Hand-held Water Quality Meter

WQC-24

INSTRUCTION MANUAL

Be sure to read this manual before use.

DKK-TOA CORPORATION

Introduction

We thank you very much for purchasing Hand-held Water Quality Meter WQC-24.

This equipment is a high performance portable water quality meter provided with a data memory function, which is suitable to the measurement on site with its waterproof structure.

We ask you to read this manual before use to ensure proper use of this equipment.

Please note that illustrations of LCD display adopted in this document are examples for explanation and actual displays might be different depending on use conditions and/or electrode type.

Please understand also that failure or damage caused by operation other than that described in the Instruction Manual shall be out of our scope of warranty.

Keep this document in a safe custody after read so that you can refer to anytime when necessary.

For Safety

Safety Precautions

WARNING	Non-respect of this indication or wrong operation may result in personal loss of life or heavy injury.
CAUTIONS	Non-respect of this indication or wrong operation may result in personal injury or physical damage.

Additionally, following symbols are applied together with above pictograph to show what are dangers and damages.

	Imperative Tells you a matter that is imperative to observe.
	Interdiction Tells you a matter that is interdict.
	Electrical shock Tells you that there is a risk of electrical shock.
	Fire Tells you that there is a risk of smoking or fire.
	Burst Tells you that there is a risk of bursting.
	Toxic Tells you that there is a risk of damage by toxic substance.

	Corrosion Tells you that there is a risk of corrosion.
	Stab Tells you that there is a risk of getting stabbed.

Precautions on operation

When anomaly occurred

WARNING	
	If you noticed anomaly, turn off the power supply and take off batteries. When you use the optional AC adapter, turn OFF the Power Supply and take out the AC adapter of the plug outlet. There is risks of fire, internal burst and so on if you have done wrong operation, noticed burning smell, smoking and so on. Make sure that the fire or smoke is put out, then contact the dealer or us. Do not try to repair by yourself. It is dangerous. Operation in abnormal condition may cause the fire and electrical shock.

Precautions on operation

WARNING	
	Do not use chemical that emit combustible gas. Do not operate in combustible gas environment. There is a risk of gas explosion inside the equipment.
	No person other than Service personnel assigned by us should take off the case cover. No person other than Service personnel assigned by us should disassemble or repair. There are risks of causing electrical shock, fire, abnormal movement and so on.
	Do not touch the AC adapter with the wet hand (when using optional AC adapter). It causes electrical shock, fire or failure.
	Do not use power supply other than specified one. It causes electrical shock and/or fire. It may also give damage to the equipment.
	Do not use AC adapter other than our specified optional accessory. It causes electrical shock and/or fire. It may also give damage to the equipment.
	Do not connect absolutely the power supply to the output terminal. It causes electrical shock, fire or failure.

	This equipment goes out of waterproof structure when taken off the connection cable, electrode, battery cap, connector cap, battery cover or used the extension function (condition that the output cover is not put). Do not touch with the wet hand and water must not splash. It causes electrical shock, fire or failure.

CAUTIONS

 	Pay attention not to let the electrode liquid, electrolyte or standard solution enter your eye. Never drink it. Wash it out if one of them put on the skin, though it is not toxic. If it entered into your eye, wash out it with a large amount of water and consult with a doctor when necessary. If you swallowed it by mistake, vomit it up immediately and consult with a doctor when necessary.

Miscellaneous precautions on operation

Observe following precautions when operating the equipment;

- Do not put the reagent solution or organic solvent on the main unit as it causes failure, discoloration or deformation. Wipe it out immediately if it was put on.
- Do not press or rub up the display or key operation section with something hard or sharp. It causes scratch or failure.
- Batteries attached to the equipment might work only short time as they are samples. Replace them with brand new AA alkaline batteries (sold on the market).
- Turn OFF the Power Supply to plug in/out the connection cable.
- To replace, make sure to connect it to the terminal that has sufficient battery power and turn OFF the Terminal power supply before replacement. Memorized data would be deleted if you take out the Sensor module batteries without connecting it to the Terminal.

Precautions on setting and storage

WARNING	
	Do not install nor store the equipment in combustible gas environment. There is a risk of gas explosion inside the equipment.
	Do not install nor store the equipment in the place when ater or chemicals may enter the inside of equipment. Circuit becomes short-circuited if the water or chemical enter the inside the equipment and that may cause fire and electrical shock.

Miscellaneous precautions on setting and storage

Make sure following precautions on setting and storing this equipment

- Set and store the equipment in the range of temperature (0 - 50° C) and humidity (under 95%).
- Set and store the equipment in the place that has no risk of getting dewdrop.
- Do not set nor store the equipment in the place that corroded gas is generated.
- Set and store the equipment in the place without vibration.
- Set and store the equipment in the place that dust and garbage are little.
- Do not set nor store the equipment in the place that has a risk of dropping off.
- Do not give strong shock to the equipment.
- Do not put the equipment in the extremely cold place or close to the heater or stove.
- Avoid, set and store the equipment in the place that gets direct wind from the air conditioner.
- Do not place anything on the equipment.

Precautions on using sample and reagent

CAUTIONS

Put gloves, protective glasses and protective mask when necessary and make sure to have sufficient ventilation.

You have a risk of skin or eye injury by droplet of the sample or reagent.

If stimulant regent was put on the skin or entered into the eye, wash it out sufficiently by running water and consult with a doctor or pharmacist.

Precautions on transfer and transport of the equipment

Make sure following precautions on transfer or transport of the equipment;

- Be sure to use the case and packing material used for the delivery of the equipment when transporting it. Please note that damage and/or failure caused by the transport using the case and packing material other than specified ones shall not be objective of the warranty.
- Be sure to turn OFF the Power Supply and take out the AC adapter of the plug outlet to transfer the equipment.

Disposal of the equipment and reagent and so on

Follow the rule and regulations of the prefectural and municipal government for the disposal of the equipment and reagent. Consult with your prefectural and municipal government as for the detail.

WARNING

Do not put the equipment in the fire or burn it.

There are risks of explosion or burst inside the equipment.

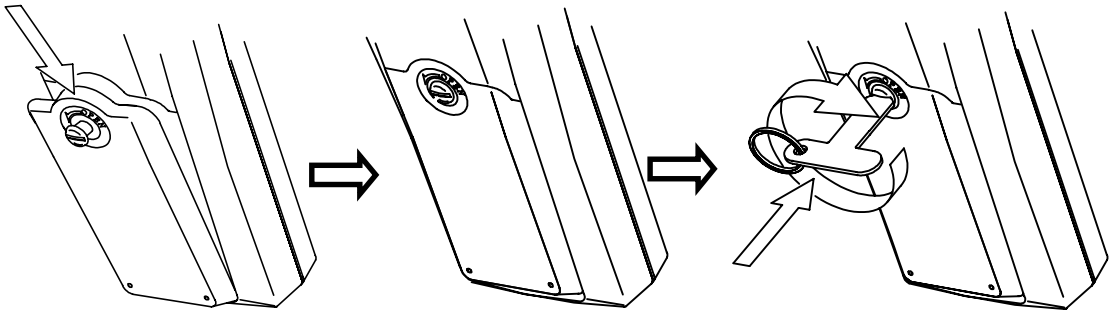
Precautions on keeping waterproof structure

1. Precautions on attaching Battery cover.

（1） Check whether the silicon packing is correctly attached in the groove of the Battery cover reception section of the main unit. If not, attach it correctly.

（2） Check that there is neither scratch nor dust on the silicon packing.

（3） After having checked above items, attach correctly the Battery cover as illustrated below.



Attach the Battery cover on pushing it to the direction of the arrow.

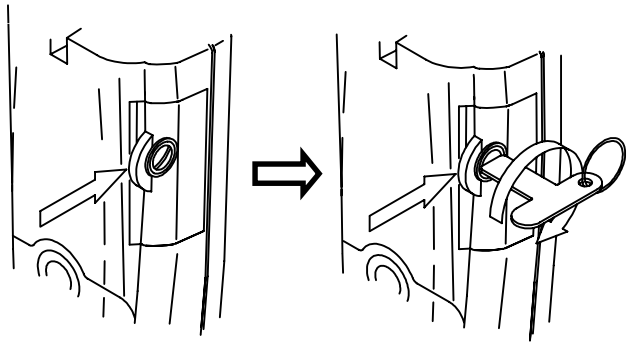
Apply the attached special driver to tighten the cover until it does not move on pushing it in.

2. Precautions on attaching the Output cover

（1） Check whether the silicon packing is correctly attached in the groove of the Output cover. If not, attach it correctly.

（2） Check that there is neither scratch nor dust on the silicon packing.

（3） After having checked above items, attach correctly the Output cover as illustrated below.



Attach the Output cover on pushing it to the direction of the arrow.

Apply the attached special driver to tighten the cover until it does not move on pushing it in.

3. Miscellaneous attentions

(1) Water proof structure of this equipment is ensured only when the Battery case cover, External output case cover (terminal), Battery cap, Connector cap, Electrode (Sensor module) and Connection cables are correctly attached and connected.

(2) Make sure to correctly tighten the Connector cap when the Sensor module unit. Separately use for measurement removing from main unit.

(3) Waterproof structure is not valid when connected optional accessories (AC adaptor, RS-232C cable, Analogue output) to the main unit. Do not put the water on the main unit, do not touch it with the wet hand.

(4) Don't submerge an ion electrode to the depth greater than the table below according to the type of ion electrode chip. Electrode chip may be damaged when submerged deeper.

Ion species	Limit of submerged depth
NO3-、NH4+	5m
K+、Ca2+	10m
F-、Cl-	15m

Warranty

We thank you very much for purchasing our product. We believe that this product will serve you long time as it has fairly passed specified inspection criteria in our plant. We shall take responsibility of rapidly repair the product if it should have failure or deterioration in performance due to our product within one year after the purchase. Please note that accessories including electrode are out of scope as they are consumables.

Notice

Please note that your all or partial payment for the repair shall be required for the repair caused by one of followings even during the warranty period.

1. Failure and/or damage caused by inappropriate handling, use, maintenance, transfer and so on that are not subject to the Instruction Manual, Product Specification and Maintenance Procedures.
2. Failure and/or damage caused by repair and/or modification made by person(s) other than our personnel or person(s) assigned by us
3. Failure and/or damage caused by Force Majeure such as fire, earthquake, storm wind, flood, lightening strike and so on.
4. Supply and replace of consumables

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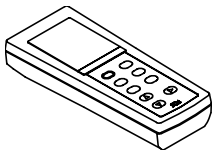
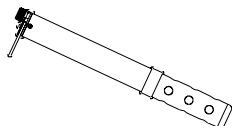
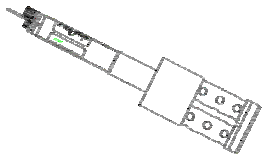
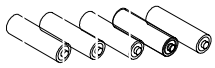
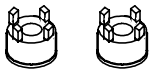
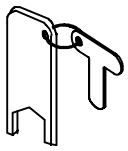
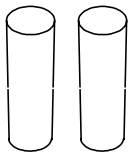
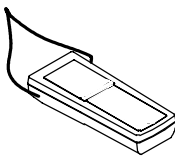
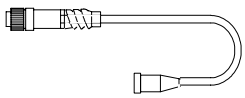
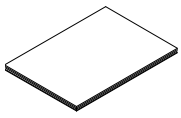
1. Contents of package

Group	Name	Type	Q'ty	Appearance
Main unit	Terminal	**WQC-24**	1	
	Sensor module (w/Connector cap)*1*2*3 With dummy cap /Ion, chlorophyll sensor module	**WMS-24**	1	 
Accessories	AA batteries (sample)*4	—	5	
	Neutral phosphate standard solution pH6.86 (500mL)	**143F192**	1	
	Phtalate standard solution pH4.01 (500mL)	**143F191**	1	
	pH replacement liquid junction part	**678458K**	1	
	Reference electrode gel liquid (50mL)	**143F234**	1	
	DO electrode diaphragm set	**6789790K**	2	
	DO electrode electrolyte (50mL)	**143A040**	1	

1. Contents of package

Group	Name	Type	Q'ty	Appearance
	Special tools (Wrench, Driver)	**67658000 (Wrench) 67826300 (Driver)**	1	
	Calibration cup	**67659900**	2	
	Calibration cup (for chlorophyll)*5	**68466300**	1	
	Silicon grease	**141D002**	1	
	Soft case（w/Shoulder belt）	**6787140K**	1	
	Connection cable（2m）	**6801640K**	1	
	Instruction manual	—	1	

CAUTIONS	*1 **Connector cap shall be used as the water-resistant cap when measuring immersion with the Sensor module unit. Pay attention not to loose and keep it in a safe custody when taken it off.** *2 **A sensor module selected from six types shown in the next page is attached,** *3 **Ion electrode and ORP are optional** *4 **Attached batteries may work only short time as ther are samples. Use the equipment on replacing them with brand new AA alkaline batteries (sold on the market).** *5 **Supplied only when the chlorophyll module is specified**

[Types of sensor module]

① Standard sensor module

② Standard sensor module/w. depth sensor

③ Ion sensor module

④ Ion sensor module/w. depth sensor

⑤ Chlorophyll module

⑥ Chlorophyll module/w. depth sensor

2. Specifications

2.1 Terminal

Model name	WQC-24
Indication	Digital　Item shift display
Waterproof structure	JIS C0920 IP67 watertight type　Not valid when the cable is not connected or when using optional external input/output
RS232C	Standard equipment
Power supply	U3 alkaline dry cell x 2, or AC power (with optional AC adapter)
Dimension	Approx. 187,8 (Depth) ×37.5 (Height)×75(Width) mm (excl. projections)
Weight	Approx. 320 g　(excl. battery)
Operating temperature range	0-50 ℃

2.2 Sensor module

Model name	WMS-24		
Product name	Standard sensor module	Ion sensor module	Chlorophyll module
Watertight structure	Withstanding pressure 1.0 MPa　Watertight [*1]		
Memory	For max. 35 days with an interval of 15 min. Max. 3360 data items		
Power supply	U-3 dry cell × 3		
Dimension	Approx. φ45×411(length) mm (excl. projections)	Approx. 52 (Depth) × 110 (Width) ×510 (Length) mm (excl. projections)	
(w. depth sensor)	Approx. φ47×487(length) mm (excl. projections)		
Weight	Approx. 1350 g (excl. battery)	Approx. 2500 g (excl. battery)	
(w. depth sensor)	Approx. 1450 g (excl. battery)	Approx. 2520 g (excl. battery)	
Operating temperature range	0-50 ℃		

*1　It is as shown below depending upon ion species when a dummy cap is mounted on the ion electrode mount, when the ion electrode is mounted.

Ion species	Submerging limit depth
NO3-、NH4+	5m
K+、Ca2+、	10m
F-、Cl-	15m

2.3 Measurement items

（1）standard sensor module

Items	Indication range	Repeatability (Main unit)	Measurement method	Calibration
pH or Oxidation-reduction potential (ORP)	0.00 - 14.00	±0.05pH	Glass electrode method	Two or three points calibration of 4, 7, 9.
	-2000 - 2000mV	±5mV	Platinum electrode method	
Dissolved oxygen (DO)	0.00 - 20.00mg/L 0 - 200%	±0.1mg/L ±1%	Galvanization diaphragm electrode method	Zero span calibration
Electric conductivity (COND)	0.00 - 10.00S/m	±1%FS	AC 4 electrodes method	Calibration capable
	Range	0.0 - 100.0mS/m, 0.000 - 1.000S/m, 0.00 - 10.00S/m, auto-range		
Salt (SALT)	0.00 - 4.00% 0.0 - 40.0(Sea water salt)	±0.1%	Converted from EC	Calibration capable
Total dissolved solids (TDS)	0.0 - 100.0g/L	±2g/L		
Sea water specific gravity (σt)	0.0 - 50.0σt	±0.1σt		
Temperature(TEMP)	-5.00 - 55.00℃	±0.25℃	Platinum thin film resistive element	Calibration capable
Turbidity (TURB)	0.0 - 800.0NTU 0.0 - 800.0mg/L	±3%FS	90°scattered light measurement method (infrared light)	Zero span calibration

【Factory option】

Depth	0.0~100.0m	±0.1m	Diaphragm pressure sensor type (equipped with temperature compensation function)	Calibration possible

（２）Ion sensor module

Addition to the measuring item of standard sensor module

Max. 3 items of ion, ORP electrodes can be simultaneously connected

Item	Measuring range	Repeatability (Main unit)	Measuring method	Calibration
Nitrate ion	0.62～62000mg/L	±5% FS	Calibration	2-point calibration
Chloride ion	1～35000mg/L			
Calcium ion	0.4～40000mg/L			
Fluoride ion	0.019～19000mg/L			
Potassium ion	0.39～3900mg/L			
Ammonium ion	0.09～1800mg/L			
ORP	-2000~2000mV	±5mV	Platinum electrode method	

【Factory option】

Depth	0.0~100.0m	±0.1m	Diaphragm pressure sensor type (equipped with temperature compensation function)	Calibration possible

（3）Chlorophyll module

Addition to the measuring item of standard sensor module

An item of electrode from ion or ORP can be connected in addition to the standard + chlorophyll

Item	Measuring range	Repeatability (Main unit)	Measuring method	Calibration
Chlorophyll	00-4000 μg/L Indication resolving power 0.1 μg/L		Direct fluorescence method	2-point calibration
Nitrate ion	0.62～62000mg/L	±5% FS	Ion electrode method	2-point calibration
Chloride ion	1～35000mg/L			
Calcium ion	0.4～40000mg/L			
Fluoride ion	0.019～19000mg/L			
Potassium ion	0.39～3900mg/L			
Ammonium ion	0.09～1800mg/L			
ORP	-2000~2000mV	±5mV	Platinum electrode method	

【Factory option】

Depth	0.0～100.0m	±0.1m	Diaphragm pressure sensor type (equipped with temperature compensation function	Calibration possible

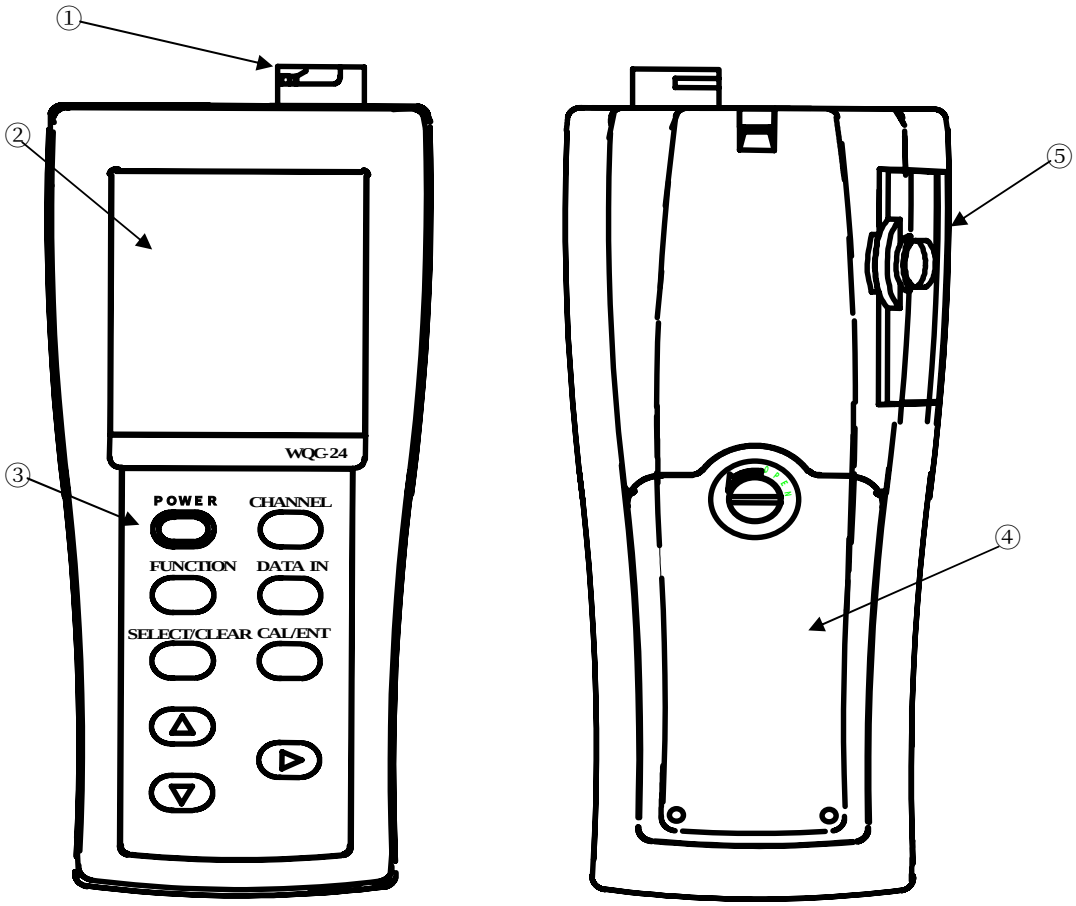
*** Ion electrode and ORP electrode are optional**

