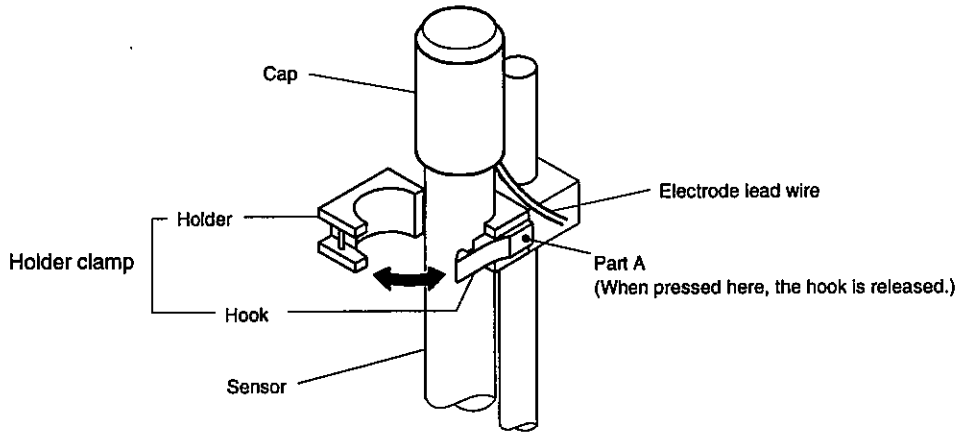
⑤Perform maintenance work.·····Perform the necessary electrode maintenance work.

(3) Installing the sensor

This method installs the pulled up sensor to the mounting bracket adapter as it was originally.

①Lower the sensor down to the holder guide support. ····· Lower the sensor down to the holder guide support along the adapter in the reverse procedure of "4.3(2)③".

②Fix with the holder clamp. ····· While pressing part A of the holder clamp, open the holder and insert the top of the sensor at the center of the holder clamp and close the holder.



Opening and closing the holder clamp

③Supply power ····· Supply power to the monitor as it was originally.

⚠WARNING

Electric Shock

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

[IMPORTANT]
- The power supply voltage of the monitor is 90 to 264VAC. If a voltage higher than this is supplied, the monitor may be damaged.
- When connecting a sensor with wash function and wash power output is necessary; always comply with the power requirement specifications (100VAC±10%, etc.) of the sensor with wash function. If a voltage higher than this is supplied, a step-down transformer is always necessary between the monitor and sensor with wash function.

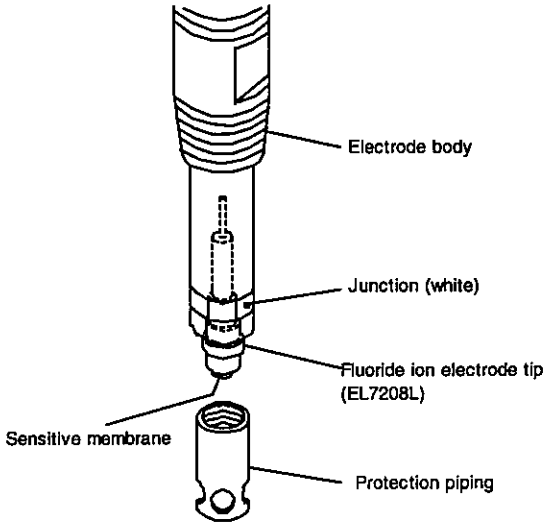
④Set the product to the measurement mode. ····· When placing into the measurement condition, set the monitor to the measurement mode. Check that the sample is within the pH4 to 8.5 range.

4.4 Washing the Electrode

(a) When an error message (E--0 to E--3, E--5) was displayed as a result of standard solution calibration, or when the response becomes slow, wash the electrode. Pull up the electrode holder from the measurement point and remove the protection piping and clean.

(b) The washing method is different when there is oil on the electrode and when there is calcium, sodium, or other alkaline salt scale on the electrode.

[IMPORTANT]
- Do not apply strong shock (bumping, dropping) or vibration to the electrode. The electrode may be damaged.
- Be sure that water, oil, strains, etc. do not get on the crimped terminals at the end of the electrode lead wire. They may cause insulation failure.



Removing the protection piping at the electrode tip

(1) Washing oily contamination

①Prepare a neutral detergent. ····· When the electrode contamination is primarily oily, prepare a neutral detergent as the washing solution.

②Maintenance preparations. ····· After referring to 4.3(2) "Removing the sensor" and turning off the power supply to the monitor, pull up the sensor from the measurement point.

③Remove the protection piping. ····· Remove the protection piping at the electrode holder tip. If dirty, wash the electrode tip and protection piping with pure water.

[IMPORTANT]
- Do not touch the sensitive membrane (lanthanum fluoride single crystal membrane) at the electrode tip with a brush or other hard object. If the sensitive membrane is damaged, the electrode performance may be lost.

④Wash the electrode. ····· Moisten a sponge, etc. with several drops of neutral detergent and wash the tip of the electrode. When dirt is noticeable, remove the sensing film section of the tip and wash the tip with a brush (toothbrush, etc.).

⑤Wash with fresh water. ····· Sufficiently wash the electrode tip with flowing water to wash off the washing solution.

⑥**Turn on the power switch.** ····· Install the protection piping to the electrode tip and set the power switch to ON.

⑦**Calibrate.** ····· Perform 2-point calibration. ▷ 2.2(2) "2-point calibration"

⑧**Return the sensor to its original state.** ····· Refer to 4.3(3) "Installing the sensor" and return the sensor to the original measurement point.

(2) Washing alkali salt scale

①**Prepare the washing solution.** ····· When contamination of the electrode is primarily alkali salt (calcium and sodium) scale, prepare the following washing solution. Enough solution to immerse the electrode tip about 40mm is necessary.

- Concentration about 5% (about 1.6mol/L) hydrochloric acid (HCl) solution (When contamination is so noticeable that standard solution calibration is impossible, make the concentration about 10%.)

[NOTE] • The concentration of commercial concentrated hydrochloric acid solution is about 35% (about 10mol/L). To make a solution having a concentration of about 5%, dilute the hydrochloric acid about 7 times and to make a solution having a concentration of about 10%, dilute the hydrochloric acid about 3.5 times.

• Because the electrode performance may be lost if the electrode is washed often and repeatedly with a high concentration hydrochloric acid solution, use a low concentration hydrochloric acid solution in the washable range.

⚠ WARNING

Hazardous substances

● Wear protective gear when handling the concentrated hydrochloric acid (HCl) and its undiluted solution. Also always check the Material Safety Data Sheet (MSDS).

②**Maintenance preparations.** ····· After referring to 4.3(2) "Removing the sensor" and turning off the power supply to the monitor, pull up the sensor from the measurement point.

③**Remove the protection piping.** ····· Remove the protection piping at the electrode holder tip. If dirty, wash the electrode tip and protection piping with pure water.

[IMPORTANT] • Do not touch the sensitive membrane (lanthanum fluoride single crystal membrane) at the electrode tip with a brush or other hard object. If the sensitive membrane is damaged, the electrode performance may be lost.

④**Immerse the electrode into the washing solution.** ····· Immerse the electrode tip into the washing solution prepared at step ① for 1 to 2 minutes.

⑤**Remove the dirt.** ····· Gently swish the electrode tip back and forth in the washing solution to remove the dirt.

⑥**Wash with fresh water.** ····· Sufficiently wash the electrode tip with flowing water to wash off the washing solution.

⑦**Turn on the power switch.** ····· Install the protection piping to the electrode tip and set the power switch to ON.

⑧**Calibrate.** ····· Perform 2-point calibration. ▷ 2.2(2) "2-point calibration"

⑨**Return the sensor to its original state.** ····· Refer to 4.3(3) "Installing the sensor" and return the sensor to the original measurement point.

4.5 Replacing the Electrode and Tip

(a) If the calibration value and measured value are abnormal even after electrode washing, the electrode has probably deteriorated. Replace the electrode.

(b) Although it depends on the sample composition and measurement environment, etc., replace the electrode at an interval of 1 to 2 years.