*** The depth sensor cannot be mounted later**

*** Remodeling between modules is impossible**

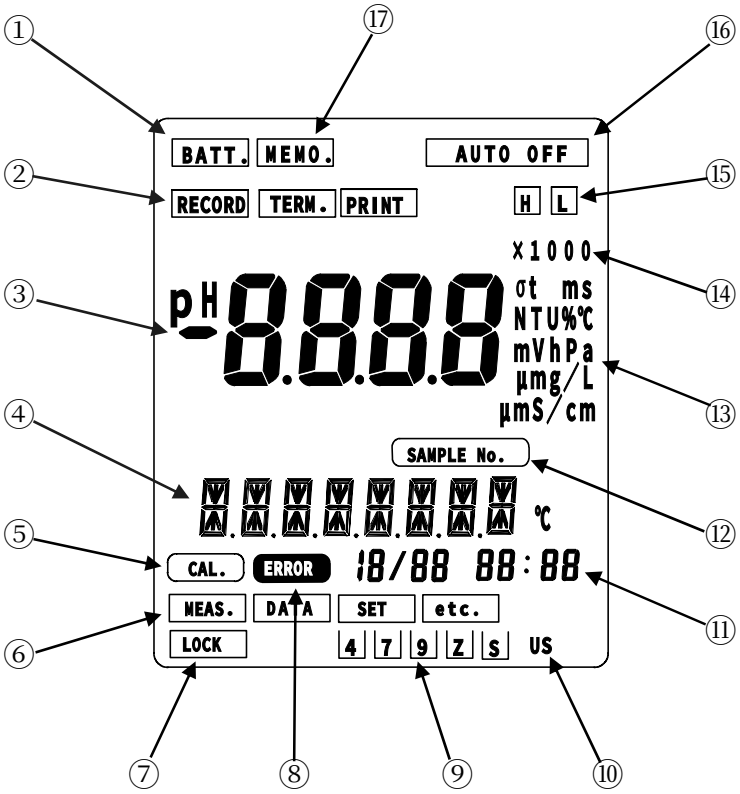
3. Name and function of each section

3.1 Terminal



①	Connection cable connector	
②	Display	
③	Operation panel	
	POWER key	Turns ON/OFF the Power Supply.
	CHANNEL key	Changes measurement item.
	FUNCTION key	Changes display mode.
	SELECT/CLEAR key	Used to change setting function and perform Clear function.
	▲ ▼ ▶ key	Used to change numeric value and function.
	CAL/ENT key	Used to perform calibration and determine changed value and function.
	DATA IN key	Used to memorize data and perform manual printing by external printer.
④	Battery case cover	
⑤	Output case cover	

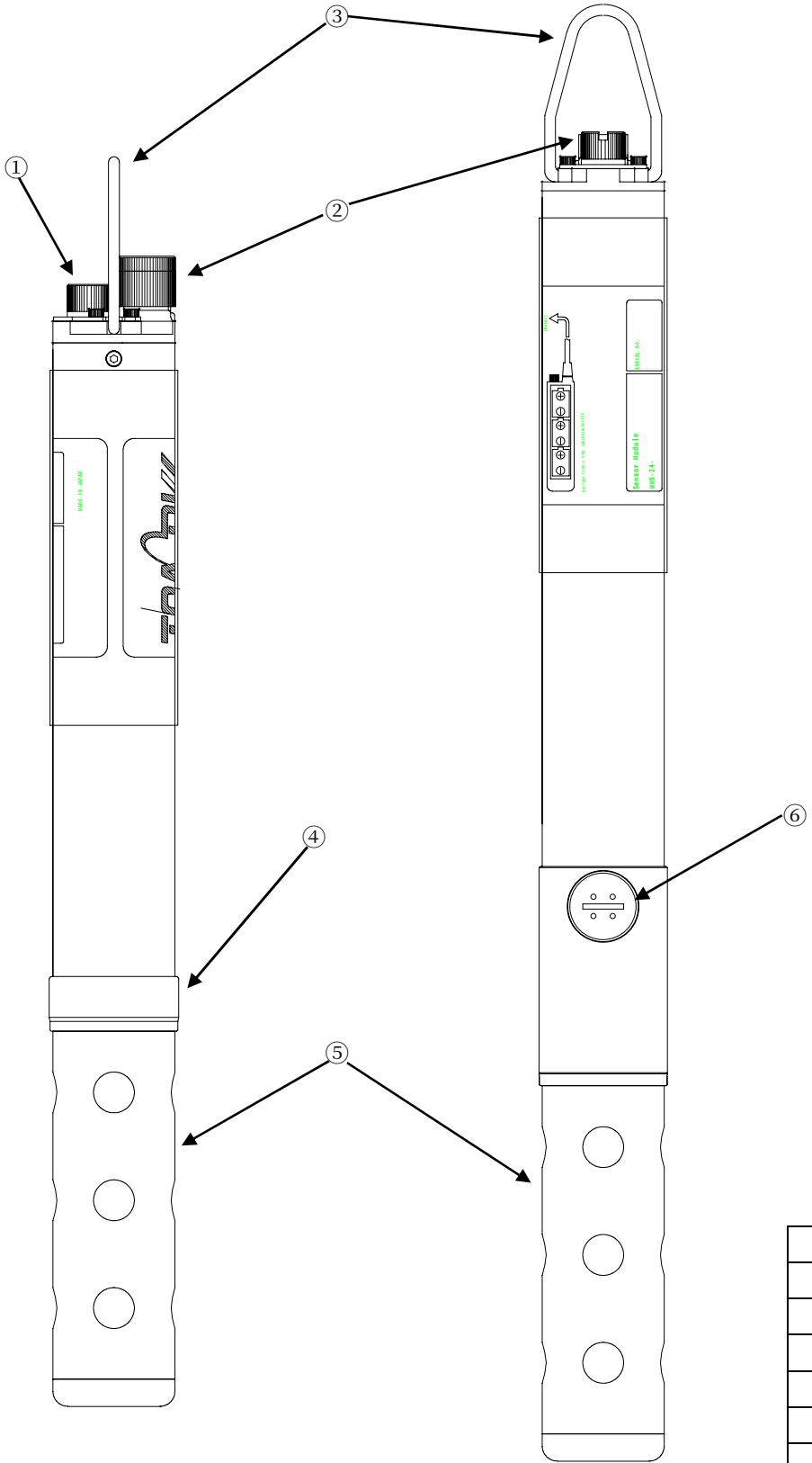
3.2 Display



①	Lights up when battery power came down.
②	Use mode type area
③	Data area Displays measured data, memory data, parameter value and year (When time is set).
④	Item name area Displays indicated item name, parameter, error message, sample No., and so on.
⑤	Calibration indicator Lights up or blinks during calibration.
⑥	Display type area
⑦	Lights up when key is locked.
⑧	Blinks when error has occurred.
⑨	Displays calibration status.
⑩	Lights up when the pH standard solution was set as US standard.
⑪	Time area Displays current time, time of last calibration, time of data memorization and error code.
⑫	Lights up when displaying memory data.
⑬	Displays the unit of displayed data on the Unit area.
⑭	Displays numeric value of four figures or more.
⑮	Lights up during Upper/Lower limit alarming.
⑯	Indicated when the Auto Power OFF was set.
⑰	Blinks approx. two seconds when recording data.

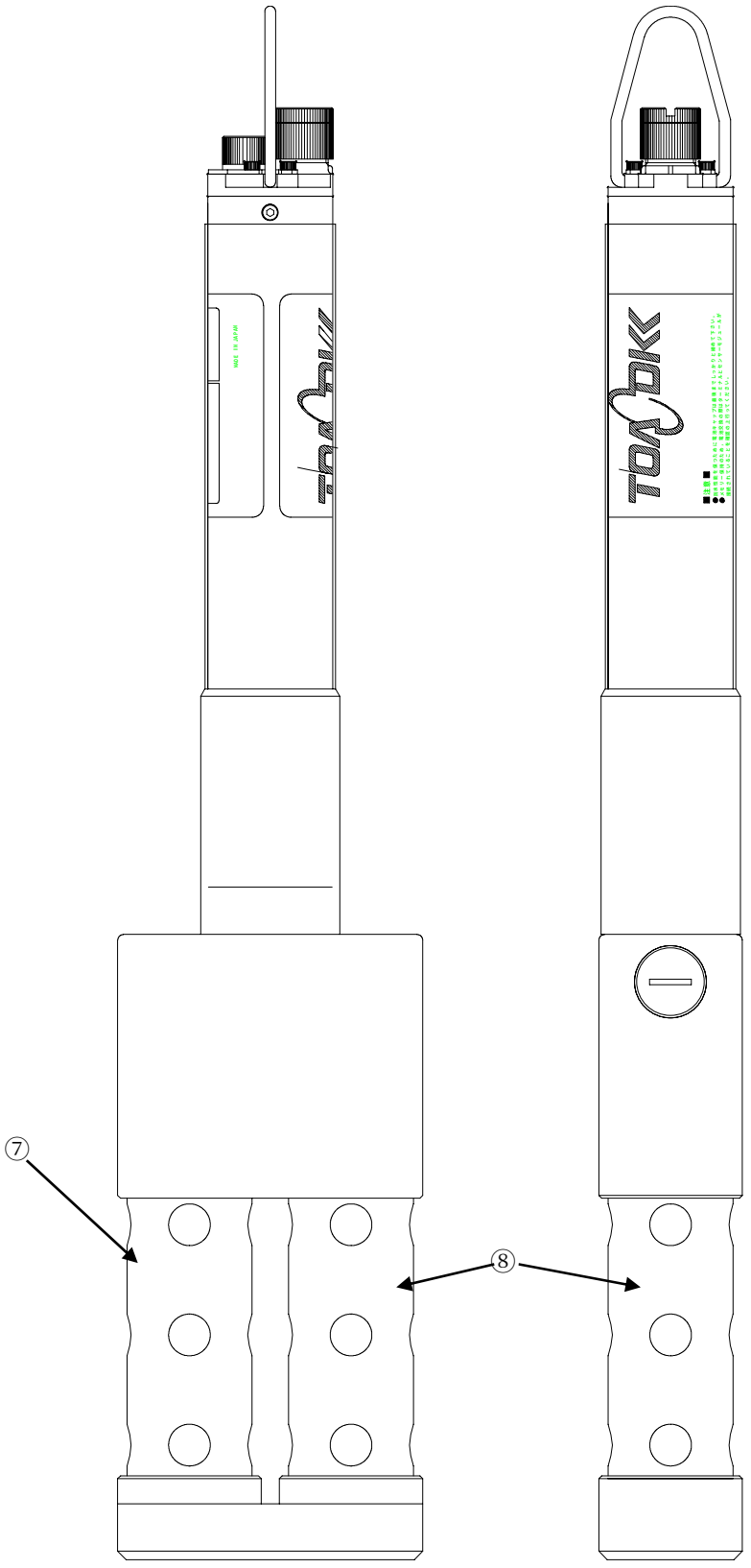
3.3 Sensor module

(1) Standard module **(2) Standard module (with depth sensor)**



	Name
①	Battery cap
②	Connector cap
③	Hook
④	Reinforced band
⑤	Protective sheath
⑥	Depth sensor

(3) Ion/Chlorophyll module

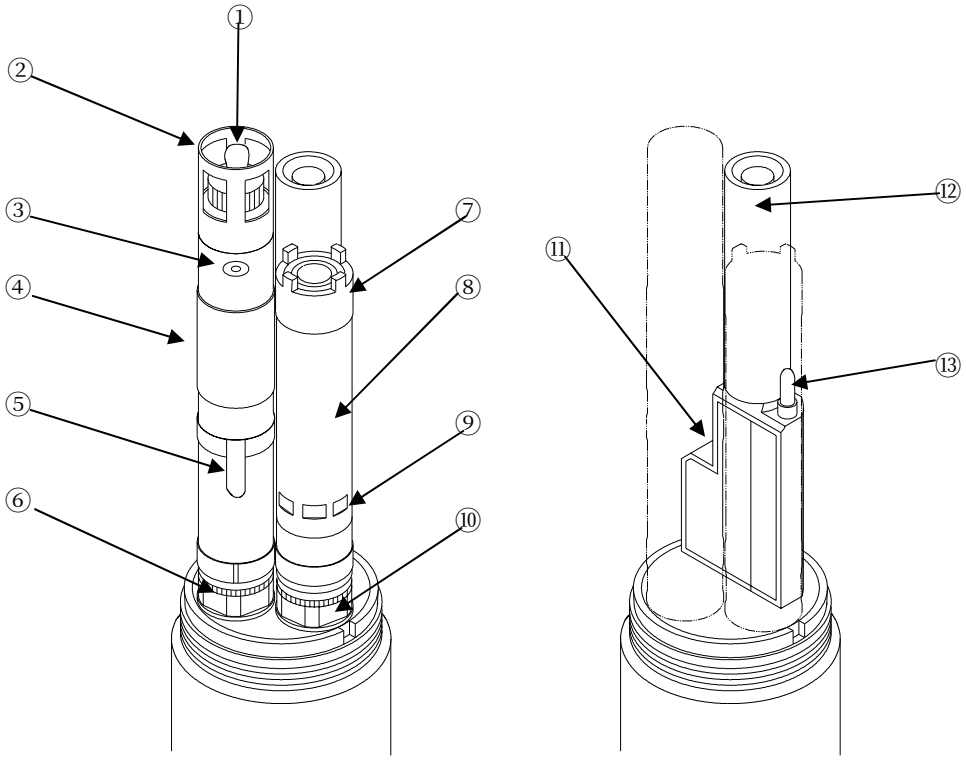


	Name
⑦	Standard module
⑧	Extended module

Front　　Extended module side

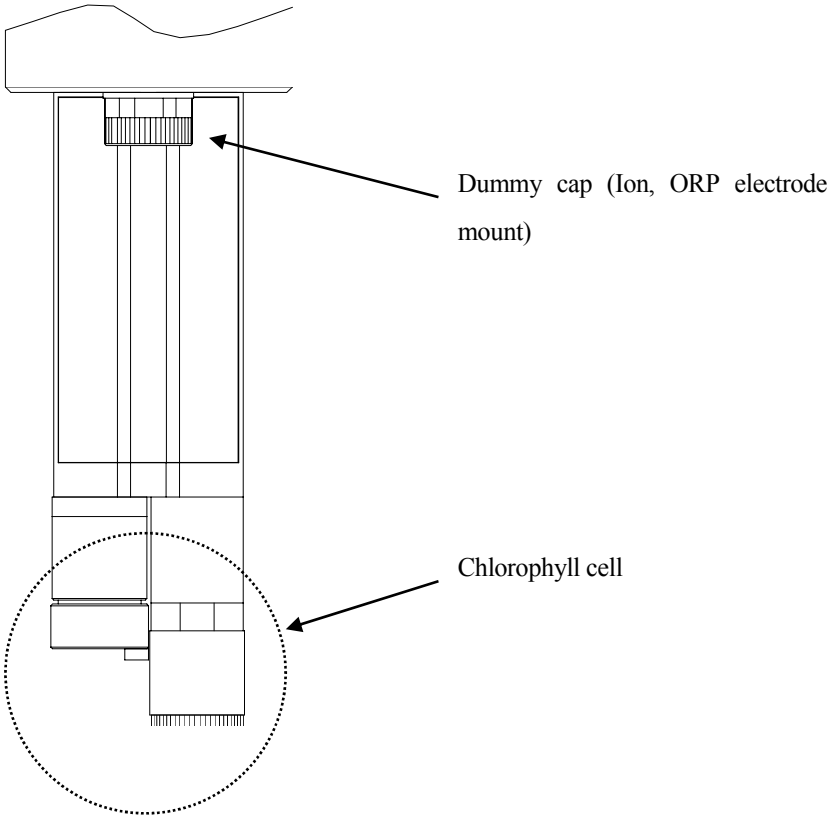
3.4 Sensor

(1) Standard sensor

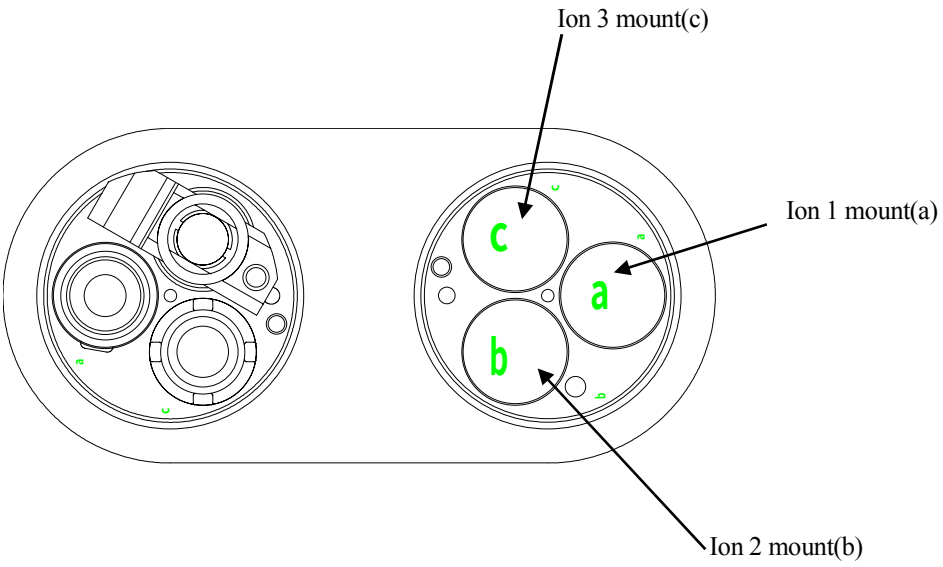


		Name
pH elect-rode	①	Glass electrode chip
	②	Protective cover
	③	Liquid junction section（replaceable）
	④	Reference electrode
	⑤	Refilling tap or plug
	⑥	Electrode fixture nut
DO elect-rode	⑦	Diaphragm set
	⑧	Outer sheath
	⑨	Wrench hook
	⑩	Electrode fixture nut
	⑪	Turbidity cell
	⑫	Specific electric conductivity cell
	⑬	Thermo-sensor

(2) Chlorophyll sensor



(3) Ion sensor　Ion electrode mounts



(Viewed from the bottom)

4. Setup

4.1 Setup of electrode

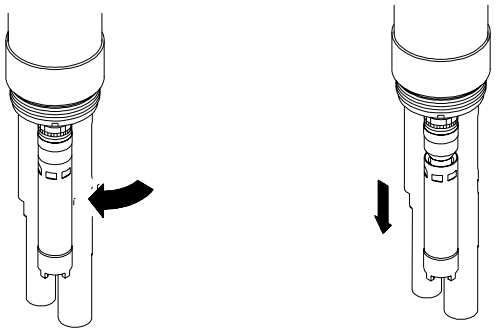
Take off the Protective sheath on turning it counterclockwise.

（1）DO electrode

① Take off the label

Pell off this tape and put electrolyte. このテープをはがして電解液を 入れて下さい。

attached to the DO electrode and take off the Outer sheath of the DO electrode on turning it counterclockwise.



② Turn lightly clockwise the Diaphragm set on the top and check that it is tightened. Just turning lightly is enough for checking.

③ Put fully the electrolyte into the Outer sheath. Make sure that no air bubble remains inside the Outer sheath or screw portion. If the air bubble remained, take it away on tapping with finger softly it or discharge the electrolyte and put it again.

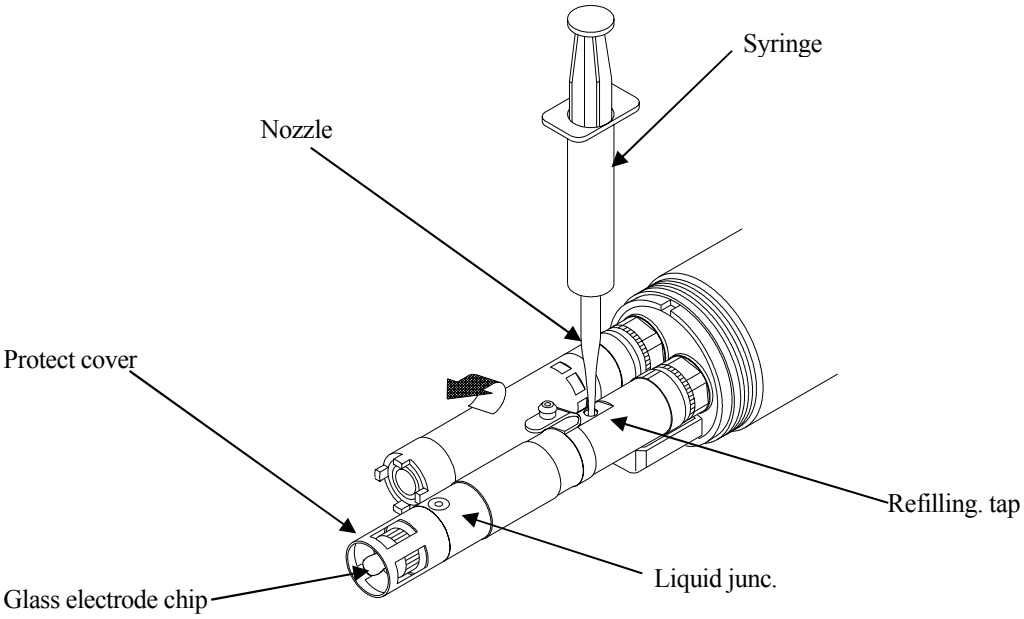
④ Attach the Outer sheath filled with electrolyte to the Electrode main body. Screw it in slowly on overflowing the electrolyte until it stops lightly so that no air bubble remains.

⑤ Leave it approx. five minutes so that remaining air bubbles come together. Take off the Outer sheath slowly and fill the electrolyte fully so as to drive away the bubbles and attach the Outer sheath again to the Electrode main body slowly to the end.

⑥ Wash away adherent overflowed electrolyte with the pure water or running water.

（2）pH electrode

① Check that there remains no air bubble in the Reference electrode. If there was bubble larger than 1mm, fill in the attached Reference electrode gel liquid to drive away bubbles inside.



② Wash away overflowed Reference electrode gel liquid with the pure water or running water.

③ Take off the Protective cap on the top. (Do not take off the Protective cover.)

（3）Ion electrode and ORP electrode

For measurement of ORP using the standard sensor module, remove the glass electrode chip and mount the OPR electrode chip (ELM-004/Optional).

Measurement should carried out in accordance to 7.1(4) and make the setting items to ORP

To measure ORP, separately from pH, using the ion sensor module or chlorophyll module, and to measure the ion, take steps as follows:

① Make preparation for the comparison electrode (ELR-001/optional), the ion electrode chip to be measured (optional), and ORP electrode chip (ELM^004/optional).

Two or three items of ions are required with the ion sensor module. Two or three comparison electrode are also required when mounting ORP electrode

*The ammonium electrode (ELX-002) is the integrated type with comparison electrode.

② Attach the ion electrode chip and the ORP electrode chip to the comparing electrode.

③ For the ammonium electrode, fill the internal solution.

④ Make sure the comparison electrode gel internal solution in similar way with the pH electrode, and make

up when necessary.

⑤ Remove dummy caps of the ion sensor module and the chlorophyll module. Don't remove dummy caps of electrode mounts not in use.

⑥ Apply a thin film of silicone grease, which is supplied as standard, to O-ring of the comparison electrode connector

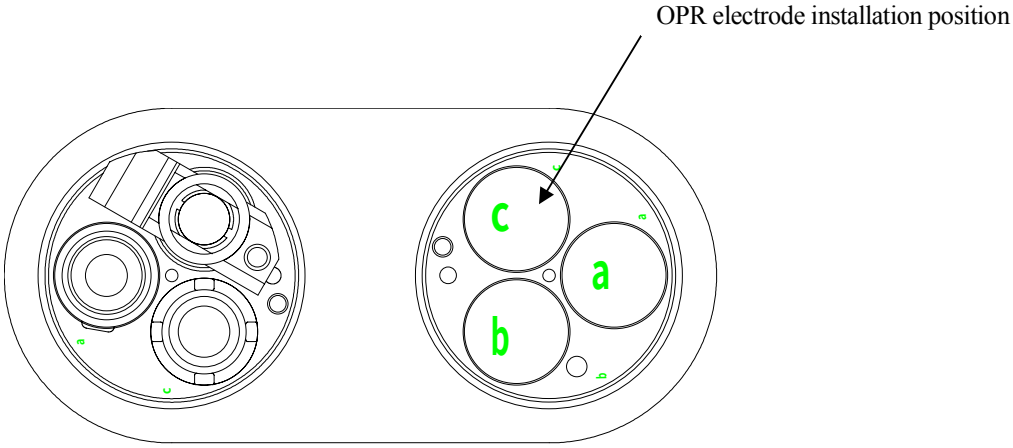
⑦ Insert an electrode into the electrode mounts of ion sensor module and chlorophyll module, and turn lightly until grooves are aligned.

⑧ Push the electrode and tighten the electrode fastening nut clockwise with a hand

⑨ Repeat it and tighten to the end with a hand

⑩ Set items in accordance to 7.1(16) along the type of mounted electrode.

⑪ For the ion sensor module, mount the OPR electrode at the position of c.



Ion sensor module (views from the bottom)

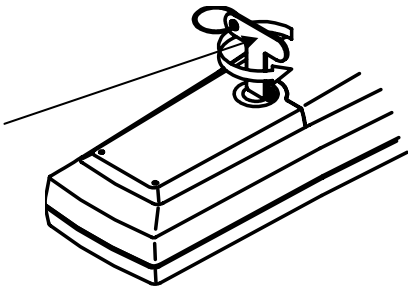
CAUTIONS	
	Pay attention not to let the electrolyte or Reference electrode liquid enter your eye. Never drink it. Wash out if one of them put on the skin, though it is not toxic. If you had scratch on the skin, it may hurt you. Put on gloves. If it entered into your eye, wash out it with a large amount of water and consult with a doctor when necessary. If you swallowed it by mistake, vomit it up immediately and consult with a doctor when necessary.

4.2 Setting of batteries

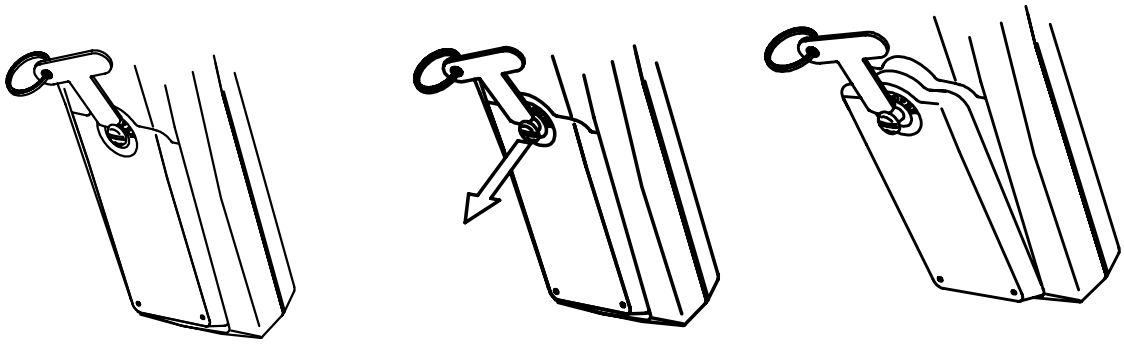
（1）Setting of Terminal batteries

① Apply the attached special driver to turn the screw of the Battery cover over 180 ° to the direction of the arrow to loosen the cover.

Special driver

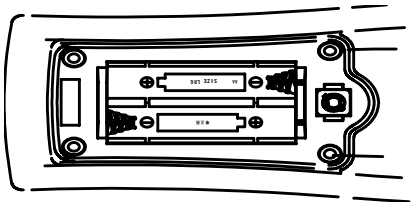


② Turn over the main body (Battery cover goes down) so that the screw head comes up. Pull it by fingers or put the special driver into the screw section as illustrated below and pull it to the arrow direction to take off the cover.



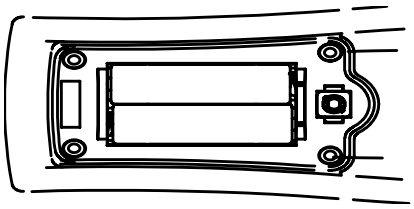
③ Check the setting direction of batteries.

Check the setting.direction



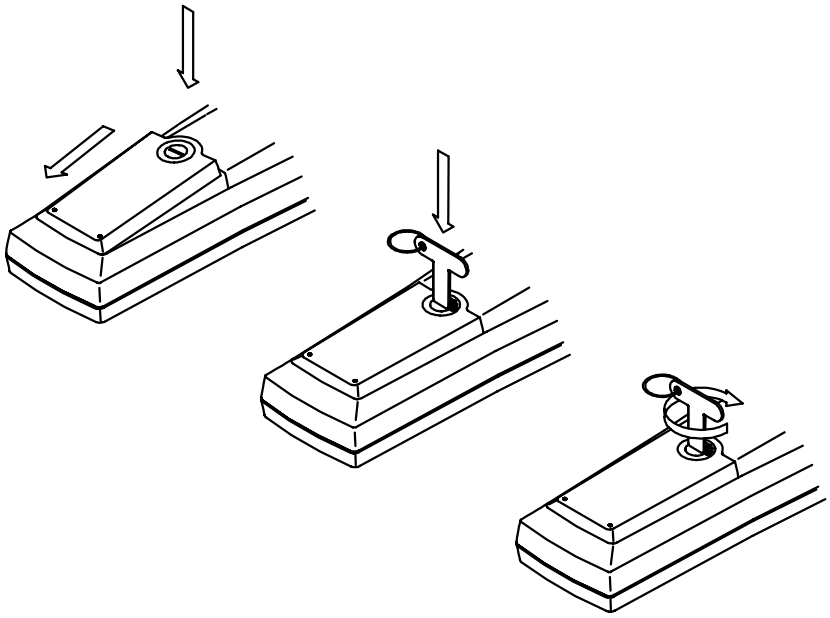
④ Set two AA alkaline batteries in the Battery holder. Battery works approx. forty hours (Work time may change depending on the battery performance, using environment, and so on).

Set batteries.



CAUTIONS

- Make sure ＋－ of the battery.
- BATT. Replace batteries if the indication on the left lit up.



⑤ Hook the Battery cover claw onto the main body and press it down on pushing it to the arrow direction.

Precautions on Battery cover setting

- Check whether the silicon packing is correctly attached in the groove of the Battery cover reception section of the main unit. If not, attach it correctly.
- Check that there is neither scratch nor dust on the silicon packing.

⑥ Apply the special driver to turn the screw to the arrow direction on pushing it. Tighten it until the ⊖ screw head comes to the horizontal position.

（2）Setting of Sensor module battery

Precautions

- Set brand new alkaline batteries.
  Memorized data would be deleted if used up batteries during operation.

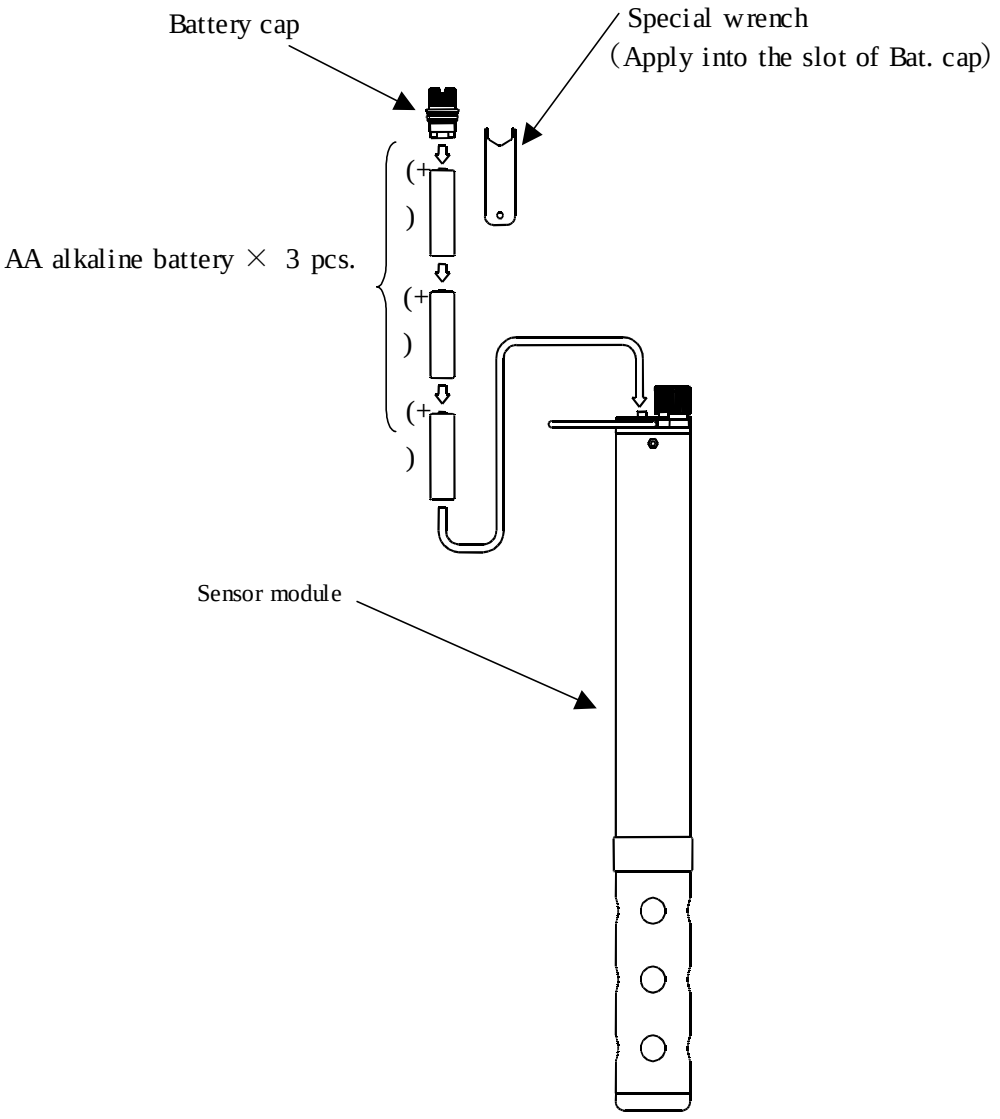
- To replace Sensor module batteries, make sure to connect it to the Terminal that has sufficient battery power and turn OFF the Terminal power supply before replacement. Memorized data would be deleted if you take out the Sensor module batteries without connecting it to the Terminal.

Three AA alkaline batteries shall be put in the Sensor module.

Turn the Battery cap counterclockwise to open it. If it was tight, apply the side of special wrench into the slot of the cap and turn it.

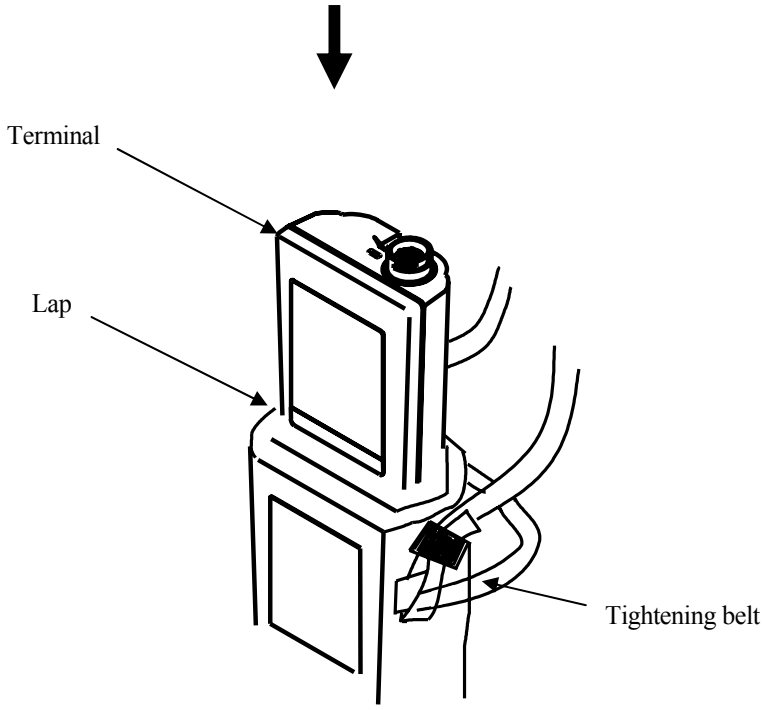
Set batteries on putting the positive pole (＋) up.

Check that there is no dust on the O-ring before closing the Battery cap, and then tighten it to the end. Apply attached silicon grease lightly on the O-ring when necessary before tightening.



4.3 Setting of Soft case

Push the Terminal into the top of the Soft cover and lay over the Lap on the front upper corner of the Terminal. Connect the Connection cable to the Connector and tighten the Ring catch of the cable, then hook the ring cap it onto the Belt to fix it.

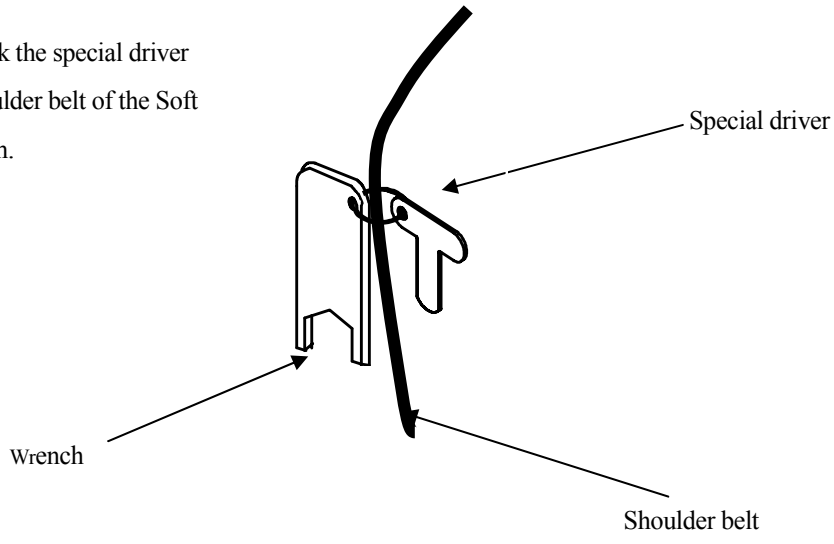


CAUTIONS

- To protect the Connector make sure to put the Soft case, tighten the Ring catch and hook it onto the belt.

4.4 Setting of special driver and wrench

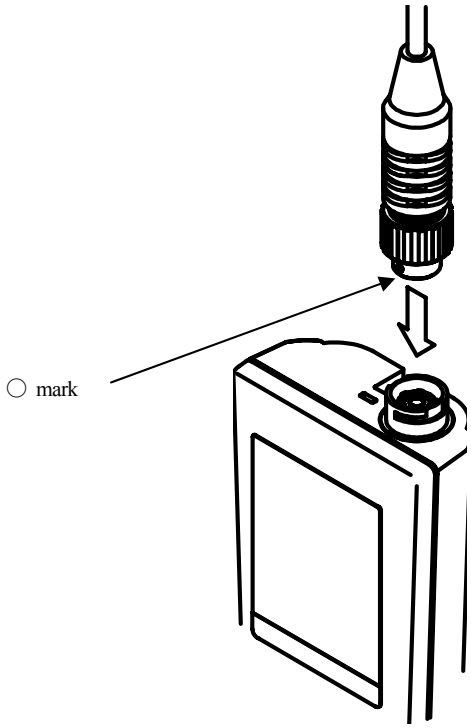
It is recommended to hook the special driver and wrench onto the Shoulder belt of the Soft case to avoid loosing them.