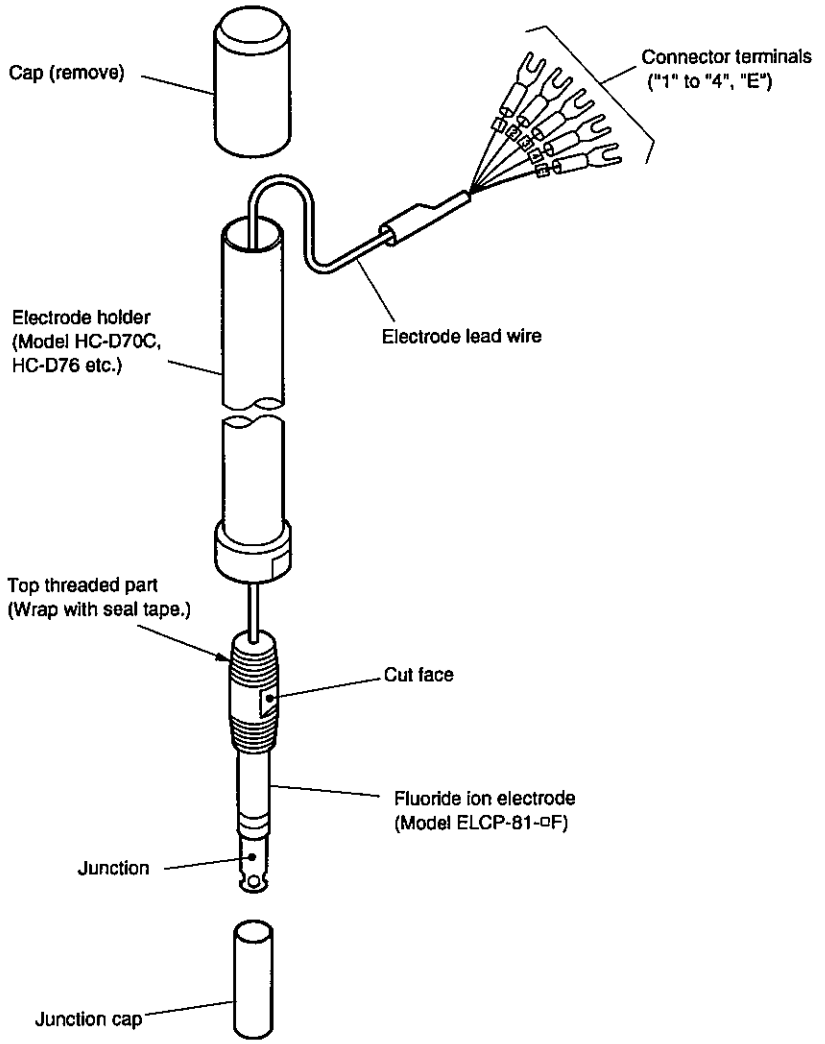
(c) The electrode can be used up to 1 year. In the following cases, replace the electrode tip only.

⊳ 4.5(2) "Replacing the electrode tip"

- When the dirt on the lanthanum fluoride single crystal membrane of the electrode tip cannot be removed.
- When the lanthanum fluoride single crystal membrane of the electrode tip is damaged.
- When the response time is slow

(d) When the electrode or electrode tip was replaced, immerse it in fresh water for at least 30 minutes to stabilize the electrode characteristics before performing calibration.

(1) Replacing the electrode



Replacing the electrode

①Maintenance preparations. ····· After referring to 4.3(2) "Removing the sensor" and turning off the power supply to the monitor, pull up the sensor from the measurement point.

[IMPORTANT]
- Do not apply strong shock (bumping, dropping) or vibration to the electrode. The electrode may be damaged.
- Be sure that water, oil, strains, etc. do not get on the crimped terminals at the end of the electrode lead wire. They may cause insulation failure.

②Remove the electrode. ····· Turn the cut face of the electrode using a wrench and remove the electrode from the electrode holder.

③Disconnect the lead wire. ····· Disconnect the electrode lead wire from the terminal board of the monitor (or connector box) and pull out the electrode toward the bottom of the electrode holder.

④Install the new electrode. ····· Wipe the water drops from the electrode holder and, being sure that the terminals of the end of the electrode lead wire do not get dirty or wet, insert the lead wire to the inside from the bottom of the holder and take it out from the top. Next, wrap the top threaded part of the new electrode with seal tape and screw the electrode into the electrode holder using a wrench.

⑤Connect the electrode lead wire. ····· Connect the terminals of the electrode lead wire to the terminal board of the monitor (or connector box).

⑥Return to the original state. ····· Install the cap to the electrode holder, remove the junction cap of the new electrode tip , and install to the original measurement point.

⑦Turn on the power switch. ····· Install the protection piping to the electrode tip and set the power switch to ON.

⑧Perform calibration. ····· Perform 2-point calibration. ⇨ 2.2(2) "2-point calibration"

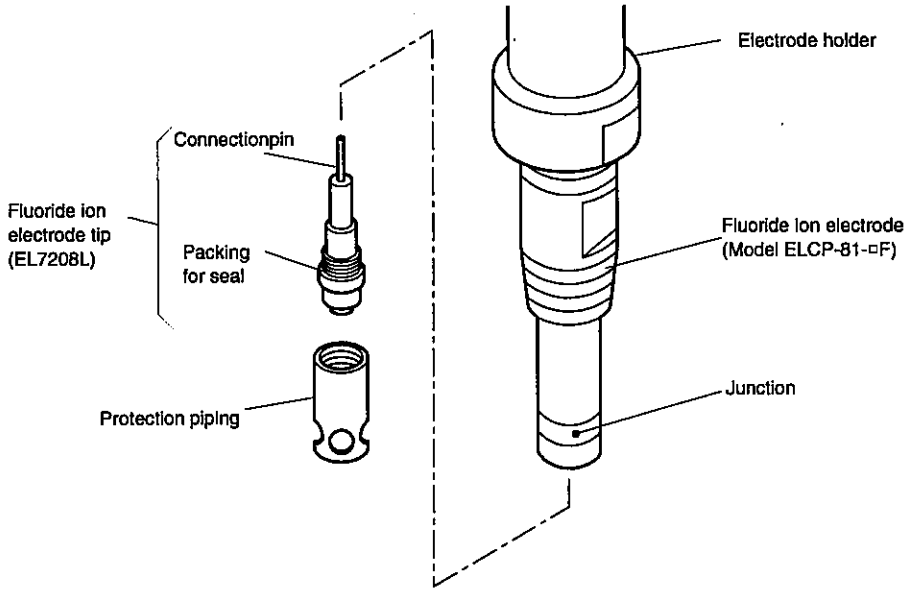
⑨Return the sensor to its original state. ····· Referring to 4.3(3) "Installing the sensor", return the sensor to the original measurement point.

(2) Replacing the electrode tip

The electrode can be used up to 1 year, but when deteriorated due to damage, etc. of the tip membrane of the electrode tip (hereinafter abbreviated "electrode tip"), replace only the electrode tip.

①Maintenance preparation. ····· After referring to 4.3(2) "Removing the sensor" and turning off the power supply to the monitor, pull up the sensor from the measurement point.

②Remove the protection piping. ····· Remove the protection piping of the electrode tip.



Replacing the electrode tip

③Wipe off the water drops. ····· Thoroughly wipe off the water drops on the electrode tip.

【IMPORTANT】 • Do not do this work with water drops on the electrode tip. Water drops on the connection part of the electrode tip will cause insulation failure.

④Replace the used electrode tip with a new electrode tip. ····· Remove the used electrode tip from the electrode and screw on the new electrode tip. Install the protection piping at its original position.

⑤Turn on the power switch. ····· Install the protection piping to the electrode tip and set the power switch to ON.

⑥Perform calibration. ····· Perform 2-point calibration. ▷ 2.2(2) "2-point calibration"

⑦Return the sensor to its original state. ····· Referring to 4.3(3) "Installing the sensor", return the sensor to the original measurement point.

5. Troubleshooting

5.1 Error Message

(1) Error messages for calibration and necessary actions

(a) When measurement is continued, the electrode characteristic 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 product indicates error messages during calibration and temperature measurement meaning "You cannot use this product under this condition".

(b) An error message can be reset by pressing ST-BY/MEAS.

(c) When the monitor returns to the measurement mode after error message is indicated, it 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--0 mg/L % mV	[1-point calibration cannot be performed] • As a result of 1-point calibration, reference potential (ZERO) which requires parallel shift was outside the 0 to 240mVrange.	• If the result is not improved even by washing the electrode, replace the electrode.
2	ST-BY CAL E--1 mg/L % mV	[Reference potential is improper] • As a result of 2-point calibration, reference potential was outside the 30 to 210mV range.	• If the result is not improved even by washing the electrode, replace the electrode.
3	ST-BY CAL E--2 mg/L % mV	[Potential slope is improper] • As a result of 2-point calibration, the potential slope was outside the -40.00 to -65.00mV/decade range.	• Wash the electrode and check the temperature measuring resistor resistance value. If the specified value is not recovered, replace the electrode.
4	ST-BY CAL E--3 mg/L % mV	[Reference potential and potential slope are improper] • As a result of calibration, both "E--1" and "E- -2" occurred simultaneously.	• Same as "3".
5	ST-BY CAL E--4 mg/L % mV	[Fluoride ion standard solution temperature abnormal] • The temperature of the fluoride ion standard solution was outside the 0 to 40 °C range set in the service mode.	• Return the temperature of the fluoride ion standard solution to within the range shown at the left.
6	ST-BY CAL E--5 mg/L % mV	[Stability cannot be checked] • Failed to stabilize within 5 minutes at standard solution calibration by stability judgment function.	• Low response is probably the result of a fluoride ion standard solution temperature drop (5°C or less is the standard) or a dirty or deteriorated electrode. If the normal state is not recovered after checking these items, replace the electrode.