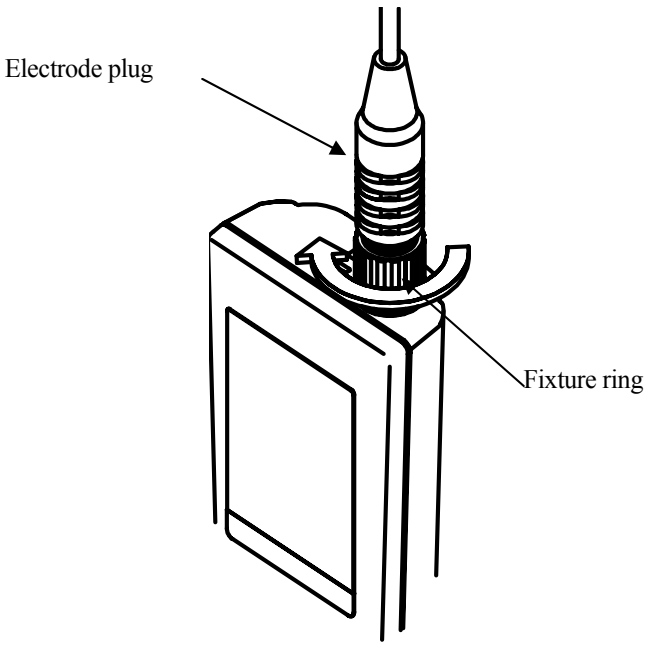
4.5 Setting of Connection cable

① Check that the Power Supply is turned OFF.

② Put the Electrode plug so that its "○" mark on the top comes to the front face and push it straight into the electrode jack on the top of the main unit.



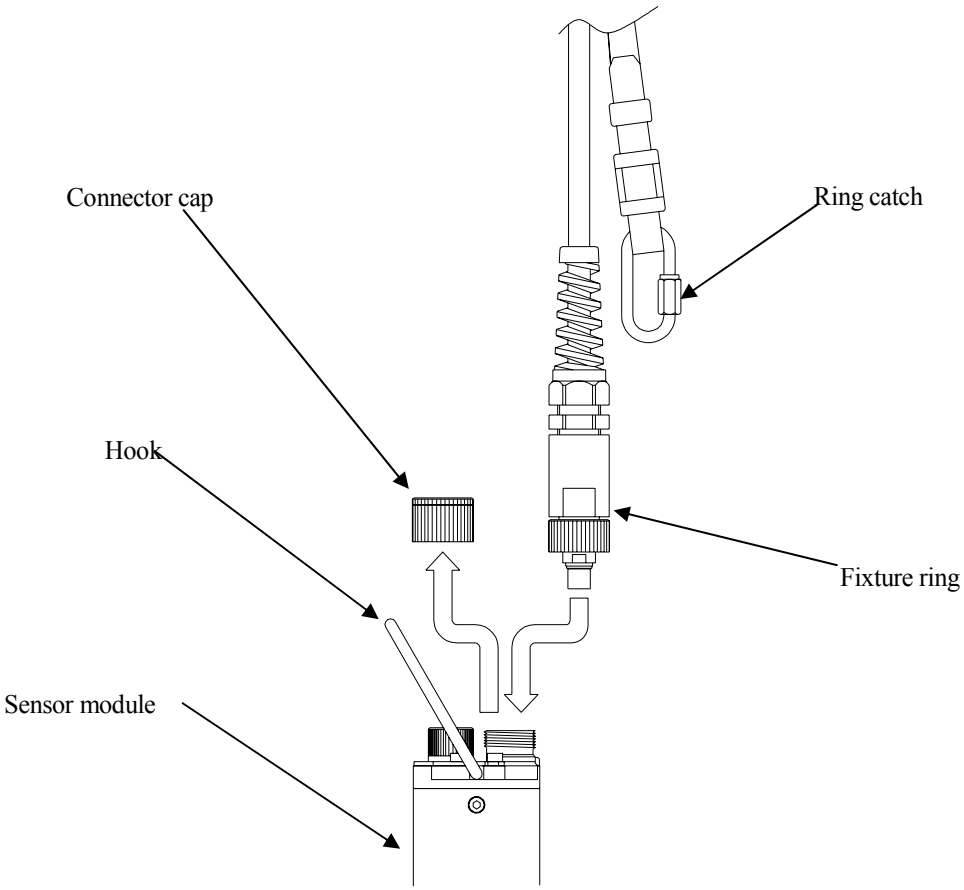
③ Turn only the Fixture ring to fix the Electrode plug. Do not turn the plug.



④ Next, take out the Connector cap and connect the Sensor module connector.

Turn the Connector lightly so that its slots inside meet the counterpart, and then tighten it to the end on pushing the Fixture ring.

Put the Ring catch onto the Hook to fix the Connector.



CAUTIONS

- Make sure that the Power Supply is turned OFF to plug in/out the Connector.
- Tighten the Connector tight to ensure the waterproof performance. Check further that there is no dust on the O-ring.
- Do not turn or move the Connector itself as it might give damage to the Terminal plug and Connector. Be sure to plug in and out straight.
- For the measurement on the place where the load by the water flow rate is anticipated, use together rope, wire and so on to protect the Connection cable and Connector from direct load.

5. Basic key operation

5.1 Outline of key function

POWER key

Turns ON/OFF the Power Supply.

FUNCTION key

Every time you press this key, Measured data display, Memory data display, Measurement parameter setting and System parameter setting are respectively selected in order.

Displayed item appoint area

Measured data display····· MEAS.
Memory data display····· DATA
Measurement parameter setting····· SET
System parameter setting ····· etc.

SELECT/CLEAR key

Switches the parameter on Measurement parameter setting and System parameter setting.

CHANNEL key

Shifts displated item on Measured value display, Memory data display and Measurement parameter setting.

DATA IN key

Manually memorizes and outputs measured values.

CAL/ENT key

① Performs calibration.
② Determines set value on Measurement parameter setting and System parameter setting.

▲, ▼ key

① Changes the Memory data No. one by one on Memory data display.
② Parameter value blinks and becomes ready to change when pressed once on Measurement parameter setting and System parameter setting.
③ Parameter value is changed when pressed while the value is blinking on Measurement parameter setting and System parameter setting.

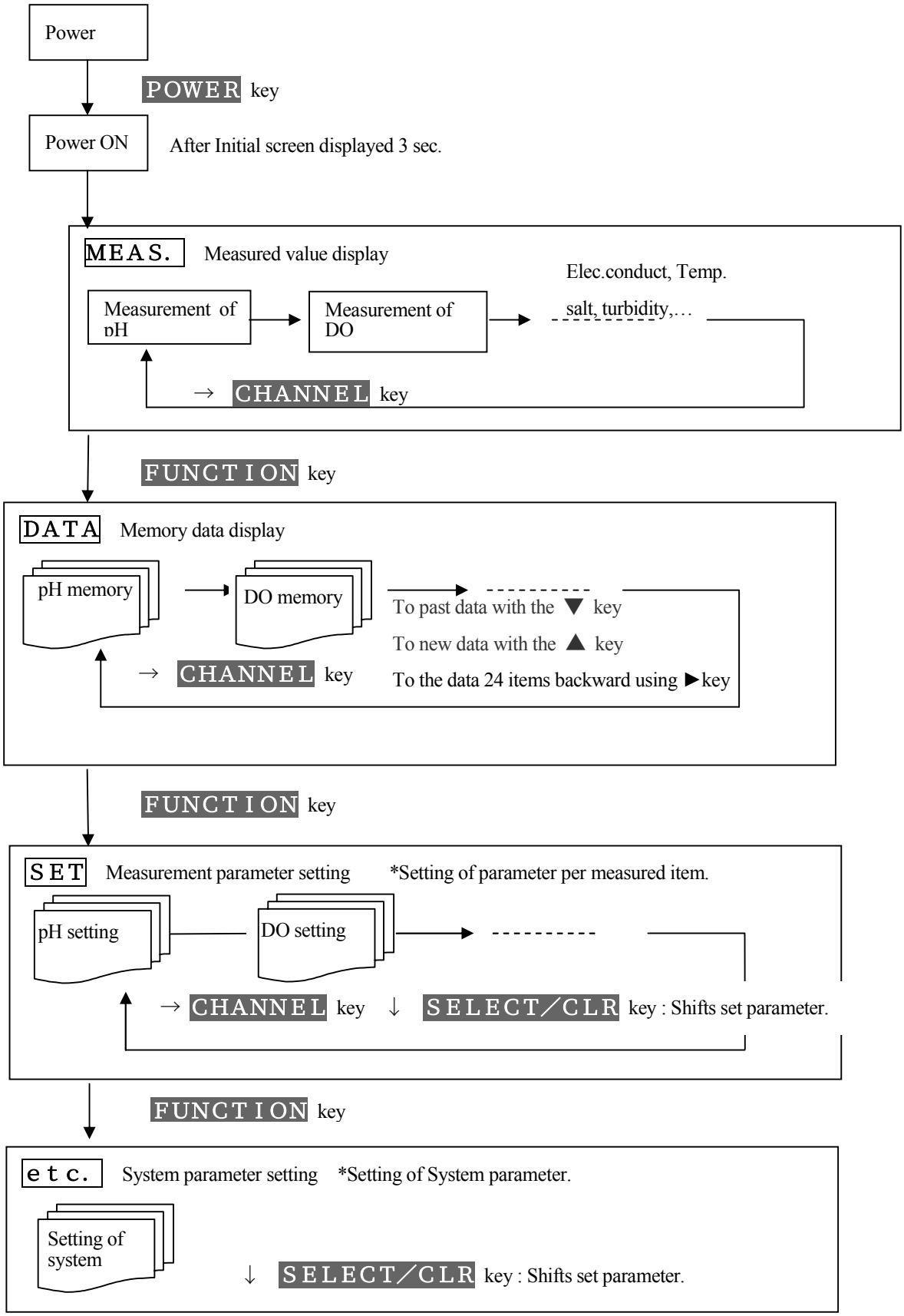
▶ Key

① Used to move onto the figure to change during setting the numeric value parameter.

② Return to before parameter on Measurement parameter setting and System parameter setting.

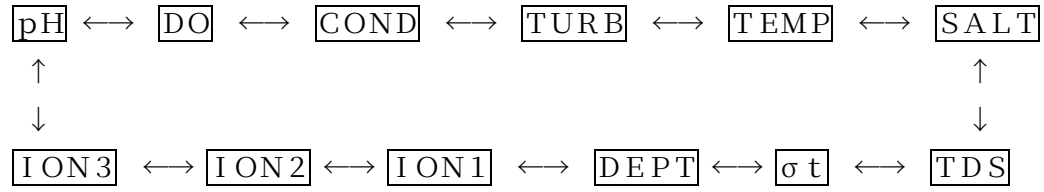
5.2 Screen flow chart

（1）Overall flow chart



(2) MEAS. screen (Measured value screen)

CHANNEL key: Displayed item changes in following order when this key is pressed.

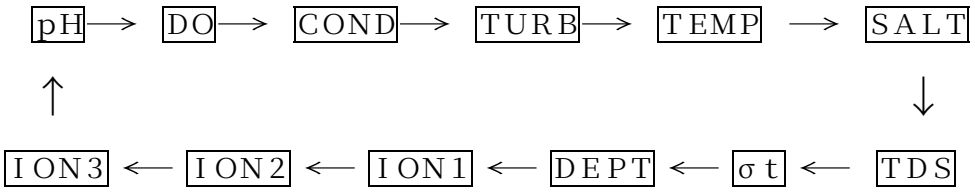


∗For SALT TDS σt DEPT ION1 ION2 ION3 they are indicated when the setting of indication is set to ON at the time of setting of each item.

∗For ION1 ION2 ION3 indication items which have been set are shown.

(3) DATA screen (Memory data display screen)

CHANNEL key: Displayed item changes in following order when this key is pressed.



▲key: increases SAMPLE No. by one and displays new data.

▼key: decreases SAMPLE No. by one and displays old data.

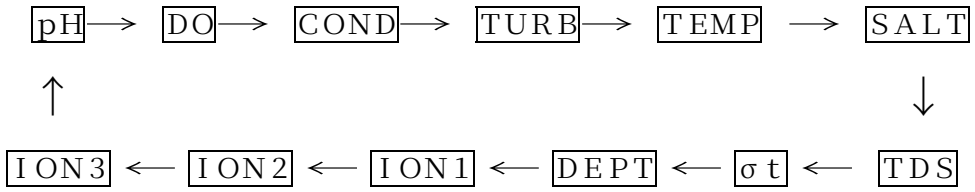
The data 24 items backward is indicated using ►key

∗For SALT TDS σt DEPT ION1 ION2 ION3 they are indicated when the setting of indication is set to ON at the time of setting of each item.

∗For ION1 ION2 ION3 indication items which have been set are shown.

(4) SET screen (Measurement parameter setting screen)

CHANNEL key: Displayed item changes in following order when this key is pressed.



SELECT/CLR key: Changes the Measurement parameter for displayed objective set item.

Also displayed are optional items not available for the standard module.

<Table of Measurement parameter for respective item> ***Italic : Initial value***

CH	Select	Contents	Indication	Remarks
1	1	pH low limit alarm	pH.ALML	***OFF***, 0.00 - 14.00(pH) -2000 - 2000mV(ORP)
	2	pH high limit alarm	pH.ALMH	
	3	pH standard solution standard selection	pH BUFFER	***JIS***, US
	4	pH/ORP selection	pH.SLCT	***pH***, ORP
2	1	Dissolved oxygen low limit alarm	DO.ALML	***OFF***, 0.00 - 20.00mg/L 0 - 200%
	2	Dissolved oxygen high limit alarm	DO.ALMH	
	3	Dissolved oxygen unit (saturation vol selection)	DO.UNIT	***mg/L(JIS)***,%,mg/L(SEA)
	4	Dissolved oxygen salt compensation	DO.SALT	ON, **OFF**
	5	Dissolved oxygen pressure compensation	DO.PRES	***1013***, 100 - 1999hPa, OFF
3	1	Elec. cond. low lim. alarm	COND.ALML	***OFF***, 0.00 - 10.00S/m
	2	Elec. cond. hi. lim. alarm	COND.ALMH	
	3	Elec. conductivity range	COND.RANG	LO, MID, HI, ***AUTO***
	4	Temperature compensation ratio	TENP.COFF	0.00 - 5.00,***2.00%***
4	1	Turbidity lo. lim. alarm	TURB.ALML	***OFF***, 0.0 - 800.0NTU 0.0 - 800.0mg/L
	2	Turbidity hi. lim. alarm	TURB.ALMH	
	3	Turbidity unit selection	TURB.UNIT	***NTU***, mg/L
5	1	Water temp. lo. lim. alarm	TEMP.ALML	***OFF***, -5.0 - 55.0
	2	Water temp. hi. lim. alarm	TEMP.ALMH	
	3	Water temp. display after decimal point	TEMP.DEC	***1***, 2(figure)
	4	Temp. compensation calculation	TEMP.CALC	***ON***, OFF
6	1	Salt lo. lim. alarm	SALT.ALML	***OFF***, 0.00 - 4.00%(NaCl) 0.0 - 40.0(SEA)
	2	Salt hi. lim. alarm	SALT.ALMH	
	3	Salt display	SALT.DISP	***ON***, OFF
	4	Salt reference selection	SALT.CALC	NaCl, ***SEA***
7	1	Total dissolved solids(TDS) lo. lim. alarm	TDS .ALML	***OFF***, 0.0 - 100.0g/L
	2	T DS hi. lim. alarm	TDS .ALMH	
	3	T DS display	TDS .DISP	***OFF***, ON
	4	T DS coefficient	TDS .FACT	0.50 - 0.99, ***AUT***
8	1	Sea water specific gravity low limit alarm	σt.ALML	***OFF***, 0.0 - 50.0 σt
	2	SW SG high limit alarm	σt.ALMH	
	3	SW SG display	σt.DISP	***OFF***, ON
	4	SW SG reference temp.	σt.TEMP	σ0, σ15, ***σt***
9*	1	Water depth lo. lim. alarm	DEPT.ALML	***OFF***, 0.0 - 100.0m
	2	Water depth hi. lim. alarm	DEPT.ALMH	
	3	Water depth display	DEPT.DISP	***OFF***, ON
10*	1	Ion 1 low limit alarm	ION1.ALML	***OFF***, 0.0 - 62000mg/L(ION) 0.0 - 400 μg/L(CHLO)
	2	Ion 1 high limit alarm	ION1.ALMH	
	3	Ion 1 display	ION1.DISP	***OFF***, ON

CH	Select	Contents	Indication	Remarks
	4	Ion type selection	ION1.SLCT	NH4,NO3,CL,CA,***F***,K,CHLO
11*	1	Ion 2 low limit alarm	ION2.ALML	***OFF***,0.0 - 62000mg/L
	2	Ion 2 high limit alarm	ION2.ALMH	
	3	Ion 2 display	ION2.DISP	***OFF***,ON
	4	Ion type selection	ION2.SLCT	***NH4***,NO3,CL,CA,F,K,
12*	1	Ion 3 low limit alarm	ION3.ALML	***OFF***, 0.0 - 62000mg/L(ION) -2000 - 2000mV(ORP)
	2	Ion 3 high limit alarm	ION3.ALMH	
	3	Ion 3 display	ION3.DISP	***OFF***,ON
	4	Ion type selection	ION3.SLCT	NH4,NO3,CL,CA,F,K,***ORP***

＊Optional items that are not available for the standard Sensor module.

(5) etc. screen（System parameter setting screen）

SELECT／CLR key changes the System parameter.

<List of System parameter> ***Italic：Initial value***

Select	Contents	Indication	Remarks
1	Use mode	USE .MODE	***RECORD***,TERM.,PRINT
2	Auto Power Off	AUTO.OFF	***ON***,OFF
3	Record mode	REC .MODE	***MANUAL***, ALWAYS,SETTING
4	Record start	REC .START	***2003.1/01 0:00***
5	Record end	REC .END	
6	Record interval (hour, minute)	REC .INTVL	00:00 - 23:59,***1:00***
7	Clock setting	CLOCK	***2003.1/01 0:00***
8	GPS use	GPS .USE	***OFF***,ON
9	Latitude data	LATI.	***N035.40.15***
10	Longitude data	LONGI.	***E139.45.22***
11	Analogue output 1	ANALOG1	1 - 12(channel),***1(pH)***
12	Analogue output 2	ANALOG2	1 - 12(channel),***5(Temp)***
13	Key lock	KEY.LOCK	***OFF***,ON
14	Memory data print	PRT.START(END,YES)	0000 - 3360,***0001***
15	Memory data clear	CLR START(END,YES)	0000 - 3360,***0001***
16	External system output	TERM.CMD	12 figures, ***0000 00000000***
17	Parameter print	PARA.LIST	***OFF***,ON

*Setting range of Year, Month, Hour and minute（Record Start, End, Clock） 2000.01.01 00：00 - 2099.12.31 23：59

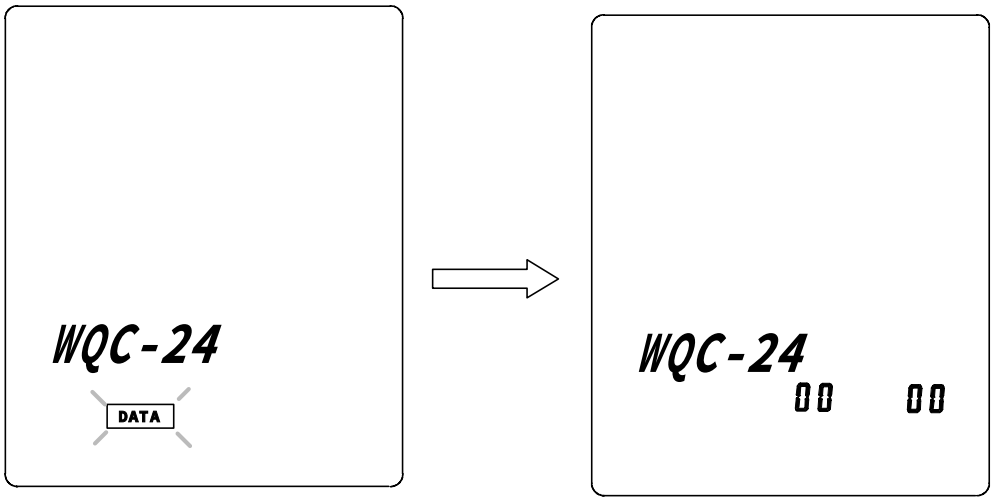
* Memory data print and Parameter print are available to set only when the Use mode is PRINT.

5.3 Power Supply turn ON

POWER key: Turns ON the Power Supply when pressed.

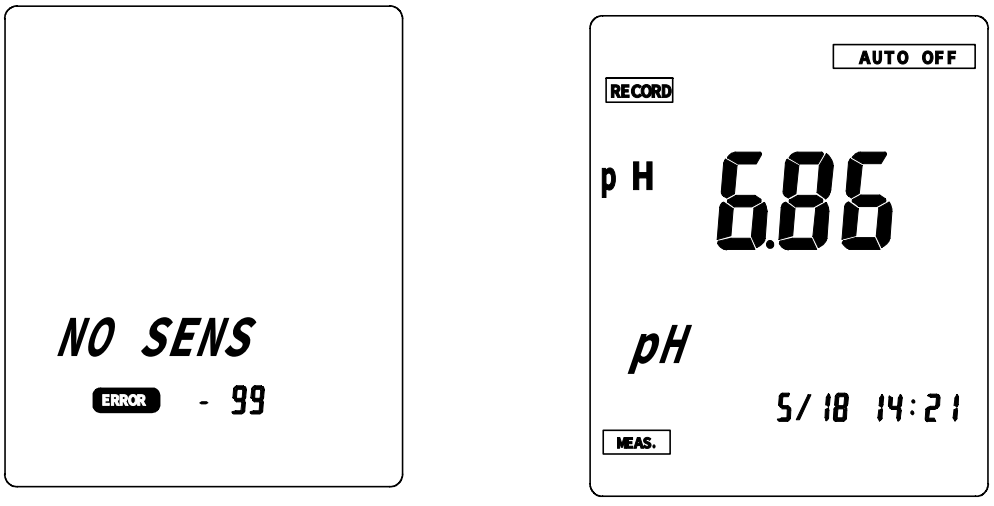
Model name WQC−24 is displayed. After DATA has blinked, Initial screen changes to the pH display screen.

If there was error in the connection of the cable, following the Initial screen NO SENS ERROR 99 is displayed and shut down. In this case, check the connection among Terminal, Sensor module and Connection cable.



Immediately after power supply ON

Initial screen



Connectied error

Measurement screen

How to deal with troubles

WARNING	
	If you noticed anomaly, turn OFF the Power Supply and take off batteries. When you use the optional AC adapter, turn OFF the Power Supply and take out the AC adapter of the plug outlet. There is risks of fire, internal burst and so on if you have done wrong operation, noticed burning smell, smoking and so on. Make sure that the fire or smoke is put out, then contact the dealer or us. Do not try to repair by yourself. It is dangerous. Operation in abnormal condition may cause the fire and electrical shock.

5.4 Parameter setting procedure

Described here are common procedure to set parameters.

（1）Measurement parameter

① On the Measurement screen MEAS., press FUNCTION key twice to change it to SET screen.

② On this SET screen, press CHANNEL key or ▶ key to display measurement items to set.

③ Press SELECT/CLR key: to displays the parameter to set.

④ When ▲ or ▼ key is pressed, the parameter item starts blinking and becomes ready to set.

⑤ When the parameter was numeric value, the numeric value on a figure available to change blinks.

⑥ Press ▶ key to move the figure of the parameter value.

⑦ If further ▲ or ▼ key is pressed, that changes the parameter item and numeric value.

⑧ On the Upper/Lower limit value setting display, when *OFF* is displayed, if ▲ or ▼ key is pressed, *OFF* blinks. If further ▲ or ▼ key is pressed, the display changes to the numeric value display and it becomes ready to move the figure and change values.

⑨ When highest numeric value is blinking, if you continue pressing ▼ key, it returns to *OFF* .

⑩ When completed set value change, press CAL/ENT key to determine the setting.

（2）System parameter

① On the Measurement screen MEAS. , press FUNCTION key three times to change it to etc. screen.

② etc. On this etc. screen, press SELECT/CLR keyor ▶ key to display parameter to set.

③ When ▲ or▼ key is pressed, the parameter item blinks and becomes ready to set.

④ If the parameter was numeric value or Year/Month/Date/Hour/Minute, the numeric value on a figure available to change blinks.

⑤ Press ▶ key to move the figure of the parameter value.

⑥ If further ▲ or ▼ key is pressed, that changes the parameter item and numeric value.

⑦ When completed set value change, press CAL/ENT key to determine the setting.

6. Measurement

Time, calibration and Measurement mode shall be set to perform measurement.

Also, calibration data has to be deleted when necessary before calibration.

CAUTIONS

- For items pH and DO,ion,chlorophill make sure to perform calibration. During continuous operation also, perform calibration once a week.

For items other than pH and DO, normally calibration is not necessary.

However, perform calibration when using data together with the data measured by other equipment or when the calibration value was considered not correct due to deterioration and/or stain on the Electrode or Cell.

6.1 Time setting

① On the Measurement screen, press FUNCTION key to get to etc. screen（System parameter setting screen）.

② Continue pressing SELECT／CLEAR key to change the Parameter display to *CLOCK*.

③ If ▲ or ▼ key is pressed, ten figure of the dominical year starts blinking and becomes ready to set.

④ ▶ key: When pressed this key, blinking figure moves one by one in the order of Year, Month, Date, Hour and Minute.

⑤ When the value to set is blinking, press ▲ or ▼ key to change the value.

⑥ After completed all setting of year, month, date, hour and minute, press CAL／ENT key to determine them.

⑦ CAL／ENT key: When pressed, the clock starts on 00 sec. of that time.

6.2 Display and clear of the calibration data

（1）How to clear the calibration data

In following cases, clear the calibration data before perform calibration.

<1> Calibration error occurs even there is no problem on the Electrode, Cell, calibration liquid, and so on.

<2> When changed any of following settings;

pH : Standard solution type JIS ←→ US

DO : Unit mg/L(JIS) ←→ mg/L(SEA)

Turbidity : Unit NTU ←→ mg/L

Salt : Salt reference NaCl ←→ SEA

TDS : Coefficient

ION : Ion type

（2）Display and clear of the calibration data

① On the Measurement screen, press FUNCTION key once to change it to DATA screen （Memory data display screen）.

② Continue pressing CHANNEL key to display the item to display or clear the calibration data. Before pressing FUNCTION key, it is possible to press CHANNEL key to select the item.

③ When pressed CAL/ENT key two seconds or more, a bleep sounds and the calibration data of displayed item is displayed.

④ In case there are two or more calibration data, the display changes by pressing ▲ or ▼ key.

⑤ When pressed SELECT/CLEAR key two seconds or more, a bleep sounds and the calibration data are cleared.

⑥ Regardless of the point displaying the calibration data, this one operation clears all the calibration data of selected items.

⑦ By pressing CAL/ENT key, the screen returns to the Memory data display screen.

6.3 pH calibration

Two types shown below are selectable for the type of pH standard solution.

JIS	pH4.01	pH6.86	pH9.18
US	pH4.01	pH7.00	pH10.01

JIS is the adjusted standard pH solution by JIS Z8802

US is a combination of the neutral phosphate standard solution (pH 7.00) and the carbonate standard solution (pH 10.01), which is generally used in U.S.

Set the type in agreement with the standard type of solution to be used in accordance to 7.1(3)

The initial value is ***JIS.***

For the calibration, 2- and 3-point calibration is possible. Calibrate for pH 6.86 or pH 7.00 first in any case.

Here, it is explained with the 2-point calibration using pH 6.86 (neutral phosphate standard solution) and pH 4.01 (phtalate standard solution)

On MEAS. display (Measurement screen), press CHANNEL key to display the Measurement item pH.

Prepare:

Calibration container (standard attachment) X 2, pH standard solution (6.86, 4.01), pure water water or running water.

① Fill the standard solution in the Calibration container until it comes to H line of the container.

② Wash the Sensor module with purified water or running water and wipe the water off.

③ Put the Sensor module in the Calibration container filled with pH6.86 and move it up and down two or three times.

④ Push the Sensor module deep in the Calibration container until the top of sensor module touches the bottom of the calibration containec.

⑤ Leave it until the pH indication is stabilized and press CAL/ENT key two seconds or more.

⑥ A bleep sounds and CAL starts blinking, then the calibration starts.

⑦ When the pH is stabilized, a bleep sounds again and the calibration mark 7 is displayed.

⑧ Take out the Sensor module of the Calibration container, wash it with purified water or running water and wipe the water off.

⑨ Put the Sensor module in the Calibration container filled with pH4.01 and repeat the same procedure with above ④ to ⑧.

⑩ When the pH is stabilized, a bleep sounds again and the calibration mark 4 is displayed.

⑪ To stop the calibration, press CAL/ENT key while CAL is blinking.

⑫ Follow the same procedure also to perform the calibration of pH 9.18. When the calibration is completed, the calibration mark 9 is displayed.

⑬ After having finished the calibration, wash the Sensor module with purified water or running water.

6.4 DO calibration, Setting

Only the span calibration is normally carried out. Zero calibration should be carried out when measurement is conducted at 1 mg/L or lower.

On MEAS. display (Measurement value display), press CHANNEL key to display DO on the measurement item.

（1）Setting

Item	Setting	Setting method description
Unit	***JIS*** SEA %	7.1(5)
Salt content compensation	ON ***OFF***	7.1(6)
Atmospheric pressure compensation	100～1999 (***1013***)	7.1(7)

【Unit】

For calculation of the amount of saturated dissolved oxygen, a method based upon Turuesdare's equation and a method based upon Weiss' equation, which is adopted in the Ocean Guidelines by UNIESCO.

When setting the unit to JIS, the span calibration is conducted by calculation with Turuesdare's equation and, when setting the unit to SEA, Weiss' equation is used.

This setting should be carried out before the calibration. When the setting is modified, the calibration should be carried out again.

【Salt content compensation】

With the salt content compensation is set ON, the salt content compensation is carried out using the measurements of salt content.

【Atmospheric pressure compensation】

The atmospheric pressure compensation is carried out by setting the atmospheric pressure that is measured by a barometer

The unit is hPa.

When the compensation is not carried out, set to the initial value, 1013 hPa

（2）Span calibration

The span calibration is carried out with the water vapor saturated atmosphere, for which the inside of calibration vessel is saturated with the water vapor.

Prepare:

Calibration container (standard accessories), purified water or running water.

① Put a small volume of water in the Calibration container (to approx. 5mm from the bottom).
② Wash the Sensor module with purified water or running water and wipe the water off.
③ Push the Sensor module deep in the Calibration container until its top touches the of calibration cortaiuer.
④ Leave it twenty minutes or more until the DO indication is stabilized and press CAL／ENT key two seconds or more.
⑤ A bleep sounds and CAL starts blinking, then the calibration starts.
⑥ When the DO value is stabilized, a bleep sounds again and the calibration mark S is displayed.
⑦ Take out the Sensor module of the Calibration container.
⑧ To stop the calibration, press CAL／ENT key while CAL is blinking.

＊ There is also another calibration method to use atmospheric saturated water. This time, immerse the Sensor module in the air saturation water and follow the same procedure.

＊ Aerate with an Air pump during fifteen minutes or more for conditioning on agitating the atmospheric saturated water or pure water.

（3）Zero calibration

Prepare:

Calibration container (standard accessories), purified water or running water, Sodium sulfite.

① Fill the purified water or running water in the Calibration container until it comes to H line of the container.
② Weigh approx. 8g of the Sodium sulfite powder and put it in the Calibration container.
③ Agitate the solution slowly until the Sodium sulfite dissolves.
④ Push the Sensor module deep in the Calibration container until its top touches the bottom of container.

⑤ Leave it fifteen minutes or more until the DO indication is stabilized and press CAL/ENT key two seconds or more.

⑥ A bleep sounds and CAL starts blinking, then the calibration starts.

⑦ When the DO value is stabilized, a bleep sounds again and the calibration mark Z is displayed.

⑧ Take out the Sensor module of the Calibration container.

⑨ On pouring the running water swiftly in a container such as bucket, put the Sensor module in the water and wash it thoroughly.

⑩ To stop the calibration, press CAL/ENT key while CAL is blinking.

6.5 Temperature calibration

For the temperature. it is normally unnecessary to carry out the calibration. Calibrate in the following steps when making coincidence with data measured by other equipment.

As the temperature becomes one-point calibration, calibrate at the temperature as close as possible to the temperature of actual measuring point. The range of calibration is the indicated temperature (the temperature measured by this unit) ±5.0 ℃.

Put the temperature (TEMP) on display in the measuring item by pressing CHANNEL key with the MEAS. indication (measured value indication).

Prepare:

Reference thermometer, Standard thermometer or a quasi thermometer, Constant temperature bath.

① Put the Sensor module and the thermometer into the Constant temperature bath filled with water kept in constant temperature.

② Change the displayed item on the Measurement screen to "Temperature."

③ When the indicated value is stabilized, press CAL/ENT key two seconds or more.

④ The screen changes to the Calibration value setting screen.

⑤ Use ▲▼▶ key to set the Calibration value to the value indicated by the thermometer and press CAL/ENT key.

⑥ A bleep sounds and CAL starts blinking, then the calibration starts.

⑦ When the temperature is stabilized, a bleep sounds again and the calibration mark Z is displayed.

⑧

6.6 Turbidity calibration

For the turbidity, ERO-SPAN calibration has been carried when shipped from the factory and it is possible to measure without any adjustment.

Calibrate when the intensity of the light is changed due to the contamination of cell that cannot be removed and the variation of data is resulted in, It is also possible to coincide with values measured with other equipment using the calibration function.

Prepare:

Clean water (tap water, purified water) formazin standard solution

（1）Zero calibration

① Thoroughly clean the sensor module with the tap water, purified water

② Remove contamination on the light emission unit and the light receiving unit with soft cloth, paper.

③ Put the turbidity (TURB) on the measuring screen.

④ Submerge the sensor module in clean water (tap water, purified water, etc) until the hole at upper part of the protection tube becomes invisible.

⑤ Move the sensor module up and down to remove bubbles from the light emission unit and the light receiving unit.

⑥ Upon the indication stabilized, press CAL／ENT key continuously for 2 sec. or longer

⑦ The calibration value setting screen appears.

⑧ Set the calibration value to 000.0 using ▲, ▼ and ► keys and press CAL／ENT key.

⑨ Calibration is started with a beep and flashing CAL.

⑩ The indication turns to 0.0 with a beep at 10 sec. later.

（2）Span calibration

① Thoroughly clean the sensor module with the tap water, purified water

② Remove the moisture as much as possible.

③ Dilute from the formazin standard raw solution to the correct value to be calibrated using the purified water. (100 – 400 NTU is adequate)

④ Submerge the sensor module in sufficiently stirred standard solution until the hole at the top of the protection tube becomes invisible.

⑤ Move the sensor module up and down to remove bubbles from the light emission unit and the light receiving unit.

⑥ Upon the indication stabilized, press CAL／ENT key continuously for 2 sec. or longer

⑦ The calibration value setting screen appears.

⑧ Set the calibration value to the value of the original solution of formazin using ▲, ▼ and ► keys and press CAL／ENT key.

⑨ Calibration is started with a beep and flashing CAL.

⑩ The indication turns to the value that has been set with a beep at 10 sec. later.

⑪ Thoroughly clean the sensor module with the tap water, purified water

Reference:

Formazin standard solution: As specified by JIS K 0101

Formazin standard solution: 4000 NTU (500 mL) HITACHI COMPANY

Formazin standard solution: 400 NTU (100 mL) Wako Junyaku Kogyo

Formazin standard solution: 4000 FTU (1 L) Toa DKK 143F200

Formazin standard solution: 1000 FTU (5 L) Toa DKK 6486310K

6.7 Electric conductivity calibration

The electric conductivity has been coincided with the cell constant when shipped from the factory. Measure as it is.

When the cell constant is likely to be changed due to the change of electrode surface of cell, calibrate it. It is also possible to coincide with values measured by other measuring instrument using the calibration function

Normally the 1-point calibration is carried out using the potassium chloride standard solution (B) specified by JIS K 0130 although the 2-point calibration is also applicable

Prepare:

Potassium chloride standard solution (B) specified by JIS K 0130 (referred to as "B solution" hereinafter)

Thermostat water vessel (25 ℃)

Reference or standard thermometer

① Pour B solution in a beaker and keep at a temperature equal to 25.0 ± 0.1℃ in a thermostat water vessel.

② Wash the sensor module with other B solution and submerge in the B solution kept at 25.0 ± 0.1℃.

③ Make sure that the temperature is 25.0 ± 0.1℃ and turn off *TEMP. CALC* with reference to 7.1(12)

④ Display the electric conductivity *(COND)* on the screen.

⑤ Upon the indication stabilized, press CAL/ENT key continuously for 2 sec. or longer

⑥ The calibration value setting screen appears.

⑦ Set the calibration value 1.29 to the value of B solution at 25℃ using ▲, ▼ and ► keys and press CAL/ENT key.

⑧ Calibration is started with a beep and flashing CAL.

⑨ The calibration mark S is shown on the screen with a beep at 10 sec. later.

6.8 Calibration of salt content, total dissolved solids, and sea water specific gravity

The salt content, total dissolved solids, and sea water specific gravity are determined by conversion from the electric conductivity. Calibration is normally unnecessary. Calibrate when necessary.

The same calibration steps are employed for all three items.

① Show the item to be calibrated on the screen

② Submerge the module in the standard aqueous solution with known value. A thermostat water vessel may be used when necessary.

③ Upon the indication stabilized, press CAL/ENT key continuously for 2 sec. or longer

④ The calibration value setting screen appears.

⑤ Set the calibration value using ▲, ▼ and ► keys and press CAL/ENT key.

⑥ Calibration is started with a beep and flashing CAL.

⑦ The calibration mark is shown on the screen with a beep at 10 sec. later.

(1) Salt content (*SALT*)

In the conversion of salt content, selection is possible between conversion to the NaCl concentration and the salt content of saline water

The NaCl conversion concentration is the weight %.

The salt content of saline water is the converted value based upon the definition by UNESCO (1980) and only the numerical value is indicated.

The initial setting is the salt content of saline watter.

For NaCl conversion, change the setting in accordance to 7.1(13)

(2) Total dissolved solids (*TDS*)

With the initial setting (*AUt*), the conversion is carried out based upon the natural water standard solution 442 supplied by Mylon, U.S. When a factor is set, it turns to the value of the electric conductivity (S/m) multiplied with the factor.

(3) Sea water specific gravity (σt)

The sea water specific gravity (density of saline water) lies between 1000 and 1031 $kg \cdot m^{-3}$. It is presented by $\sigma = \rho - 1000$ ($kg \cdot m^{-3}$)for the convenience.

Here, ρ is given by a function of the salt content S, temperature t, and the pressure p according to the definition of UNESCO (1980). In paraticular, it is a common practice to present the density by σt at 1 atm. $= \rho(S, t, 0) - 1000(kg \cdot m^{-3})$. Values of $\sigma 0$ (0℃), $\sigma 15$ (15℃), and σt (measuring temperature) can be selected as the reference temperature.

[Note] Set the reference salt content as the salt content of saline water (***SEA***) when measuring the sea water specific gravity .

6.9 Depth calibration (optional item)

It is calibrated by equivalent to the fresh water 100 m when shipped from the factory. It incorporates the temperature compensation function and little error is caused by the change in water temperature. The variation is caused, however, by the change of atmospheric pressure.

For the measurement with a higher accuracy, calibrate in accordance to the water quality and environments prior to the measurement.

The 2-point calibration of ZERO and SPAN is possible. Calibration is possible in the range of 0.0 – 1.0 m for ZERO and in the range of 5.0 – 1000 m for SPAN.

The zero calibration is normally carried out to 0.0 m in the atmosphere.

① Show the depth (***DEPT***) on the measurement screen.

② Place the sensor module in the atmosphere and wait until the indication is stabilized.

③ Press CAL／ENT key continuously for 2 sec. or longer

④ The calibration value setting screen appears.

⑤ Set the calibration value to 0.0 using ▲, ▼ and ► keys and press CAL/ENT key.

⑥ Calibration is started with a beep and flashing CAL.

⑦ The ZERO calibration is finished with a beep at 10 sec. later.

⑧ Submerge the sensor module at a measuring point of a known depth that is greater than 5 m and wait until the indication is stabilized.

⑨ Press CAL/ENT key continuously for 2 sec. or longer

⑩ Set the depth using ▲, ▼ and ► keys and press CAL/ENT key.

⑪ Calibration is started with a beep and flashing CAL.

⑫ The SPAN calibration is finished with a beep at 10 sec. later.

6.10 Chlorophyll calibration (optional item)

This unit measures the chlorophyll by the direct fluorescent method. Therefore, an error may be caused by the effect of the pheo pigment, a decomposition product of chlorophyll.

Use after measurement of specimens from the water area under the investigation using the extraction method and calibrate with the value. Correct when necessary during the measurement using the value by the extraction method. For calibration, the 2-point calibration is possible.

For the extraction method, refer to followings:

1. JIS K 0400 8010 Absorption photometric measurement of the concentration of chlorophyll a
2. Guidelines to the oceanographic observation Measurement of plant pigments
3. Tap water testing procedures Chlorophyll

① Put the chlorophyll (***CHLO***) on the measurement screen

② Put approx. 80 mL of sample for calibration in the chlorophyll calibration vessel.