(2) Other error messages and necessary actions

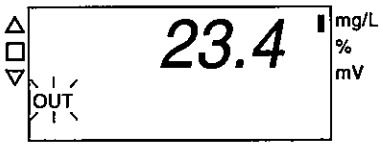
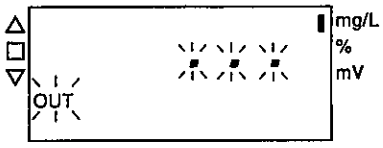
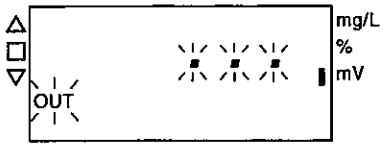
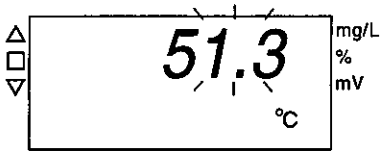
(a) When DISP is pressed, error messages "E-12", "E-20", "E-21", and "TIME" are temporarily reset and the current measured value and set values are displayed. However, if the error cause is not removed, after about 1 minute, the error message will be redisplayed.

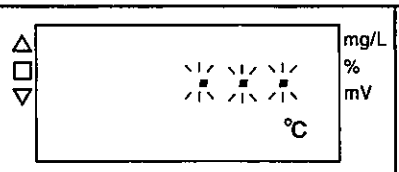
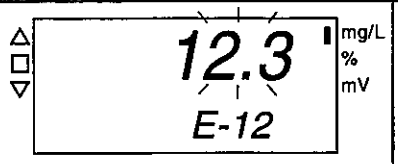
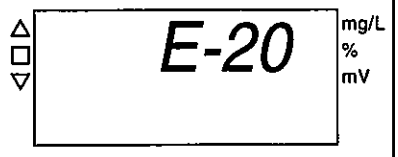
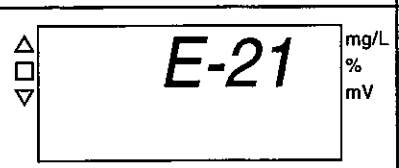
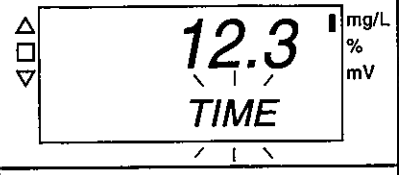
(b) The "E-12", "E-20", and "E-21" abnormal signals can be output to the outside by burnout function or signal contact output function.

- The burnout function becomes valid when "on high" (on.H) or "on low" (on.L) was set at the "Burnout" screen. ▻ 3.3(10) "Burnout changing"
- The signal contact output function becomes valid when C3 (abnormal signal output) was set at the "Alarm 1 Function" to "Alarm 4 Function" screen. ▻ 3.3(5) "Changing the alarm settings"

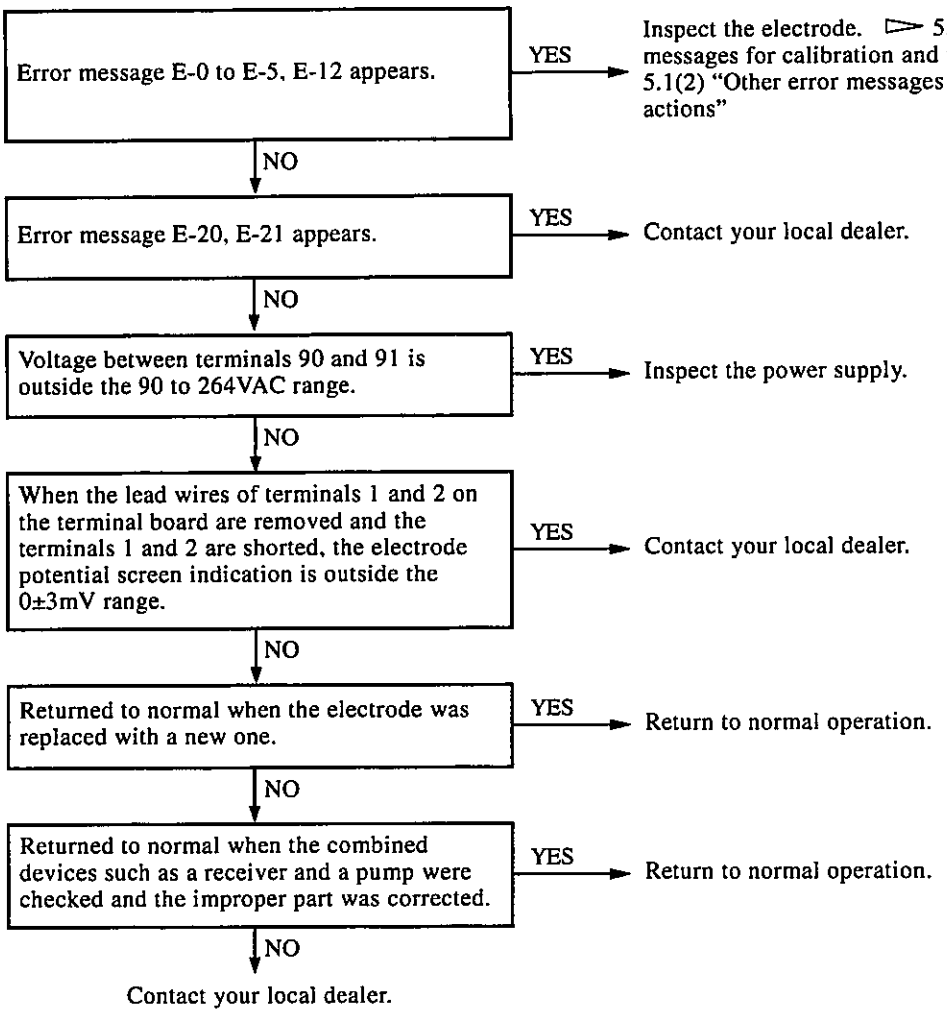
(c) When "E-12" occurs, the fluoride ion concentration measured value (25°C converted value) blinks at the main display and the fluoride ion concentration measured value output and upper/lower limit alarm operation are performed by 25°C conversion as emergency action until the error cause is removed.

Other Error Messages and Necessary Actions

Item	Indication	Message name and contents	Actions, etc.
1		[Fluoride ion concentration measured value is outside the measuring range] • Blinking of "OUT 1" shows that the fluoride ion concentration measured value is outside the measuring range.	• If the ion concentration measured value returns to within the measuring range, "OUT 1" will stop blinking. • This message is displayed at the measurement mode measured value screen group.
2		[Fluoride ion concentration is off scale] (Indication off scale) • Blinking of the decimal points of the main display shows that the indication is outside the display range shown below (Display ranges 1 to 3 depend on the order specifications.). Display range 1: 0.0 to 99.9 mg/L Display range 2: 0 to 999 mg/L Display range 3: 0 to 9990 mg/L	• When the sample fluoride ion concentration value is returned to within the range shown at the left, the error display is automatically reset. • If the electrode tip is in the air, immerse it into the sample. • If an electrode lead wire is disconnected, wire it properly. • ▻ 5.2 Troubleshooting
3		[Electrode potential abnormal] • The potential from the electrode is outside the ±999.9mV range. • An electrode lead wire is broken or the electrode is abnormal.	• If the electrode tip is in the air, immerse it into the sample. • If an electrode lead wire is disconnected, wire it properly. When the electrode is considered to be improper, replace the electrode.
4		[Temperature is outside the measuring range] • When the solution temperature is outside the measuring range and became the −5 to 0°C or 50 to 55°C range, the main display temperature measured value blinks.	• If returned within the measurement range, the error display is automatically reset. • This message is displayed at the measurement mode measured value screen group.

5		[Temperature off scale] (Indication off scale) • When the solution temperature is outside the −5 to 55°C range, the decimal points blink. (See "E-12".)	• When the sample temperature value is returned to within the range shown at the left, the error display is automatically reset. • When the temperature element and its lead wires appear to be improper, replace the electrode.
6		[Temperature element abnormal] • The temperature element is abnormal. • The burnout function is performed. • A closed contact signal is output as the abnormal signal output. • This message is not displayed in the setting mode.	• If an electrode lead wire is disconnected, wire it correctly. • If the temperature element and its lead wire appear to be improper, replace the electrode.
7		[Memory element abnormal] • Writing to EEPROM (nonvolatile memory) failed. • The burnout function is performed. • A closed contact signal is output as the abnormal signal output. • Upper/lower limit alarm operation is not performed during this error.	• Repeat operation when set value change and standard solution calibration, etc. caused this error. • If this error occurs again, contact your local dealer.
8		[Set data abnormal] • The EEPROM (nonvolatile memory) in-company calibration data and set data are outside the regulated range. • The burnout function is performed. • A closed contact signal is output as the abnormal signal output. • Upper/lower limit alarm operation is not performed during this error.	• Contact your local dealer.
9		[Clock must be set] • The clock must be lock set at the start of use and when the power has been turned off for 1 week or longer.	• ⇨ 3.3(15) "Changing the date and time (clock setting)"
10		[Set value error] • A value exceeding the setting range was entered in the setting mode and ENT was pressed. • Displayed for approximately 0.5 second and then returns to setting operation initial state.	• Enter a value the setting range.

5.2 Troubleshooting



5.3 Measures against Noise

(a) Error symptom due to noise

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

This product 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 may occur.

(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 Model 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 Operational Explanation

6.1 Specifications

(1) Product specifications

Product name : Fluoride Ion Monitor

Model No. : FBM-100A

Measurement objective composition : Free fluoride ions in water

Display range : (a) Ion measurement .....Depends on the order specifications. One of the following:

Display range 1..... 0.0 to 99.9mg/L

Display range 2..... 0 to 999mg/L

Display range 3..... 0 to 9990mg/L

(b) Electrode potential..... -999.9 to 999.9mV

(c) Temperature measurement ..... 0 to 50°C

Display system : Digital

Display resolution : Display range 1 ..... 0.1 mg/L

Display range 2 ..... 1mg/L

Display range 3 ..... 10mg/L

Performance : Linearity..... Within ±8%FS (equivalent value input), Within ±30%FS (electrode combined)

Repeatability ..... Within ±5%FS (equivalent value input), Within ±30%FS (electrode combined)

Temperature compensation range ..... 0 to 40°C

Response speed ..... 90% response within 15s (equivalent input), 90% response within 60s (electrode combined: (electrode combined: Stir using a standard solution and electrode sufficiently temperature balanced near 25°C. For actual sample, differs depending on the composition.)

Measuring range (Measured value output range) : Output signal..... 4 to 20mADC isolated type (load resistance 650Ω or less)

Fluoride ion measurement:

Display range 1..... Full scale value 10. 0m/L or more,99. 9mg/L or less. Arbitrary setting in 0.01mg/L increments.

Display range 2..... Full scale value 100mg/L or more, 999mg/L or less. Arbitrary setting in 0.1mg/L increments.

Display range 3..... Full scale value 1,000mg/L or more, 9,990mg/L or less. Arbitrary setting in 10mg/L increments.

Alarm output : Number of circuits..... 4 circuits

Output contacts..... 4 circuits make contacts (a contact)

Output contact capacity ..... 250VAC, 3A or less (resistance load) or 30VDC, 3A or less (resistance load.)

Output function selection..... Selected from among upper limit alarm, lower limit alarm, wash-in-progress signal, maintenance-in-progress signal, and abnormal signal.

Washer control output : Drive voltage is output to water jet washer, etc. Output voltage is the same as the supply power specifications.

Output contact capacity .....250VAC, 2A or less (resistance load)

Wash interval.....Can be arbitrarily set within the 0.1 to 48.0h range.

Wash time[*1] .....Can be arbitrarily set within the 1 to 999s range.

Number of pulses[*2].....1 to 19 times

Pulse on time[*2] .....0.1 to 9.9s

Pulse off time[*2].....0.1 to 99.9s

Wait time after wash.....Can be arbitrarily set within the 0.0 to 99.9min range.

Wash start.....By internal timer, manually, or external start signal (0.1 or more closed contact input)

(*1: When combined with water jet (or chemical solution) or other general wash type sensor.)

(*2: When combined with pulse air jet wash type sensor)

Power supply : 90 to 264VAC, 50/60Hz
(However, when combined with sensor with wash function, 100VAC ±10%)

Power consumption : Approx. 10VA (Power consumption of sensor with wash function not included)

Ambient temperature & humidity : –10 to 50°C, 90%RH or less (no condensation)

Sample conditions : pH ..... pH 4 to9(little fluctuation)

Temperature..... 0 to 40°C (little change, no freezing)

Conductivity..... 500µS/cm (50mS/m) or more

Flow..... 0.01 to 0.20m/s

Construction : Indoor installation (IP30 equivalent)

Installation	: 96×96×90(Body), Panel mounting
Material	: Body.....Aluminum Panel frame .....Painted aluminum
Surface color	: Body.....Metallic silver Display panel and control panel.....Munsell N1.5
Wiring port	: Cable gland 6 places (for outside diameter ϕ6 to ϕ12 cable), Cable gland can be removed and electric conduit connected (G1/2X6)
Weight	: Approx. 0.5kg
Self diagnosis functions	: Temperature measuring electrode broken wire, short circuit, etc. detected and error message displayed.
External output	: (a) When burnout function is on, fluoride ion concentration and temperature measured value output can be selected from 3.8mA and 21mA. (b) When abnormal signal is selected at alarm output, a closed contact signal is output.

(2) Sensor specifications

(a) Electrode holder

Product name	: Immersion type electrode holder
Model No.	: Model HC-D70C, HC-D76 etc.
Length	: 0.5, 1.0, 1.5, 2.0m(1 of either)
Material	: Model HC-D70C.....Polyvinylchloride (PVC) Model HC-D76.....Polypropylene (PP)
Operating temperature range	: Ambient temperature.....0 to 50°C Sample temperature.....0 to 40°C(No condensation)

(b) Electrode

Product name	: Fluoride ion electrode
Model No.	: ELCP-81-□F
Lead wire length	: 5, 10m(either specified when ordering)

(3) Connector box specifications (option)

Model No.	: FC-4
Construction	: Site installation rainproof construction (JIS C 0920)
Installation	: 25 to 50A pipe or wall & rack mounting
Material	: ABS resin
Finishing	: Chrome plating with satin finish, metallic silver
Weight	: Approx. 1kg

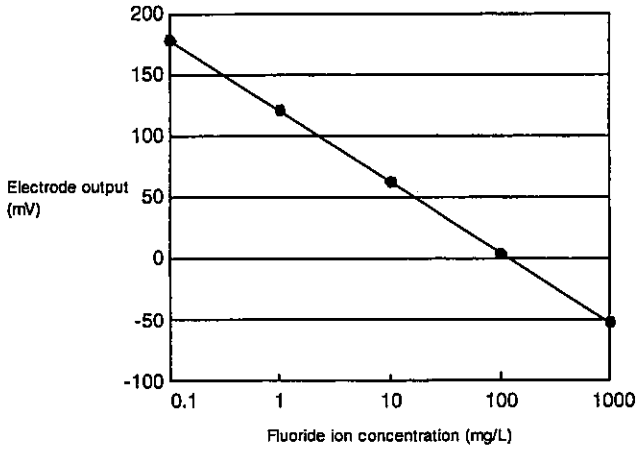
(4) Extension cable specifications (option)

Model No.	: EC-10
Outside diameter	: ϕ8
Insulation	: Polyethylene and vinyl
Insulation resistance between conductors	: 10^5 MΩ or more/100m
Standard length	: 5, 10m

6.2 Operation Explanation

(1) Electrode output and concentration

The fluoride ion electrode generates a constant electromotive force between it and a comparison electrode corresponding to the fluoride ion concentration in the sample. The logarithm and electromotive force of the fluoride ion concentration have a linear relationship. This is generally called "calibration curve". If calibrated (correcting the calibration curve) beforehand using a standard solution, the fluoride ion concentration can be measured by only dipping the electrode into the sample.



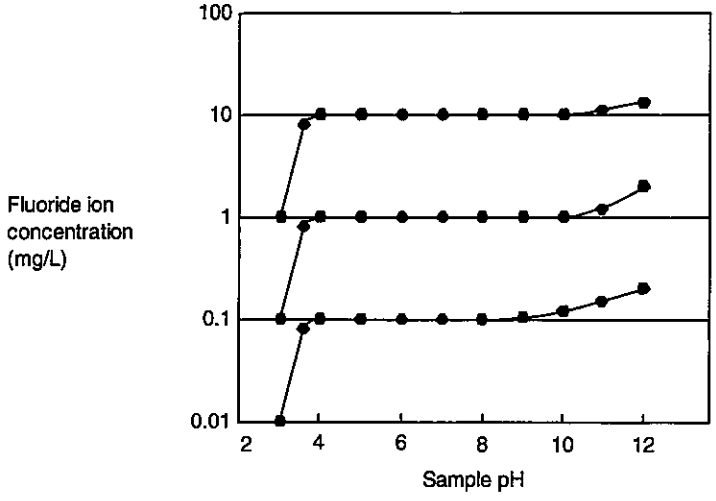
Example of relationship between fluoride ion concentration and electrode output

(2) Effect of pH

The sensitive membrane itself can be used between pH4 to 11. However, the higher the pH, the poorer the quantitative performance. With samples of 100mg/L or more, even high alkalinity of pH11 can be measured, but to measure 0.1mg/L, pH9 or lower is necessary. In addition, at pH4 or lower the reaction

$$H^+ + F^- \rightarrow HF$$

produces hydrogen fluoride (HF) and since it is not ionized, it cannot be measured with this product. The sample condition is pH4 to 9, but for more stable measurement, use within the pH5 to 8 range is recommended.