ZERO calibration: Purified water, tap water

SPAN calibration: Sample with a known value by measurement using the extraction method

③ Put the chlorophyll module in the calibration vessel and wait until the indication is stabilized.

④ Press CAL/ENT key continuously for 2 sec. or longer

⑤ The calibration value setting screen appears.

⑥ Set the calibration value using ▲, ▼ and ► keys and press CAL/ENT key.

⑦ Calibration is started with a beep and flashing CAL.

⑧ Calibration is finished with a beep at 10 sec. later.

6.11 Setting of Record mode

Set the Record mode before starting the measurement.

There are three kinds of Record mode as follows;

ALWAYS

Records the data by specified measurement interval. There is no recording miss since it always keeping recording the data, however, the data before putting in the sample and the data after taking out of the sample are also recorded.

SETTING

Records the data by specified measurement interval during specified Start and End duration. Set the Start and End time also when setting this mode.

MANUAL

Records the data only when pressed DATA IN key.

Data recording stops when set *MANUAL* during recording data on *ALWAYS* or *SETTING* mode.

When pressed DATA IN key during recording data on *ALWAYS* or *SETTING* mode, that time data shall be recorded regardless of specified interval.

When set *ALWAYS* or *SETTING* mode, Sensor module continues recording by unit even after the Terminal Power Supply was turned OFF and the Connection cable was taken out of the Connector.

(1) Setting of Record mode

① On etc. screen (System parameter setting screen), continue pressing SELECT/CLR key to display *REC. MODE* on the Item display area.

② Currently set Record mode and *REC. MODE* are alternatively displayed.

③ By pressing ▲ or ▼ key, currently set Record mode blinks.

④ Press ▲ or ▼ key to select the Record mode and determine it by CAL/ENT key.

⑤ When set the *SETTING*, followingly set the Start and End time.

(2) Setting of Start / End time

① After having selected and determined the Record mode, press SELECT/CLR key to display *REC.START* (Start time setting screen).

② Press either ▲ or ▼ key, ten figure of the dominical year blinks and becomes ready to set.

③ ▶ By pressing this key, blinking figure moves one by one in the order of Year, Month, Date, Time and

Minute.

④ On the blinking item that is to set, press ▲ or ▼ key to change the numeric value.

⑤ After having set all the values, press CAL／ENT key to determine them.

⑥ Press SELECT／CLR key to display *REC.END* (End time setting screen).

⑦ Follow the above procedure after ② to set the End time.

(3) Setting of measurement interval

① After having set and determined the End time, press SELECT／CLR key to display *REC.INTVL* (Measurement interval setting screen).

② By pressing ▲ or ▼ key, first figure of the Time blinks and becomes ready to set.

③ ▶ By pressing this key, it blinks the figure to set. Press either ▲ or ▼ key to change the numeric value.

④ After having set the value, press CAL／ENT key to determine it.

⑤ Setting range is from 1 minute to 23 hour 59 minute.

6.12 Measurement

Measurement by this equipment has two way; one is measurement on connecting the Terminal and Sensor module and another is measurement by Sensor module by unit on recording the data.

WARNING

Do not throw the Sensor module in the objective of measurement.

You have risks of getting dragged down, hitting persons and resulting in death or heavy injury.

CAUTIONS

- Put the Sensor module in the sample up to the upper hole of the Protective sheath or over.
- When putting it into the water, put in slowly keeping the speed less than approx. 10m/min.
- On the measurement to put the module in 2-inches pipe used for boring inspection, Reinforced band of the Sensor module might be obstacle. In this case, take off the band and put the module in paying attention not to give strong shock.
- The withstanding pressure when the ion electrode is mounted is up to the depth shown in the table below in accordance to the type of ion electrode chip.
  The electrode chip may be damaged if it is submerged to a depth greater than it,

Ion species	Limit of submerged depth
NO3-、NH4+	5m
K+、Ca2+、	10m
F-、Cl-	15m

（1）Measurement on connecting the Terminal

CAUTIONS

- Set the Auto Power Off setting function to “OFF” in case of performing RS-232C input/output, printing or analogue output longer that 15 minutes consecutively. (Initial setting is ON) Refer to 7.2.(2). Power Supply shall be turned OFF when Auto Power off function is set ON, if no key input was made during 15 minutes, then current operation such as RS-232C input/output, printing or analog output has to be halted.

① Data display

You can check the data in real time when connected the Terminal.

Displayed data change by pressing CHANNEL key on MEAS. screen.

② Data record

Data are recorded by specified Record mode and interval, however, by pressing DATA IN key,

data shall be recorded regardless of setting.

③ Data output

You can output the data on connecting the Terminal RS-232C with a PC by the RS-232C cable.

On [etc.] screen, set *USE MODE* (Use mode) to *TERM*.

Data are output to RS-232C concurrently with data recording.

Use the Proper Data Software WQC-LOG (option) for editing data by PC.

④ Printing

You can print the data on connecting the optional printer and Terminal's RS-232C.

On [etc.] screen, set *USE MODE* (Use mode) to *PRINT*.

Data are printed concurrently with data recording.

⑤ Analogue output

You can output the data to a device such as Recorder using the optional Analogue output cable.

Analogue output is made through optional two channels.

Set channels to analogue output the date to *ANALOG1* and *ANALOG2* on [etc.] screen.

⑥ Location data acquisition through GPS

Connect the optional GPS to the Terminal RS-232C to get the location data (latitude, longitude) and record it together with the measured data

Set *GPS USE* to *On* by [etc.] screen.

CAUTIONS

- When *GPS USE* is set *On*, you cannot change setting of *USE MODE* (Use mode). Set *GPS USE OFF* if you want to change it.

WARNING

Waterproof structure of this equipment is not valid when connected any of optional accessories. Do not touch them with the wet hand. Pay attention not to splash water on it.

It may cause electrical shock, fire or failure.

（2）Measurement by Sensor module unit disconnected from terminal

CAUTIONS

- Replace batteries with new ones before use. Recorded data are deleted if batteries are exhaust during operation.
- Tighten firmly the Connector cap. If not, there is a risk of water immersion into the Sensor module and causing failure.
- Make sure to output the recorded Memory data as earlier as you can. Data that were left long time might be deleted due to battery consumption.
- To replace batteries of Sensor module, make sure to connect it to the Terminal that has sufficient battery power and turn OFF the Terminal power supply before replacement. Memorized data would be deleted if you take out the Sensor module batteries without connecting it to the Terminal.

Start measuring

① Before starting, set *REC. MODE*（Record mode）to *ALWAYS* or *SETTING* and set also *REC.INTVL*（Measurement interval).

② When selected *SETTING*, set also *REC.START*（Start time) and *REC.END*（End time）.

③ Take out the Connection cable from the Sensor module.

④ **Put the Connector cap firmly** to the Connector of the sensor module.

⑤ Put firmly a tough rope or wire onto the Hook of the sensor module.

⑥ Put slowly the Sensor module in the Inspection liquid.

⑦ Fix tightly the end of rope or wire.

End measuring

⑧ Take out the Sensor module of the measurement water.

⑨ Wash out thoroughly the Sensor module with running water.

⑩ Wipe out the water of Sensor module with dried towel.

⑪ Make sure to wipe out particularly the water around the Connector with attention.

⑫ Take off the Connector cap and connect with the Terminal with the Connection cable.

⑬ To stop recording data, set *REC. MODE*（Record mode）to *MANUAL*.

（3）Memory data display

Press CHANNEL key on DATA screen（Memory data display screen）to change displayed item.

Press ▲ or ▼ key to increase the sample No. one by one.

▶ Pressing this key would display total twenty-four sample data.

（4）Memory data clear

【Clearing the data of displayed sample No.】

① Display the Memory data to delete.（Any displayed item is available)

② Press SELECT／CLEAR key to blink the data.

③ Press CAL／ENT to delete the all of data in the displayed sample Nos.

【Clearing data on appointing the sample No. range】

① Continue pressing SELECT/CLEAR key on etc. screen to display *CLR.START* screen.

② Press either ▲ or ▼ key to blink the figure of "0" of the sample No.1000.

③ To appoint the displayed figure as the Clear start No., press CAL/ENT key while the the figure of "0" of the sample No.1000 figure is blinking

④ ▲ ▼ ▶ On pressing these keys, set the Clear start No. and press CAL/ENT key.

⑤ Screen changes to *CLR.END* screen.

⑥ ▲ ▼ ▶ On pressing these keys, set the Clear end No. and press CAL/ENT key.

⑦ *YES.OR.NO* is displayed.

⑧ To cancel, press SELECT/CLEAR key, then the screen returns to *CLR.START* screen.

⑨ Deletion starts when CAL/ENT key is pressed and returns to *CLR.START* screen when completed.

(5) Memory data download to PC

Connect a PC to the Terminal RS-232C with the optional RS-232C cable.

To download data to the PC, refer to [Read Memory] of the optional Proper Data Software WQC-LOG.

Refer to the Instruction Manual of the WQC-LOG as for the detail.

(6) Memory data print

① Connect an optional Printer to the Terminal is RS-232C.

② Turn ON the Printer Power Suith.

③ Set *USE MODE* (Use mode) to *PRINT* on etc. screen.

④ Change the screen to *PRT.START* screen on etc. screen.

⑤ Press either ▲ or ▼ key to blink fifth figure of "0" of the sample No.1000.

⑥ ▲ ▼ ▶ Press these keys to set the Print start No. and press CAL/ENT key.

⑦ The screen changes to *PRT.END* screen.

⑧ ▲ ▼ ▶ Press these keys to set the Print end No. and press CAL/ENT key.

⑨ *YES.OR.NO* is displayed.

⑩ Press SELECT/CLEAR key to return to *PRT.START* screen.

⑪ Press CAL/ENT key to start printing.

⑫ To stop printing, keep turning OFF the Power Supply of the Terminal or the Printer for thirty seconds or more.

⑬ Calibration data are printed when set *0* at the sample No.

Read also the Instruction manual of the Printer.

（7） Data input/output mode table

Mode	RS-232C output	RS-232C Command response	GPS information acquisition	Printer output	Analog output
RECORD	×	○	○	×	○
TERM.	○	○	×	×	○
PRINT	×	×	×	○	○
Remarks	When used WQC-LOG as reception only.	When automatically/ manually recording WQC-LOG and using by memory readout	***Record*** is fixed on ***GPS USE On.***		Any time output.

6.13 Calibration and measurement of ion

Samples are taken and measured by addition of the ion intensity adjusting agent in order to measure the ion by the ion electrode method. Prior to starting the measurement, 2-point calibration should be carried out.

A large error may be resulted in by measurement with direct submersion in a sample.

Calibration and sample measurement should be carried out at temperatures as close as possible.

An electrode which is first put in operation and an electrode which has not been used for a long period of time should be submerged in a standard solution with the ion intensity adjusting agent added for 30 min. prior to calibration. When the response becomes slow, it may be recovered by this. The concentration of standard solution to be submerged are as follows depending upon the ion species.

Ion	Submersing standard solution concentration
NO_3^-、K^+、Ca^{2+}	1000mg/L
F^-、Cl^-	10mg/L
NH^{4+}	1mg/L

CAUTIONS

Wear gloves, protection goggles, and protection mask, use the draft chamber and fully ventilate when handling certain types of samples and reagents

Injuries to the skin or eyes may be caused by splashing samples and reagents

When a stimulating reagent is deposited on the skin or gets in eyes, sufficiently wash with tap water and see a doctor or pharmacist.

Note

The withstanding pressure when the ion electrode is mounted is up to the depth shown in the table below in accordance to the type of ion electrode chip. The electrode chip may be damaged if it is submerged to a depth greater than it,

Remove the ion electrode and mount a dummy cap in place whenever possible at the time other than ion measurement

Ion species	Submersion limit depth
NO3-、NH4+	5m
K+、Ca2+、	10m
F-、Cl-	15m

（1）Calibration

Prepare:

Containers of larger than 200 mL such as beakers, Stirrers

Ion standard solution (varies depending upon ion species)

Ion intensity adjusting agent (varies depending upon ion species)

① Indicate the ion to be measured on the measurement screen

② Prepare standard solutions of different concentrations between 10 to 100 times so that the ion concentration of sample to be measured falls within the range.

③ Correctly measure a standard solution on the lower concentration side and put it in a container. (For a 200 mL beaker, adequate volume is 150 mL.)

④ Add the ion intensity adjustment agent of a 1/10 volume of the standard solution

⑤ Place the ion sensor module in the vessel and agitate with a stirrer

⑥ Upon stabilization of the indication, continuously press CAL／ENT key for 2 sec. or longer.

⑦ Make sure that **L** is indicated at the upper right corner of the screen. If **H** is indicated, press

SELECT/CLEAR key to change it to **L**

⑧ Select an adequate range by pressing ▲ and ▼ keys. The range is switched as follows:

#.## ⟷ ##.# ⟷ ### ⟷ #.##×10^3 ⟷ ##.#×10^3 ⟷ ###×10^3

Unit; mg/L

⑨ When pressing CAL/ENT key. all numerical values are changed to zero and setting of the value of concentration is possible.

⑩ Set the value of standard solution on the lower concentration side using ▲, ▼ and ► keys and press CAL/ENT key.

⑪ Calibration on the lower concentration side is finished

⑫ Place a standard solution of higher concentration side and the ion intensity adjustment agent in a container.

⑬ Fully remove the moisture of the ion sensor module and place in the container and agitate with a stirrer.

⑭ Upon stabilization of the indication, continuously press CAL/ENT key for 2 sec. or longer.

⑮ Press SELECT/CLEAR key to change **L** on the upper right corner of screen to **H**

⑯ Calibrate on the higher concentration side in similar way to ⑧ and after it

⑰ Clean the ion sensor module with purified water

⑱ When calibrating other ions, prepare the ion standard solution and ion intensity adjusting solution and repeat from ①

（2）Measurement

① Measure the sample correctly in an adequate container. Add the ion intensity adjusting agent of 1/10 volume of it.

② Submerge the ion sensor module and stir.

③ Upon stabilized, read the indication

④ For calibration of other ions, repeat sample collection. Other ions cannot be measured with a sample to which the ion intensity adjusting agent has been added since a different ion intensity adjusting agent is used.

⑤ When the measurement is finished, sufficiently clean the ion sensor module with purified water.

7． Parameter detail and setting procedure

7.1 Measurement parameter SET

<Table of Measurement parameter for respective item >

Italic：Initial value

CH	Select	Contents	Indication	Remarks
1	1	pH low limit alarm	pH.ALML	***OFF***,0.00 - 14.00(pH) -2000 - 2000mV(ORP)
	2	pH high limit alarm	pH.ALMH	
	3	pH reference solution	pH BUFFER	***JIS***、US
	4	pH/ORP selection	pH.SLCT	***pH***、ORP
2	1	Dissolved oxygen low limit alarm	DO.ALML	***OFF***,0.00 - 20.00mg/L 0 - 200%
	2	Dissolved oxygen high limit alarm	DO.ALMH	
	3	Dissolved oxygen unit (saturation vol selection)	DO.UNIT	***mg/L(JIS)***,%,mg/L(SEA)
	4	Dissolved oxygen salt compensation	DO.SALT	ON,***OFF***
	5	Dissolved oxygen pressure compensation	DO.PRES	***1013***,100 - 1999hPa、OFF
3	1	Elec. cond. low lim. alarm	COND.ALML	***OFF***,0.00 - 10.00S/m
	2	Elec. cond. hi. lim. alarm	COND.ALMH	
	3	Elec. conductivity range	COND.RANG	LO,MID,HI,***AUTO***
	4	Temperature compensation	TENP.COFF	0.00 - 5.00,***2.00%***
4	1	Turbidity lo. lim. alarm	TURB.ALML	***OFF***,0.0 - 800.0NTU 0.0 - 800.0mg/L
	2	Turbidity hi. lim. alarm	TURB.ALMH	
	3	Turbidity unit selection	TURB.UNIT	***NTU***,mg/L
5	1	Water temp. lo. lim. alarm	TEMP.ALML	***OFF***,-5.0 - 55.0
	2	Water temp. hi. lim. alarm	TEMP.ALMH	
	3	Water temp. display after decimal point	TEMP.DEC	***1***, 2(figure)
	4	Temp. compensation	TEMP.CALC	***ON***,OFF
6	1	Salt lo. lim. alarm	SALT.ALML	***OFF***,0.00 - 4.00%(NaCl) 0.0 - 40.0(SEA)
	2	Salt hi. lim. alarm	SALT.ALMH	
	3	Salt display	SALT.DISP	***ON***,OFF
	4	Salt reference selection	SALT.CALC	NaCl, ***SEA***
7	1	Total dissolved solids(TDS) lo. lim. alarm	TDS .ALML	***OFF***,0.0 - 100.0g/L
	2	TDS hi. lim. alarm	TDS .ALMH	
	3	TDS display	TDS .DISP	***OFF***,ON
	4	TDS coefficient	TDS .FACT	0.50 - 0.99,***AUT***

CH	Select	Contents	Indication	Remarks
8	1	Sea water specific gravity (SW SG)low limit alarm	σt.ALML	***OFF***,0.0 - 50.0σt
	2	SW SG high limit alarm	σt.ALMH	
	3	SW SG display	σt.DISP	***OFF***,ON
	4	SW SG reference temp.	σt.TEMP	σ0, σ15, ***σt***
9*	1	Water depth lo. lim. alarm	DEPT.ALML	***OFF***,0.0 - 100.0m
	2	Water depth hi. lim. alarm	DEPT.ALMH	
	3	Water depth display	DEPT.DISP	***OFF***,ON
10*	1	Ion 1 low limit alarm	ION1.ALML	***OFF***,0.0 - 62000mg/L(ION) 0.0 - 400μg/L(CHLO)
	2	Ion 1 high limit alarm	ION1.ALMH	
	3	Ion 1 display	ION1.DISP	***OFF***,ON
	4	Ion type selection	ION1.SLCT	NH4、NO3、CL、CA、***F***、K、CHLO
11*	1	Ion 2 low limit alarm	ION2.ALML	***OFF***,0.0 - 62000mg/L
	2	Ion 2 high limit alarm	ION2.ALMH	
	3	Ion 2 display	ION2.DISP	***OFF***,ON
	4	Ion type selection	ION2.SLCT	***NH4***、NO3、CL、CA、F、K、
12*	1	Ion 3 low limit alarm	ION3.ALML	***OFF***,0.0 - 62000mg/L(ION) -2000 - 2000mV(ORP)
	2	Ion 3 high limit alarm	ION3.ALMH	
	3	Ion 3 display	ION3.DISP	***OFF***,ON
	4	Ion type selection	ION3.SLCT	NH4、NO3、CL、CA、F、K、***ORP***

＊Optional items that are not available for the standard Sensor module.

（1）Low limit alarm, High limit alarm（ *###.ALML, ###.ALMH* ）

It is possible to set high and low limit alarm.

Except that those values are set *OFF*, in case where measured value of the channel attained the set value, indication H or L lights up on upper right of the display when displaying measured value of that channel. H means high limit while L means low limit.

This time, Open collector output ① turns ON (External alarm).

It returns to OFF when the alarm is cleared.

Open collector output ① is a common output (OR) shared by alarms for all the channels.

OFF is displayed.
↓ ▲ or ▼ key
OFF blinks.
↓ ▲ or ▼ key
Numeric value is displayed.
↓
▲, ▼, ▶ key to set value
↓ CAL／ENT key
Determine

On blinking the highest numeric value, continue pressing ▼ key to turn it *OFF*.

（2）Display（ *###.DISP* ）

Setting is provided after 6th channel (SALT, salt).

Display, measurement, data record and calibration are available for the channels that are set *On*.

When set *OFF*, display, measurement, data record and calibration become not available for that channel, and you can not display even pressing CHANNEL key.

OFF or *On* is displayed.
↓ ▲ or ▼ key
OFF o *On* blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（3）pH reference buffer selection (*PH.BUFFER*)

JIS : Reference buffer of pH4.01, pH6.86 and pH9.18 shall be used.

US : Reference buffer of pH4.01, pH7.01 and pH10.01 shall be used.

JIS or *US* is displayed alternatively with *PH.BUFFER.*
↓ ▲ or ▼ key
JIS or *US* is displayed.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

When set *US*, indication **US** is displayed aside of the pH calibration mark on MEAS.

screen (Measured value display screen).

（4）Selection of pH and ORP（ *PH. SLCT* ）

You can perform ORP measurement on replacing the pH glass electrode chip with an ORP electrode chip (separately sold).

Change the setting from *PH* to *ORP* to measure ORP.