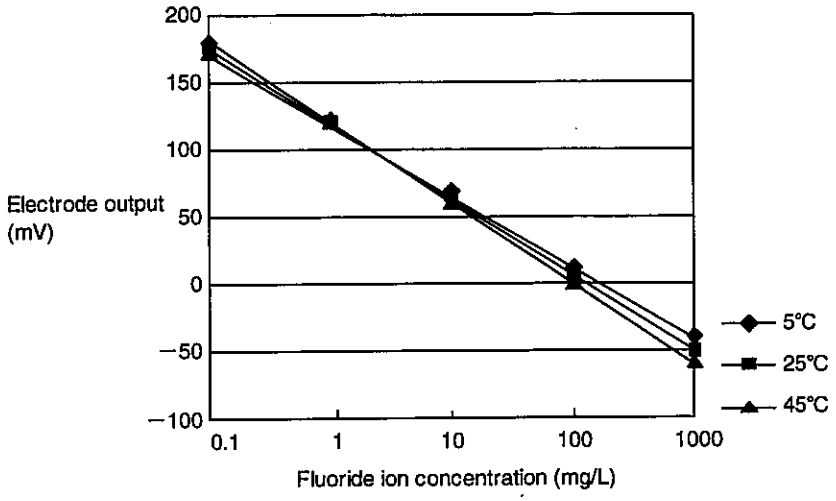
Effect of pH

(3) Effect of temperature

The potential difference of the fluoride ion electrode is affected by temperature changes. The absolute value of the potential slope becomes larger as the temperature rises and increases about 2mV for a temperature rise of 10°C. Generally, it is not a constant value. The isothermal intersection point of the electrode is about 1mg/L.

Relationship between potential slope and temperature

Temperature(°C)		0	10	20	25	30	40	50
Potential slope(mV)	Theoretical value	–54.2	–56.2	–58.2	–59.2	–60.2	–62.1	–64.1
	Average of measured values	–53	–55	–57	–58	–59	–61	–63



Effect of temperature

(4) Effect of coexisting material

Calcium, aluminum, iron, etc. combine with fluorine to produce compounds with characteristics different than those of fluoride ions.

Since these compounds cannot be detected by the fluoride ion electrode, a value (low value) different from the JIS method (the compounds mentioned above are also broken down and the total fluoride is measured by a method which performs measurement by distillation processing) is indicated.

7. RS-232C Communication Function (Option)

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

(a) When equipped with RS-232C connector (option), the monitor can be connected with a PC using a communication (cross) cable. The digital measured value can be imported to PC by connecting the product 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
Connector : D-sub 9 pins

(2) Pin arrangement and communication (cross) cable

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

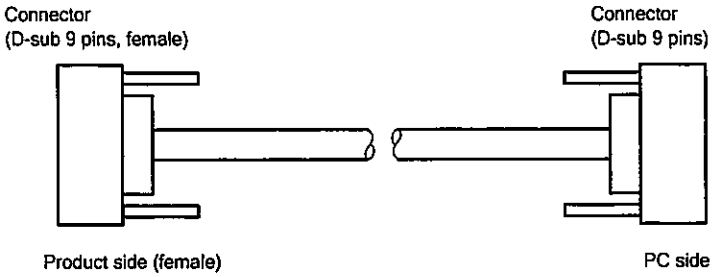
Pin arrangement and signal names

Pin No.	Signal symbol	Signal name	Direction	Remark
1	—	—	—	Not used
2	RD (RXD)	Receive data	Input	
3	SD (TXD)	Send data	Output	
4	ER (DTR)	Data terminal ready	—	Not used
5	SG	Signal ground	—	
6	DR (DSR)	Data set ready	—	Not used
7	RS (RTS)	Request to send	—	Not used
8	CS (CTS)	Clear to send	—	Not used
9	—	—	—	Not used

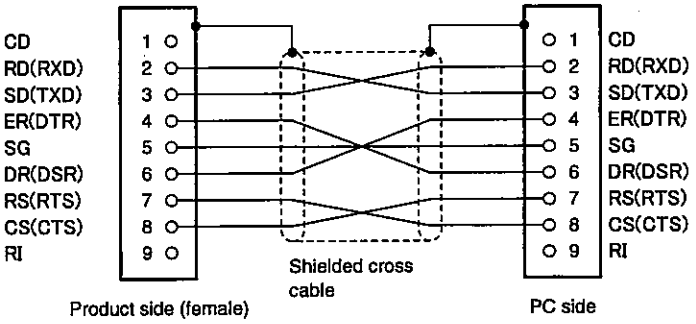
(b) When connecting to a PC, prepare a communication (cross) cable like that shown in the figure below. Make the monitor side of the communication (cross) cable a "D-bus 9-pin, female" connector and match the other end to the PC.

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

【IMPORTANT】 • If the length of the communication (cross) cable exceeds 10m, the signals may not be fetched normally.

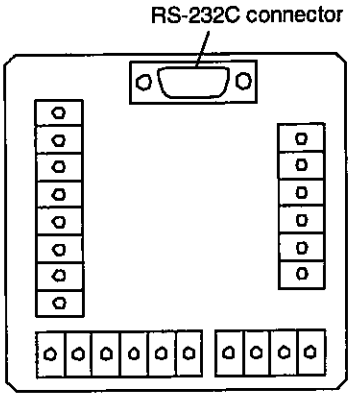


Exterior appearance of communication (cross) cable



Composition of communication (cross) cable

(3) Wiring



Terminal board

(a) Always connect the communication (cross) cable to the RS-232C connector of the figure above after turning off the supply power to the monitor and turning off the PC power. After connection, turn on the supply power and turn on the PC power. The purpose is to prevent electric shock and prevent erroneous operation by touching the terminal board.

(b) Separate the communication (cross) cable from the power input cable and alarm output cable.

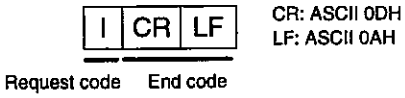
【IMPORTANT】 • If the communication (cross) cable is laid down together with the power input cable or alarm output cable, it may be affected by noise and communication errors may be generated.

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

(4) Command format 1

(a) PC command

The command format 1 for PC to request the monitor to send the measurement data is shown below.

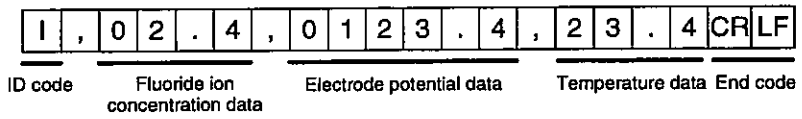


Command Format from PC

(b) Response

Responding to a request from PC, the monitor sends data in the format (CSV format) below.

- Command format 1 from the monitor is as follows:



Command Format 1 from Monitor

- Fluoride ion concentration data is 4 digits, including the decimal point.
  Ex) Output range for display range 1: 00.0 to 99.9
  Output range for display range 2: 0000 to 0999
  Output range for display range 3: 0000 to 9990
  Out of output range (off scale) is "OVER".

- Electrode potential data is 6 digits, including the decimal point.
  Output range: -999.9 to 0999.9
  Out of output range (off scale) is "UNDRmV" for minus off scale and "OVERmV" for plus off scale.

- Temperature data is 4 digits, including the decimal point.
  Output range: -5.0 to 55.0
  Out of output range (off scale) is "UNDR" for minus off scale and "OVER" for plus off scale.

  [NOTE] • Each measured value data is sent without regard to the transmission output format selected at the display screen and hold screen.

(5) Command format 2

(a) PC command

The command format 2 to request the measurement data and status flag responding to the monitor from PC is shown below.

Command Format 2 from PC

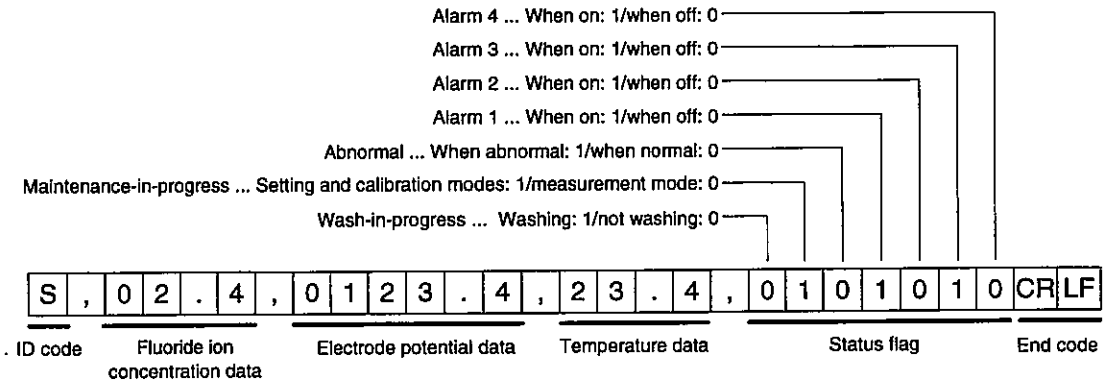
(b) Response

Responding to a request from PC, the monitor sends data in the format (CSV format) below.

- Command format 2 from the monitor is as shown below.
- The fluoride ion concentration data, electrode potential data, and temperature data format is the same as 7. (4) "Command format 1".

  [NOTE] • Each measured value data is sent without regard to the transmission output format selected at the display screen and hold screen.

- Status flag is 7 digits. From the top it represents the wash-in-progress, maintenance-in-progress, abnormal, and alarms 1 to 4 states.
- The alarms 1 to 4 status flags represent the on/off state of alarm operation when upper limit (H) or lower limit (L) is set at alarms 1 to 4.



Command Format 2 from Monitor

8. Installation

8.1 Installation Location

(1) Monitor installation location

Install the monitor in a location which conforms to the specifications and satisfies the following conditions:

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

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

(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.

(g) A location where there is no corrosive gas

(h) A location where the monitor will not be exposed to dripping water, etc.

⚠ WARNING

Hazardous gasses

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

(2) Sensor installation location

Install the monitor in a location which conforms to the specifications and satisfies the following conditions:

(a) A location where maintenance work is easy.

(b) Avoid locations where there is severe vibration and locations near electric equipment, rotating equipment, etc.

(c) When the sample includes slurry or solids which can damage the electrode, remove them in advance.

(d) A location where the sample temperature is within the electrode and sensor body usage temperature range when working and when not operating.

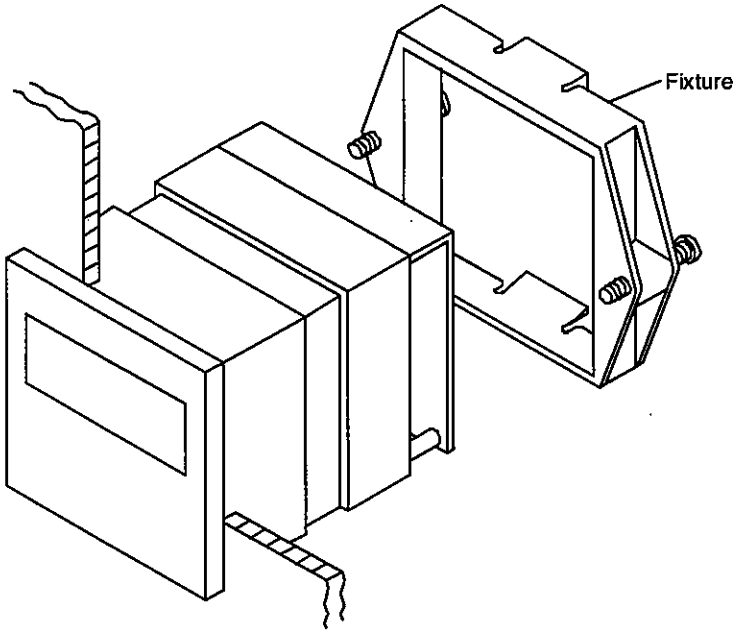
(e) A location where the sample is within the pH4 to 9 range (Recommended value: pH5 to 8 range).

8.2 Mounting

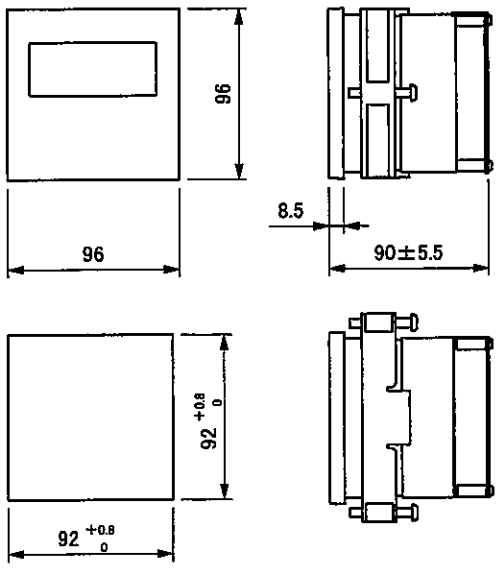
(a)Make a panel cut of the dimensions shown in the figure "Outline dimensions and panel cut" at the position at which the monitor is to be mounted, and mount the monitor using the fixture from the rear.

(b)To read the display and do other work, make the installation height 1.3 to 1.5m from the floor.

(c)Mount so that the top of the monitor body is level.



Panel cut mounting method



<Panel cut> Unit: mm

Outline dimensions and panel cut

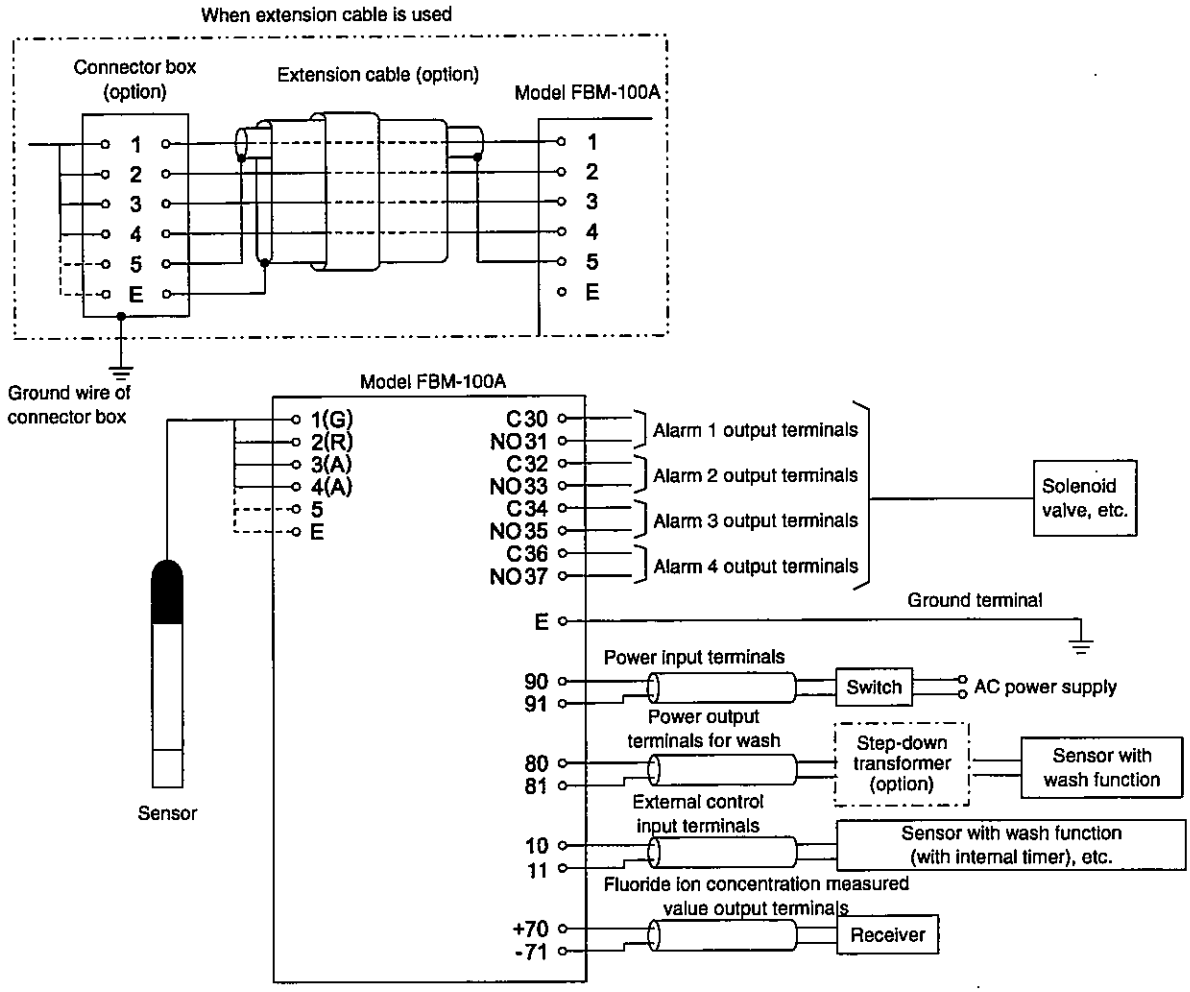
8.3 Connection

(1) Wire connection diagram

⚠ WARNING

Electric shock

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



Wire Connection Diagram Example

(a) Normally connect electrode lead wires directly to this product. However, necessarily if the product is installed in a location far from the sensor, wiring shall be connected via connector box and extension cable. ⇨ 8.4 "Extension Cable and Connector Box (Option)"

(b) To control a sensor with wash function using the wash control function, it is necessary to connect the sensor to the power output terminals for wash (80 and 81).

[IMPORTANT]
- The power supply voltage of the monitor is 90 to 264VAC. If a voltage higher than this is supplied, the monitor may be damaged.
- When connecting a sensor with wash function and wash power output is necessary; always comply with the power requirement specifications (100VAC±10%, etc.) of the sensor with wash function. If a voltage higher than this is supplied, since it will damage the sensor with wash function, in this case a step-down transformer is always necessary between the monitor and sensor with wash function.

(c) When a monitor with wash function containing its own internal timer is used instead of using the monitor's wash control function, a wash-in-progress signal (dry contact) of external hold command can be input from the washer to the wash-in-progress input terminals (10 and 11).

(d) For connection to each terminal board, refer to 8.3(9) "Wiring to terminal board"

(2) 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(G), 2(R) : Electrode

  3(A), 4(A) : Temperature element (terminals not provided for electrode without a temperature element)

  5 : Shield

  E : Ground
- If terminals "3, 4" are not provided for electrode lead wires (temperature element not provided), set "on" for manual temperature compensation and set the temperature. ▷ 3.3(14) "Changing the manual temperature compensation"
- Terminals "5, E" may not be provided depending on the type of electrode used.