PH or *ORP* is displayed alternatively with *PH.SLCT.*

↓ ▲ or ▼ key

PH or *ORP* blinks.

↓ ▲ or ▼ key

↓

Change setting

↓ CAL／ENT key

Determine

（5）Dissolved oxygen unit selection（ *DO.UNIT* ）

mg/L *JIS* : Correction of temperature and salt are performed using the formula of Truesdale to obtain the saturated value.

mg/L *SEA* :Correction of temperature and salt are performed using the formula of Weiss to obtain the saturated value.

% : Expressed by saturation factor.

JIS or *SEA* is displayed alternatively with *DO.UNIT.*

（No alternative display in the case of **%**. Unit is displayed in the Unit display area.）

↓ ▲ or ▼ key

Unit blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

（6）Dissolved oxygen salt correction（ *DO.SALT* ）

On : Dissolved oxygen value is corrected by measured salt value.

Correction is performed even the *DISP*（display）of *SALT*（salt) is set OFF.

OFF : Salt correction is not performed.

OFF or *On* is displayed.
↓ ▲ or ▼ key
OFF or *On* blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（7）Dissolved oxygen atmospheric pressure correction（ *DO.PRES* ）

OFF :Atmospheric pressure correction is not performed.

Atmospheric pressure（hPa）setting: Corrected to the value of 1013hPa.

OFF is displayed.
↓ ▲ or ▼ key
OFF blinks.
↓ ▲ or ▼ key
Numeric value is displayed.
↓
▲, ▼, ▶ key to set value
↓ CAL／ENT key
Determine

（8）Specific electric conductivity range（ *COND.RANG* ）

AUTO : Range is switched automatically.
LO : Range is fixed on 0.0 - 100.0mS/m.
MID : Range is fixed on 0.000 - 1.000S/m.
HI : Range is fixed on 0.00 - 10.00S/m.

Current setting and *COND.RANG* are alternatively displayed.
↓ ▲ or ▼ key
Current setting blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（9）Temperature compensation ratio（ *TEMP.COEF* ）

This is a coefficient to compensate the temperature of specific electric gravity, in which the compensation per 1℃ is set as percentage. Normally the value is 2.00%.

Current set value is displayed.
↓ ▲ or ▼ key
The highest figure of the value blinks.
↓
▲, ▼, ▶ key to set value
↓ CAL／ENT key
Determine

（10）Turbidity unit（ *TURB.UNIT* ）

NTU : Forumajin turbidity

mg/L : Kaolin turbidity

NTU or **mg/L** is displayed（Unit display area）
↓ ▲ or ▼ key
NTU or **mg/L** blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（11）Water temperature display after the decimal point（ *TEMP.DEC* ）

1 One figure after the decimal point.

2 Two figures after the decimal point.

1 or *2* is displayed.
↓ ▲ or ▼ key
1 or *2* blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（12）Temperature compensation calculation（ *TEMP.CALC* ）

On : Temperature compensation or temperature conversion shall be performed for items that have set respective operation.

OFF : Displays the data that do not perform neither temperature compensation nor temperature conversion.

This is a function for the check and automatically returns to On after 60 minutes.

It also returns to On in case where the Sensor module became a unit by taking out the Connection cable.

On or OFF is displayed.
↓ ▲ or ▼ key
On or OFF blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（13）Salt reference selection（ *SALT.CALC* ）

NACL : Converts the NaCl density through the specific electric gravity.

SEA : Converts the Seawater salt value through the specific electric gravity. Converted in accordance with the definition of UNESCO (1980).

NACL or SEA is alternatively displayed with SALT.CALC .
↓ ▲ or ▼ key
NACL or SEA blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（14）Total dissolved solids coefficient（ *TDS.FACT* ）

This function sets the coefficient to convert through the specific electric gravity.

When set to AUt, conversion is made subject to the natural standard solution 442 of Mylon, USA. Once set the coefficient, the value shall be obtained from multiplying the specific electric gravity by that coefficient.

AUt or set value is displayed.

↓ ▲ or ▼ key

AUt or set value blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

（15）Sea water specific gravity reference temperature（ σt.TEMP ）

This function sets the reference temperature to be converted through the specific electric conductivity and temperature.

σt : Converts the specific gravity at temperature of measured water.

σ0 : Converts the specific gravity at 0℃.

σ15 : Converts the specific gravity at 15℃.

Current setting and TEMP are alternatively displayed.

↓ ▲ or ▼ key

Current setting blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

（16）Ion type selection（*ION#.SLCT*）

This function selects the Ion, ORP and Chlorophyll.

Setting available items alter according to the Ion No.

Setting shall be made in accordance with attached Electrode and Cell.

Indication	Item	ION1	ION2	ION3
NH4	Ammonia ion	○	○	○
NO3	Nitrate ion	○	○	○
CL	Chloride ion	○	○	○
CA	Calcium ion	○	○	○
F	Fluoride ion	○	○	○
K	Potassium ion	○	○	○
CHLO	Chlorophyll	○	---	---
ORP	Oxidation-reduction potential	---	---	○

Settings are not valid for the standard Sensor module.

Current setting, *ION(No.) and SLCT* are alternatively displayed.

↓ ▲ or ▼ key

Current setting blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

7.2 System parameter etc.

<List of System parameter> *Italic：Initial value*

Select	Contents	Indication	Remarks
1	Use mode	USE .MODE	***RECORD***,TERM.,PRINT
2	Auto Power Off	AUTO.OFF	***ON***、OFF,DC
3	Record mode	REC .MODE	***MANUAL***,ALWAYS,SETTING
4	Record start	REC .START	***2003.1/01　0：00***
5	Record end	REC .END	
6	Record interval （hour, minute）	REC .INTVL	00:00 - 23:59,***1:00***
7	Clock setting	CLOCK	***2003.1/01　0：00***
8	GPS use	GPS .USE	***OFF***,ON
9	Latitude data	LATI.	***N035.40.15***
10	Longitude data	LONGI.	***E139.45.22***
11	Analogue output 1	ANALOG1	1 - 12(Channel),***1(pH)***
12	Analogue output 2	ANALOG2	1 - 12(Channel),***5(Temp)***
13	Key lock	KEY.LOCK	***OFF***,ON
14	Memory data print	PRT.START(END,YES)	0000 - 3360,***0001***
15	Memory data clear	CLR START(END,YES)	0000 - 3360,***0001***
16	External system output	TERM.CMD	12 figures,***0000 00000000***
17	Parameter print	PARA.LIST	***OFF***,ON

* Setting range of Year, Month, Hour and minute（Record Start, End, Clock） 2000.01.01

00：00 - 2099.12.31　23：59

* Memory data print and Parameter print are available to set only when the Use mode is PRINT.

（1）Use mode（ *USE.MODE* ）

RECORD

This is a mode to be used normally.

When the Record mode setting was either *ALWAYS* or *SETTING*, and if current time is between the Record start and end time, measured value, GPS data and error codes of all channels are recorded at set time of the specified interval.

When pressed DATA IN key, data are recorded regardless of the setting.

When used RS-232C, Command response method shall be applied.

TERM.

This is a mode to output data from the Terminal RS-232C.

When the Record mode setting was either *ALWAYS* or *SETTING*, and if current time is between the Record start and end time, measured value, GPS data and error codes of all channels are output from RS-232C and concurrently recorded at set time of the specified interval.

When pressed DATA IN key, data are recorded regardless of setting.

PRINT

This is a mode to print data by an optional printer connected to RS-232C.

When the Record mode setting was either *ALWAYS* or *SETTING*, and if current time is between the Record start and end time, measured value, GPS data and error codes of all channels are output from RS-232C and concurrently recorded

When pressed DATA IN key, data are recorded regardless of setting.

This time the RS-232C is used only for the printer.

Current setting and *USE.MODE* are alternatively displayed.

↓ ▲ or ▼ key

Current setting blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

（2）Auto Power OFF（ *AUTO.OFF* ）

When this is set *On*, Terminal Power Supply shall be turned OFF if there was no key operation during fifteen minutes.

When this is set ***dC***, Terminal Power Supply shall be turned on without power-key push, if power supplied from the ac adapter.

During this is set *On*, indication **AUTO OFF** lights up in the Display.

On or *OFF* or *dC* is displayed.
↓ ▲ or ▼ key
On or *OFF*or *dC* blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（3）Record mode（ *REC.MODE* ）

ALWAYS

Regardless of the setting of Record start and Record end time, always data are recorded at set time of the specified interval.

SETTING

Data are recorded according to the setting of Record start, Record end time and Record interval.

MANUAL

Data are recorded only when pressed DATA IN key.

Current setting and *REC.MODE* are alternatively displayed.
↓ ▲ or ▼ key
Current setting blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

*When Use mode（ *USE.MODE* ）was set to *TERM* or *PRINT*, and if the Terminal was connected, data output to RS-232C or output to the Printer shall be executed.

（4）Record start（ *REC.START* ）and Record end（ *REC.END* ）

Sets the Record start time and end time when set the Record mode（ *REC.MODE* ）to ***SETTING***.

If current time is within this setting range, data shall be recorded at specified time interval of

following record interval;

Year/Month/Date/Hour/Minute are displayed.（ *REC. START*）

（Year on the Data display area, Month/Date/Hour/Minute are on the Time display area）

↓ ▲ or ▼ key

Third figure of the Year blinks.

↓

▲, ▼, ▶ key to set value.

↓ CAL／ENT key

Determine

↓ SELECT／CLEAR key

Year/Month/Date/Hour/Minute are displayed.（ *REC. END* ）

↓ ▲ or ▼ key

Third figure of the Year blinks.

↓

▲, ▼, ▶ key to set value.

↓ CAL／ENT key

Determine

（5）Record interval（ *REC.INTVL* ）

When set the Record mode (*REC.MODE*) to *ALWAYS* or *SETTING* , data are recorded by the Record interval.

Time/Minute are displayed（ *REC. INTVL*）

（Time display area）

↓ ▲ or ▼ key

First figure of Time blinks.

↓

▲, ▼, ▶ key to set value.

↓ CAL／ENT key

Determine

（6）Clock setting（ *CLOCK* ）

Sets current time.

Year/Month/Date/Hour/Minute are displayed.（ CLOCK ）

（Year on the Data display area, Month/Date/Hour/Minute are on the Time display area）

↓ ▲ or ▼ key

Third figure of the Year blinks.

↓

▲, ▼, ▶ key to set value.

↓ CAL／ENT key

Determine

（7）GPS Use setting（ *GPS.USE* ）

On : RS-232C port becomes the proper port to GPS and *USE.MODE* is fixed to *RECORD*.
If connected the optional GPS, Location data of the latitude and longitude are obtained through the GPS and recorded together with measured data.

OFF : when Manual was set, Location data of the latitude and longitude are recorded together with measured data.

OFF or *On* is displayed.
↓ ▲ or ▼ key
OFF or *On* blinks.
↓ ▲ or ▼ key
Change setting
↓ CAL／ENT key
Determine

（8） Display and setting of Latitude（ *LATI* ）and Longitude（ *LONGI*）

〈Display〉

LATI,LONGI and Location data obtained through the GPS or manually input data are alternatively displayed.

LATI. ←→ ***N 35.40.15***

LONGI. ←→ ***E139.45.22***

〈Setting〉

When *GPS.USE* was set *OFF,* manual input is available.

Location data and *LATI*, *LONGI* are alternatively displayed.
↓ ▲ or ▼ key
E, *W*, *S*, *N* ***of the Location data*** blink.
↓
▲, ▼, ▶ key to set.
↓ CAL／ENT key
Determine

（9）Setting of analogue output（ *ANALOG1,ANALOG2* ）

Set channels to output data to the Analogue output port (X 2).

Data to be output shall be the data of set output channels, specific electric conductivity and Open collector.

Current set channel is displayed.

↓ ▲ or ▼ key

Current setting blinks.

↓ ▲ or ▼ key

Change setting

↓ CAL／ENT key

Determine

（10）Setting of key lock（ *KEY.LOCK* ）

When set it *On*, key operations other than CHANNEL, POWER, SELECT／CLEAR become not available.

While it is set *On*, indication LOCK lights up in the Display.

To cancel it, continue pressing SELECT／CLEAR key two seconds or more.

OFF is displayed.

↓ ▲ or ▼ key

OFF blinks.

↓ ▲ or ▼ key

On blinks.

↓ CAL／ENT key

Determine

↓

Setting of etc. mode is always available.

↓FUNCTION key

Key lock setting

Press ↓SELECT／CLEAR key two sec. or more.

Key lock is released.

（11）Memory data printing（ *PRT.START*）

Appoints the No. of recorded data and prints them.

When set *PRT.START* and *PRT.END* both "0", calibration data are printed.

0001 is displayed.（ *PRT.START*）

↓ ▲ or ▼ key

0 figure of 1000 blinks.

↓

▲, ▼,▶ key to set No. to start.

↓ CAL／ENT key

Numeric value of 1000 figures blinks.（ *PRT.END*）

↓

▲, ▼,▶ key to set No. to end.

SELECT／CLEAR key↓ ↓CAL／ENT key

Cancel Print

↓

0001 is displayed.（ *PRT.START*）

To stop printing, turn OFF the Power Supply of the Terminal and Printer 30 sec. or more.

（12）Memory data clear（ *CLR.START* ）

Appoints the No. range of recorded data and deletes them.

---- is displayed.（ *CLR.START*）

↓ ▲ or ▼ key

0001 is displayed nad *0* figure of 1000 blinks.

When No.0001 to start

↓

▲, ▼,▶ key to set No. to start

↓ CAL／ENT key

Numeric value figure of 1000 blinks.（ *CLR.END*）

↓

▲, ▼,▶ key to set No. to end

↓

YES. OR. NO

SELECT／CLEAR key↓ ↓CAL／ENT key

Cancel Delete

↓

0001 is displayed.（ *CLR.START*）

【For reference 1】 To delete one Memory data.

DATA screen
↓ ▲ or ▼ key
Display the data to delete.
↓ SELECT／CLEAR key
Data blink.
↓ CAL／ENT key
Delete

【For reference 2】To delete the calibration data.

DATA screen
↓ CHANNEL key
Choose the item to delete the calibration data.
Press ↓ CAL／ENT key (2 sec. or more)
Calibration data are displayed.
Press ↓ SELECT／CLEAR key (2 sec. or more)
Delete

（13）External system command (*TERM.CMD* ）

This function outputs from RS-232C the numeric value command that was consecutively set on the Data area and Item area.

0 0 0 0 （Data area）
0 0 0 0 0 0 0 0 ←→ *T E R M. C M D* (Item area)
↓ ▲ or ▼ key
0 0 0 0 （Data area）
0 0 0 0 0 0 0 0 (Item area)
*0*が figure of 1000 on Data area blinks.
↓
▲, ▼,► key to set num. value.
↓ CAL／ENT key
Command output
↓
 # # # # （Data area, set numeric value）
 # # # # # # # # (Set numeric value) ←→ *T E R M. C M D* (Item area)

（14）Parameter printing（ *PARA.LIST* ）

Prints the parameter set on [SET] mode and [etc.] mode.

OFF is displayed.
↓ ▲ or ▼ key
OFF blinks.
↓ ▲ or ▼ key
On blinks.
↓ [CAL/ENT] key
Print
↓
OFF is displayed.

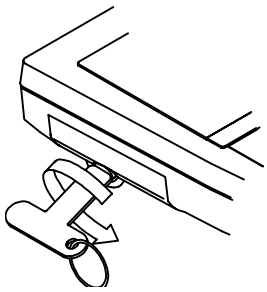
8. Connection of optional accessories

8.1 Handling of optional accessories input/output

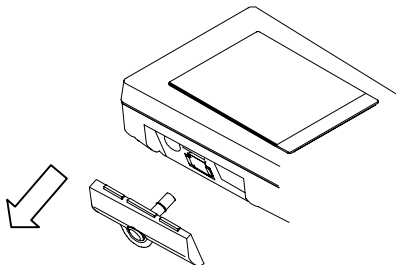
CAUTIONS	**Turn the Power Supply OFF before open/close the Cap.** **Waterproof structure of this equipment becomes not valid when the Cap is open (during use of optional accessories). Fully pay attention not to put water drop on.**

（1）Open the Cap

① Loosen the screw of Input/Output Cap on the side of main body using the attached special driver.

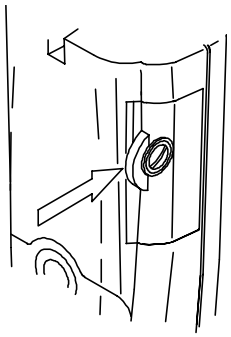


② Take off the Cap on pulling it.

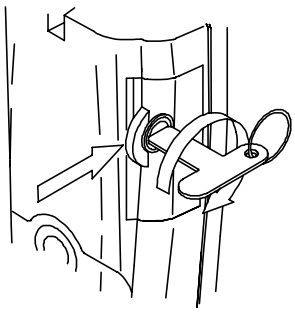


（2）Close the Cap

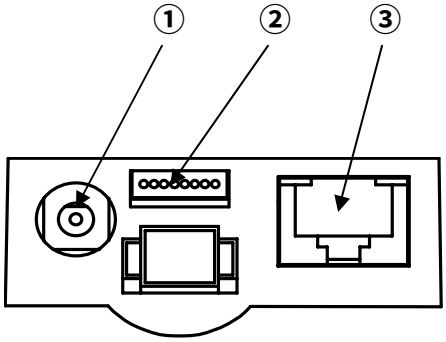
1) Check whether the silicon packing is correctly attached in the groove of the Option cover and that it is not out of the glove.
   Check also that there is neither scratch nor dust on the silicon packing.
2) Attach the Option cover on pushing it to the direction of the arrow.



3) On pushing the Option cover to the arrow direction, tighten the screw with the special driver until it stops.



（3）Names of Input/Output section



Option Input/Output section

	Name
①	AC adapter socket
②	Analogue output cable socket
③	RS-232C Input/Output socket Printer output socket

*RS-232C and Printer cannot be used at the same time.

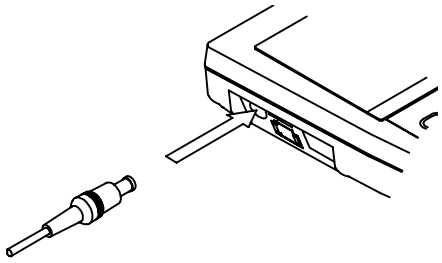
8.2 Connection of AC adapter

WARNING	Make sure to use only the special optional AC adapter appointed by us. Do not touch it with the wet hand.

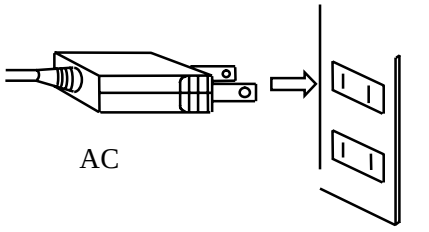
CAUTIONS

- Turn OFF the Power Supply of main body before connecting the adapter.

① Connect the Output plug of the special AC adapter to the AC adapter socket of the main body Input/Output section.



② Connect the AC adapter to the AC 100V socket.



③ Turn ON the Terminal Power Supply.

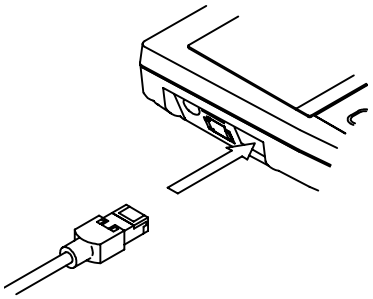
8.3 Connection of external printer

CAUTIONS	Make sure to use only the special Printer appointed by us. Do not touch it with the wet hand.

CAUTIONS

- Turn OFF the Power Supply of main body before connecting the Printer.
- Refer to the Instruction Manual of the Printer as for its detail.

① Connect the attached Connection cable of the Printer to the RS-232C socket of the main body Input/Output section.



② Connect the Connection cable to the Printer.

③ Connect the attached special AC adapter to the Printer.

④ Put Printer sheets in the Printer.

⑤ Turn ON the Printer Power Supply.

⑥ Turn ON the Terminal Power Supply.

⑦ Set *USE. MODE* to *PRINT* to use the Printer.

8.4 Connection of RS-232C cable

CAUTIONS	Make sure to use only the RS-232C cable appointed by us. Do not touch the PC connector with the wet hand.