(b) If the monitor must be installed in a location far from the sensor so that the electrode lead wires cannot be used, an optional extension cable and a connector box must be used to connect between them. ▷ 8.4 "Extension Cable and Connector Box (Option)"

(c) The resistance value of the temperature compensation circuit of this monitor is 10kΩ/25°C or 1kΩ/0°C. The temperature compensation element of the Model ELCP-81-□ F electrode used is 10kΩ.

(3) Fluoride ion concentration measured value output terminals

(a) The measured value output of the ion concentration measured value corresponding to the measuring range can be taken from the terminals 70 (+) and 71 (–) of the terminal board. Use a 2-core shielded cable to connect between these terminals and a receiver (such as a recorder).

(b) The specifications of the measured value output are shown below (isolated type from ground):
Current output: 4 to 20mADC (load resistance 650Ω max.)

(4) Power input terminals

(a)Power supply of this monitor is 90 to 264VAC. Connect a 2-core cable to the terminals 90 and 91 of the terminal board. However, when power output for wash is needed, power supply must be 100VAC ±10%.

[IMPORTANT]
- The power supply voltage of the monitor is 90 to 264VAC. If a voltage higher than this is supplied, the monitor may be damaged.
- When connecting a sensor with wash function and wash power output is necessary; always comply with the power requirement specifications (100VAC±10%, etc.) of the sensor with wash function. If a voltage higher than this is supplied, since it will damage the sensor with wash function, in this case a step-down transformer is always necessary between the monitor and sensor with wash function.
- Do not connect power supply to terminals other than 90 and 91 erroneously. The product may be damaged.
- For safety, do not supply power to the product or sensor with wash function here. Turn on the power in accordance with 2.1 "Operation Start Procedure".

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

(5) Ground terminal

(a)The ground terminal (E) of the terminal board 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 product 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 board.

⚠ WARNING

Electric shock

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

(6) Alarm output terminals

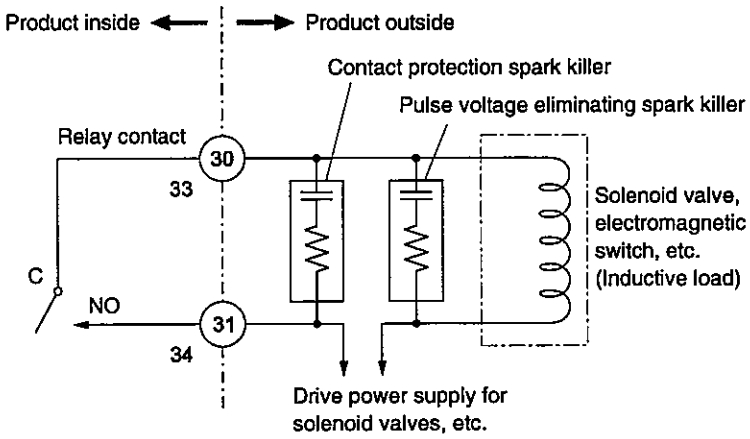
(a)The alarm function can output alarm output signals from 4 make contact (a contact) circuits. Connect it to a solenoid valve, etc.

(b)A wash-in-progress signal, maintenance-in-progress signal, and abnormal signal can be output by using the alarm output terminals.

Alarm Output Terminals

	Terminal No.	Alarm output circuit type
Alarm 1 output terminals	30, 31	Make contact (a contact)
Alarm 2 output terminals	32, 33	Make contact (a contact)
Alarm 3 output terminals	34, 35	Make contact (a contact)
Alarm 4 output terminals	36, 37	Make contact (a contact)

(c) If you want to use a contact output to drive an inductive load such as a solenoid valve or an electromagnetic switch, install a contact protection spark killer and a pulse voltage eliminating spark killer.

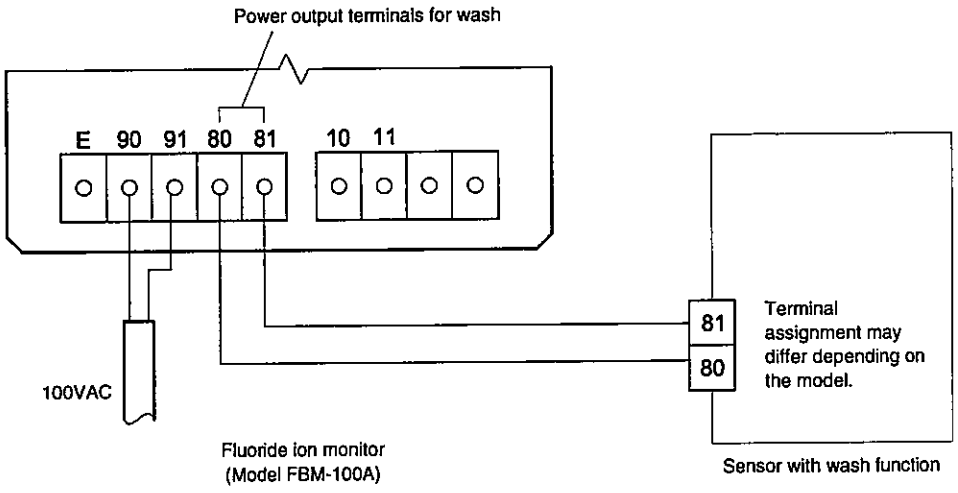


Example of Protection against Noise for Alarm Circuits

(d) When lower limit alarm (L) or upper limit alarm (H) is selected for alarm function, the contact of the alarm output terminal closes if an alarm condition occurs and the contact opens if the ion concentration measured value returns to within the alarm value. The contact capacity is 250VAC 3A, 30VDC 3A (resistance load). For sending an electric current higher than this, provide a power relay, etc. and use alarm output signals to switch the power relay on/off.

(e) Selection of each alarm function, alarm values, distinction between upper and lower limits, alarm dead band, and other settings can be changed by key operation.

(7) Power output terminals for wash



Connection of Power Output Cable for Wash

(a) When the wash control function is valid (on or P.on), AC power for sensor with wash function is output from the power output terminals for wash (80, 81) as the wash time arrives.

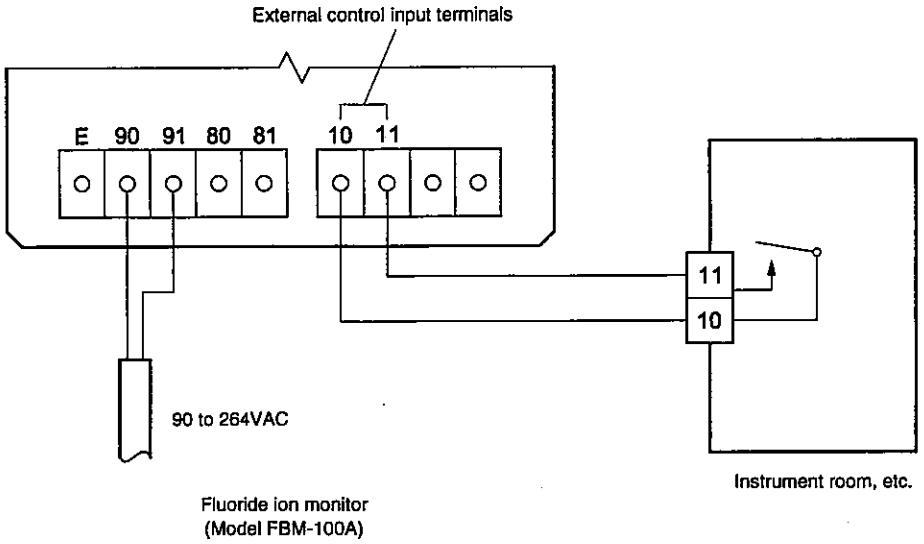
(b) Use a 2-core cable to connect to the sensor with wash function.

(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 with wash function.

(d) AC power supply connected to the power input terminals (90, 91) will be output from the power output terminals for wash (80, 81).

[IMPORTANT] • When connecting a sensor with wash function and wash power output is necessary; always comply with the power requirement specifications (100VAC±10%, etc.) of the sensor with wash function. If a voltage higher than this is supplied, the sensor with wash function will be damaged.

(8) External control input terminals



Connection of External Control Input Cable

(a) The external control input terminals (10, 11) operate as an external wash command when wash control function is valid (on or P.on) and as an external hold command when the wash control function is invalid (oFF).

(b) When a 0.1s or more closed contact pulse is input at the external wash command input, washing is started. When the wash interval is set to other than "0.0h" at the "Wash Interval" screen (W.INT), washing is performed by interrupt at the normal wash interval. When the wash interval is set to "0.0h", washing is only performed by external wash command.

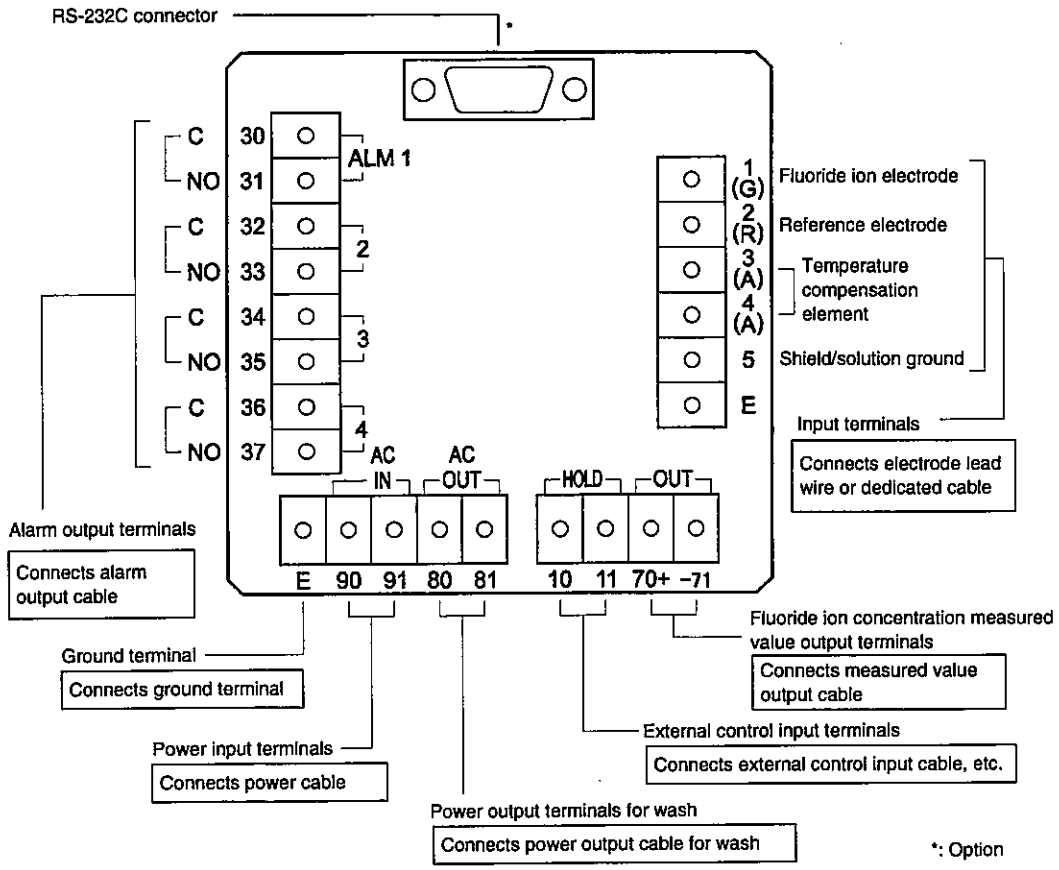
(c) At the external hold command input, a wash-in-progress or other dry close contact signal from a sensor with wash function (internal timer type) places the fluoride ion concentration measured value output into the hold state set at the "Hold" screen (HOLD). This is the objective when the product is combined with a sensor without wash function or a sensor with internal timer type wash function.

[IMPORTANT] • When the product is combined with a sensor with internal timer type wash function, set the setting mode "Wash Function" screen (WASH) to off (oFF) and do not wire the power output terminals for wash (80, 81).
⇨ 3.3(7) "Changing the wash control function"

(d)When a wash-in-progress signal is input from the outside, the product enters the hold state and "HOLD" blinks at the sub display. This is done to avoid the effect of indication fluctuations during washing.

(e)Since the sensor with wash function may be taken out from the installation site for maintenance, provide a surplus in the cable length.

(9) Wiring to terminal board



Terminal board

After confirming that the supply power is off, remove the terminal board cover at the rear of the monitor and connect each cable to the terminals. After wiring is complete, install the terminal cover to its original position.

【IMPORTANT】

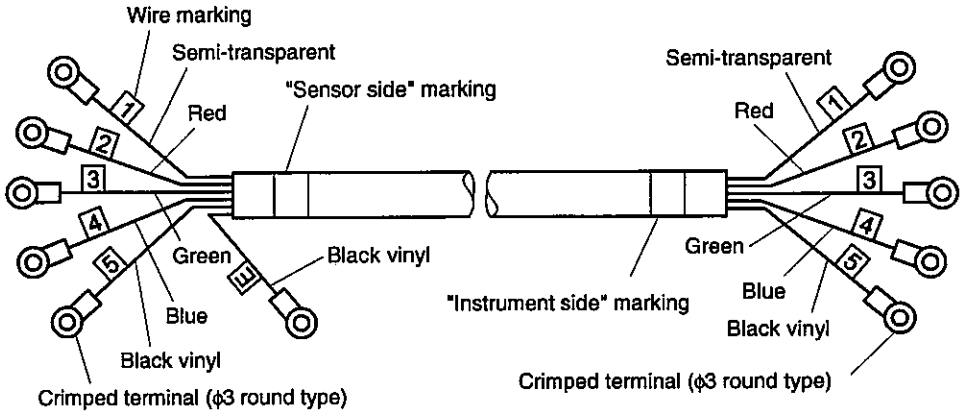
- Do not connect power supply terminals or alarm output terminals 1 to 4 to other terminals. The product may be damaged.
- For safety, do not supply power to the product or sensor with wash function here. Turn on the power in accordance with 2.1 "Operation Start Procedure".
- Terminal "1" of the electrode lead wires must not be in contact with other terminals. If they are in contact, insulation deterioration may occur.

8.4 Extension Cable and Connector Box (Option)

If it is necessary to install the product 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. These items are attached to the product depending on the ordered specification.

(1) Extension cable

Connect the "Sensor side" of the extension cable to the terminal block of the connector box for extension cable and the "Instrument side" of the extension cable to the terminal block of the product for electrode lead wires. To prevent the harmful effect of 2-point grounding, "E" terminal is not provided on the "Instrument side".

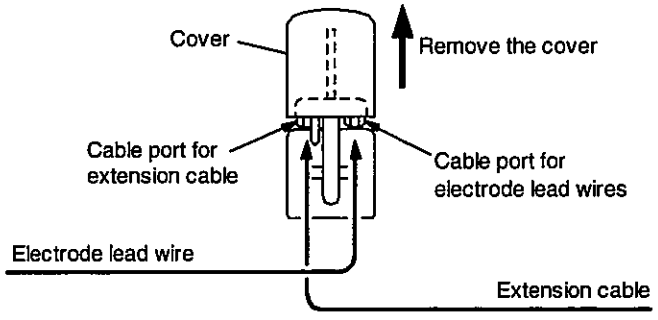


Extension Cable

(2) Connector box

(a) When removing the cover of the connector box, pull it upward.

- If one of the waterproof glands at cable ports is loosened, air enters inside and the cover can be removed easily.

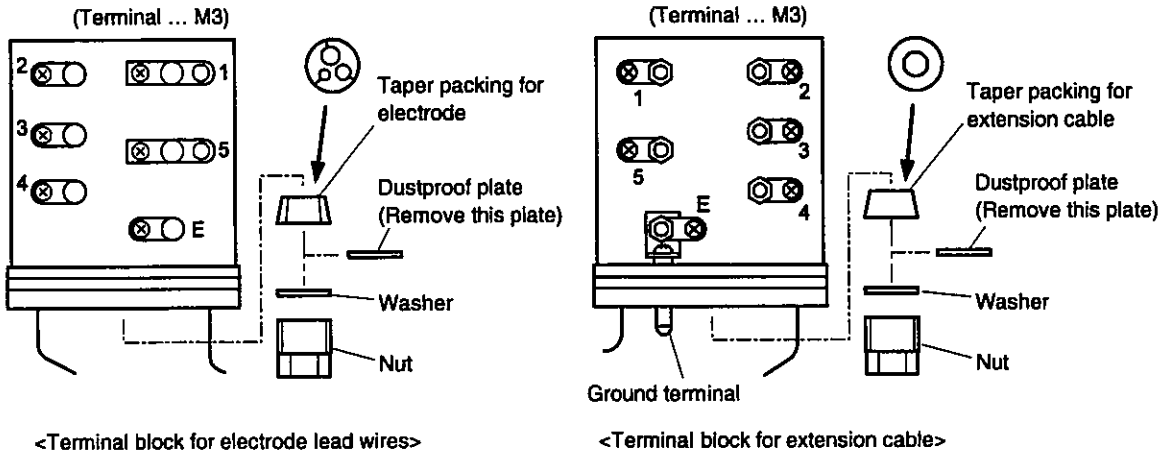


Connector Box and Cable Ports

(b) Connect wiring to the connector box as shown in the diagram below. Remove the dustproof plate because it is intended for transportation and storage.

- Electrode lead wires ..... Connect the wires through the cable port for electrode lead wires on the right side of the connector box to the terminal block for electrode lead wires inside.

- Extension cable ..... Connect the cable through the cable port for extension cable on the left side of the connector box to the terminal block for extension cable inside.
- Ground wire ..... Ground the connector box ground terminal using D type grounding method (ground resistance 100Ω max.)



<Terminal block for electrode lead wires> <Terminal block for extension cable>

Connector Box Terminal Block

Revision History

Instruction Manual No. FBM-IB51602E	9/14/2009 (JJ)	New Version in English (RS2 Setoguti／SD Nakamura)

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