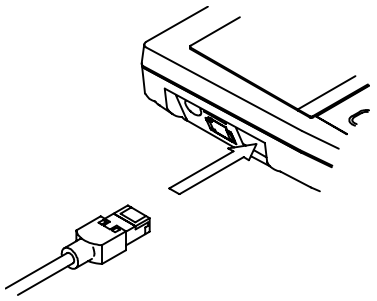
CAUTIONS

- Check that the main body Power Supply is turned OFF before connection.
- Connect one PC or Recorder to the WQC-24 one-on-one.
- If tou connected plural WQC-24s to a PC or Recorder, it might bother measuring by the interference caused by respective module. When you had no choice but to connect plural WQC-24s to a PC or Recorder, be sure to put apart Sensor modules by several meters or use the commercially available insulation device.

（1）Connection of RS-232C cable

RS-232C cable model No.	
1m	０ＧＣ００００５
2m	０ＧＣ００００６
4m	０ＧＣ００００７
10m	０ＧＣ００００８

① Connect the Connector of RS-232C cable to the RS-232C socket of the main body Input/Output section.



② Connect the RS-232C cable to the external Input/Output device.

③ Turn the Terminal Power Supply ON.

（2）Connection of GPS

Connect the exclusively assigned cable supplied with GPS to the RS-232C connector

RS-232C cable cannot be used with GPS

（3）Setting of the RS-232C input/output

Follow the setting listed below according to using external input/output device and type of use.

Type of use, external device	Setting of WQC-24
Download of Memory data to the PC (Command response)	Set the Use mode (*USE. MODE*) to *RECORD*.
Simultaneous output with data recording	Set the Use mode (*USE. MODE*) to *TERM.*
Obtention of Location data on connectingthe GPS	Set the ＧＰＳ Use (*GPS.USE*) to *On.*

8.5 Connection of Analogue output cable

⚠ CAUTIONS	Make sure to use only the Analogue output cable appointed by us. Do not touch the cable with the wet hand.

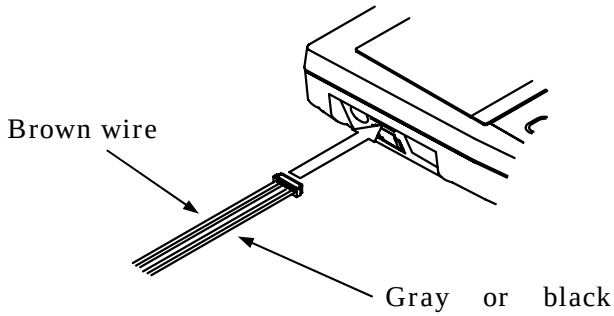
CAUTIONS

- Check that the main body Power Supply is turned OFF before connection.
- Connect one PC or Recorder to the WQC-24 one-on-one.
- If tou connected plural WQC-24s to a PC or Recorder, it might bother measuring by the interference caused by respective module. When you had no choice but to connect plural WQC-24s to a PC or Recorder, be sure to put apart Sensor modules by several meters or use the commercially available insulation device.

（1）Connection of Analogue output cable

Special Analogue output cable, Model No.: 6548270K

Connect the optional Analogue output cable to the Analogue output socket of the main body Input/Output section.



① Connect the Analogue output cable to the Recorder.

② Turn ON the Power Supply of the Terminal and Recorder.

（2）Analogue output specification

Measured data output

Output item	Optional two channels selected from 1 to 12 channels.
Output DC voltage	0 - 1V full scale（Ion is fixed to 0mv）

Specific electric gravity range output

Output item	Specific electric gravity range	
Output DC voltage	ＬＯ	0mV
	ＭＩＤ	500mV
	ＨＩ	1000mV

Open collector output

Output item		Open collector output
Output		DC36V, lower than 100mA
Output contents	Alarm output	On High/Low limit of respective channel and on error.
	Measurement timing output	Output approx. one minute before and after the measurement on the interval measurement.

（3）Wiring of Analogue output cable（6548270K）terminals

Pin No.	Wire color	Output contents
1	Brown	ＡＮＡＬＯＧ１（Analogue output１）
2	Red	ＡＮＡＬＯＧ１ and ２, common use
3	Orange	ＡＮＡＬＯＧ２（Analogue output２）
4	Yellow	Specific electric gravity range output
5	Greem	Specific electric gravity range output and Open collector output, common use
6	Blue	N.A.
7	Purple	Open collector output１
8	Gray / black	Open collector output２

9. RS-232C interface

9.1 Interface specification

(1) Transfer system

Asynchronous communication method, half duplex.

(2) Transmission speed

9600 bps

(3) Character configuration

Start bit : 1 bit
Data length : 8 bit
Parity check : No
Stop bit : 2 bit

(4) Connector and pin arrangement

D-sub-9 pin connector is adopted for the RS-232C connector.

Pin No.	Signal symbol	Signal name	*Direction
1	Not connected		
2	SD (TXD)	Transmission data	Input
3	RD (RXD)	Reception data	Output
4	Pull-up		Output
5	GND	Grounding for safety	
6	Not connected		Input
7	CS (CTS)	Transmission available	Output
8	RS (RTS)	Transmission request	Input
9	Not connected		

* Direction from the viewpoint of the PC.

CAUTIONS

- Make sure to control the CS and RS.

9.2 Data contents

（1）Request of data

<1> Request of measured data (14 items)

Last measured values are requested (from PC to Terminal);

C	H	n	n	,	D	CR	LF
①						②	③

(Note) CR is ODH of ASCII.
LF is OAH of ASCII

① Channel code nn = 00 ：All channels
01 – 14 ：Channels 1 - 14

② Request code

③ End code

Response：When received the Data request command (from Terminal to PC).

- CH3（Specific electric conductivity measured value);

C	H	0	3	,	D	,		8	.	1	8		CR	LF
①						②		③					④	

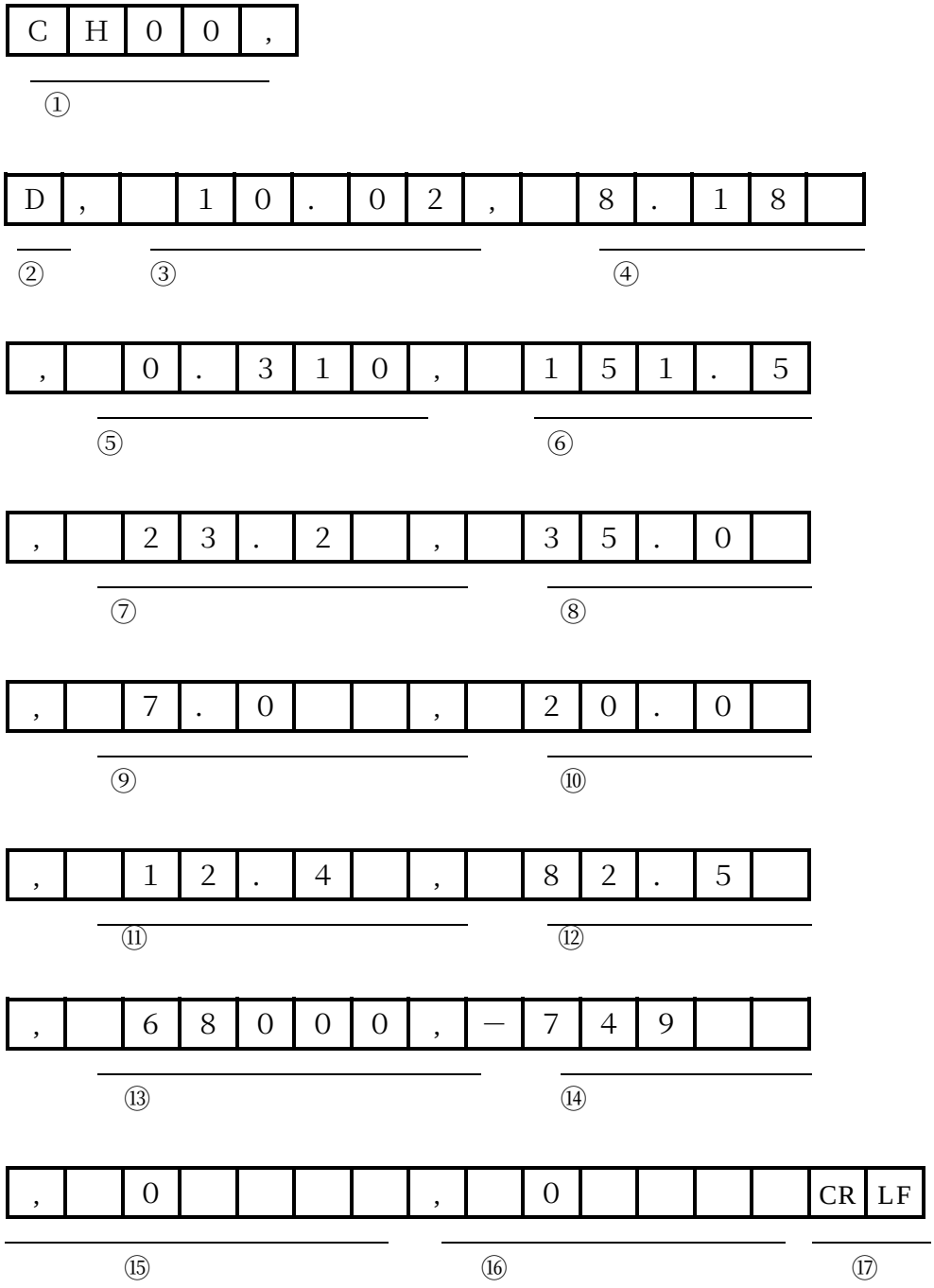
① Channel code

② Request code（Top symbol of the command returns）

③ Specific electric conductivity measured value

④ End code

- Measured value of all the channels;



① Channel code

② ID code

③ pH measured value ④ Dissolved oxygen measured value

⑤ Specific electric conductivity measured value

⑥ Turbidity measured value ⑦ Water temperature measured value

⑧ Salt measured value ⑨ Total dissolved solids measured value

⑩ Sea water specific gravity measured value ⑪ Water depth measured value

⑫ Ion 1 measured value ⑬ Ion 2 measured value ⑭ Ion 3 measured value

⑮ Backup 1（Always 0） ⑯Backup 2（Always 0） ⑰ End code

Attention Datum always becomes 0 if Display OFF was set.

< 2 > Request of Memory data (Data No. appointment)

Requests the memorized data on appointing the data No.（from PC to Terminal).

C	H	n	n	,	D	M	,	m	m	m	m	CR	LF
①					②			③				④	

① Channel code nn = 00 ：All channels
01 – 14 ： Channels 1 - 14

② Request code

③ Data No.（No.０００１ - ３３６０）

④ End code

Response：When received the data request command（from Terminal to PC）

- When transmitting memorized values of all the channels, transmission is performed in the order of 1 to 14 CH.

C	H	0	0	,	D	M	,	m	m	m	m
①					②			③			

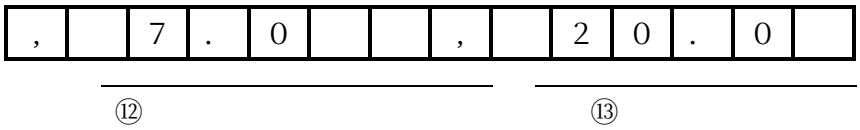
,	0	0	,	1	,
④					

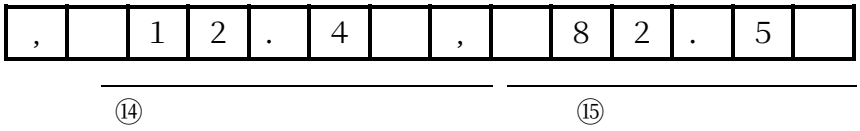
2	0	0	2	／	0	6	／	0	5	,	1	7	:	1	5
⑤															

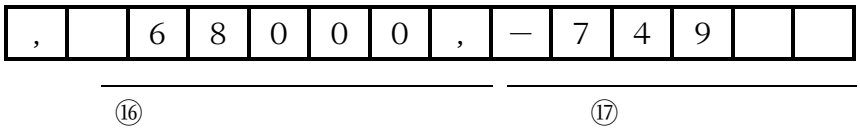
,		1	0	.	0	2	,		8	.	1	8	
⑥									⑦				

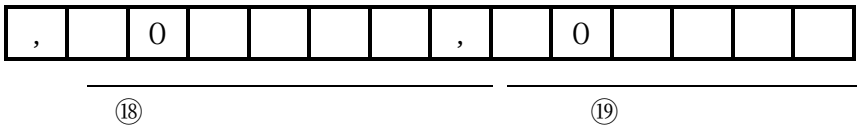
,		0	.	3	1	0	,		1	5	1	.	5
⑧									⑨				

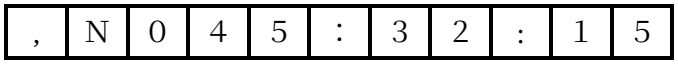
,		2	3	.	2		,		3	5	.	0	
⑩									⑪				

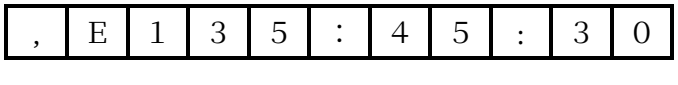


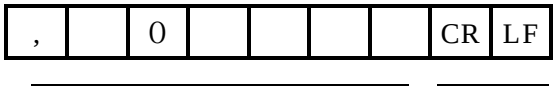












① Channel code ② ID code ③ Sample No.
④ 00 fixed, 1 fixed ⑤ Year/Month/Hour/Minute ⑥ pH memorized value
⑦ Dissolved oxygen memorized value ⑧ Specific electric conductivity memorized value
⑨ Turbidity memorized value ⑩Water temperature memorized value
⑪ Salt memorized value ⑫ Total dissolved solids memorized value
⑬ Sea water specific gravity memorized value ⑭ Water depth memorized value
⑮ Ion 1 memorized value ⑯ Ion 2 memorized value ⑰ Ion 3 memorized value
⑱ Backup 1 (Always 0) ⑲ Backup 2（Always 0） ⑳ GPS latitude daya
㉑ GPS longitude data ㉒ Error code ㉓ End code

Attention Datum always becomes 0 if Display OFF was set.

<3> Request of Memory data (Data No. range appointment)

Requests consecutive data output on appointing the No. range (from PC to Terminal).

C	H	0	0	,	D	M	O	,

① ②

m	m	m	m	,	n	n	n	n	CR	LF

③ ④ ⑤

① Channel code ② ID code

③ Start No.

④ End No.

⑤ End code

Response：When received the data request command（from Terminal to PC）

<2> Output shall be made on the same format with the one used to request all the channels data by Memory data request (Data No. appointment).

<4> Consecutive output of Memory data stop

Requests to stop consecutive output of Memory data (from PC to Terminal).

C	H	0	0	,	D	M	S	CR	LF

① ② ③

① Channel code ② ID code ③ End code

Response: When received Consecutive output stop command (from Terminal to PC).

O	CR	LF

① ②

① OK code ② End code

<5> Request of Data Memory status

Requests remaining data memory volume or used data memory volume (from PC to Terminal)

C	H	0	0	,	Q	8	0	CR	LF

① ② ③

①Channel code 00 fixed

②Request code　Q80: Remaining data memory volume（Data memory remaining volume）

Q81: Current data memory volume（Used data memory volume）

③End code

Response：Remaining data memory volume or used data memory volume.

C	H	0	0	,	Q	8	0	,	0	2	0	4	8	CR	LF
①					②				③					④	

① Channel code 00 fixed

② Request code　Q80: Remaining data memory volume

Q81: Current data memory volume

③ Remaining data memory volume or used data memory volume.

④ End code

<6> Request of Sensor status (14 items)

Requests the actual packaging status of the Sensor and its range (from PC to Terminal).

C	H	n	n	,	D	S	CR	LF
①					②		③	

(Note) CR is ODH of ASCII.LF is OAH of ASCII.

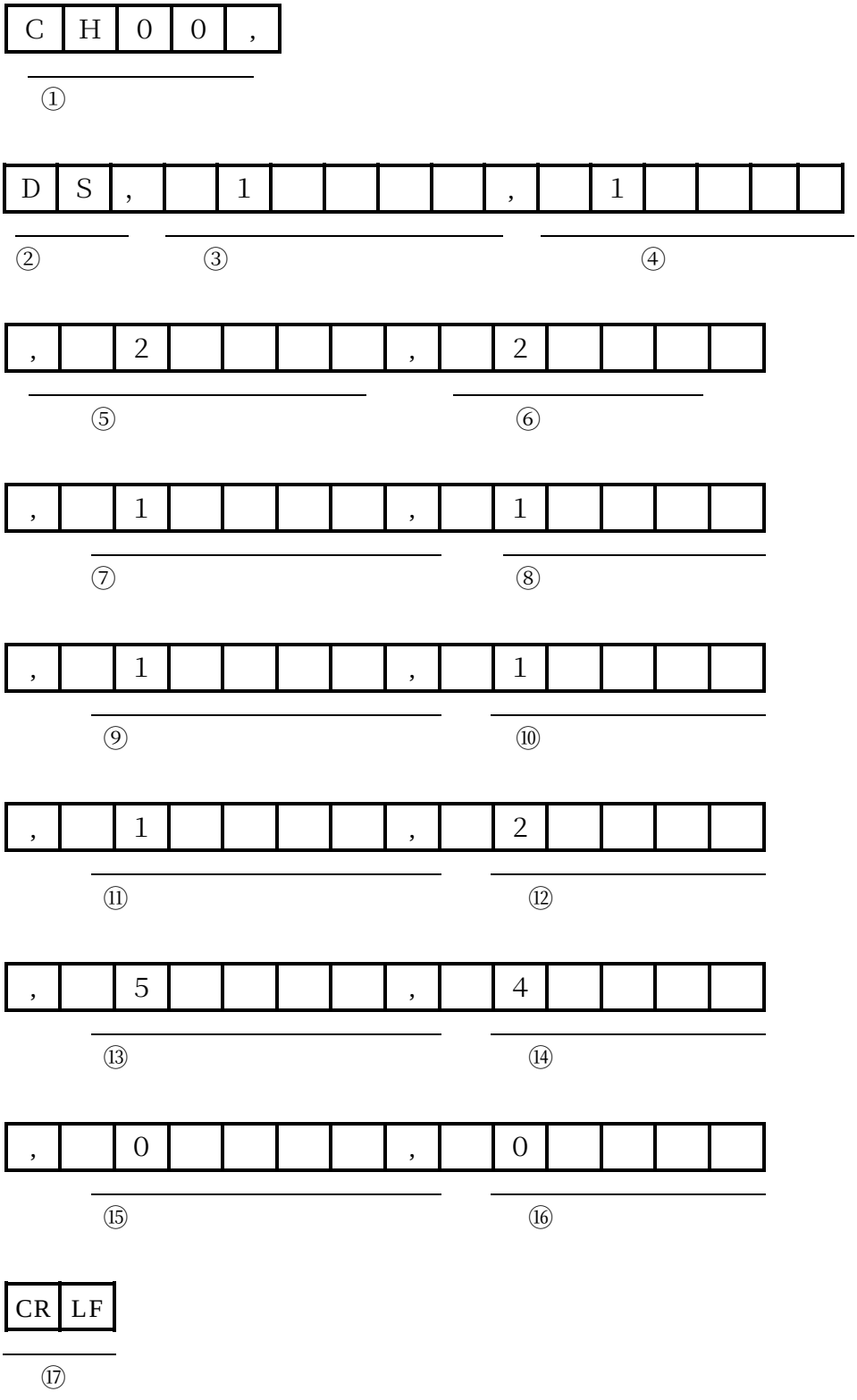
① Channel code

② Request code

③ End code

Response：When received the request command (from Terminal to PC).

- When transmitting status of all the channels, transmission is performed in the order of 1 to 14 CH.



① Channel code
② ID code
③ pH actual packaging ·····always 1
④ Dissolved oxygen actual packaging·····always 1
⑤ Specific electric conductivity actual packaging manual range: LO=1, MID=2, HI=3 automatic range: LO=4, MID=5, HI=6.
⑥ Turbidity actual packaging·····NTU=1, mg/L=2
⑦ Water temperature actual packaging ·····after decimal point first figure=1, second figure=2.
⑧ Salt actual packaging·····Display OFF=0, ON=1
⑨ Total dissolved solids actual packaging·····Display OFF=0, ON=1
⑩ Sea water specific gravity actual packaging·····Display OFF=0, ON=1
⑪ Water depth actual packaging·····Display OFF=0, ON=1
⑫ Ion 1 actual packaging·····Display OFF=0, NH4=1, NO3=2, CL=3 CA=4, F=5, K=6, Chlorophyll=8
⑬ Ion 2 actual packaging·····Display OFF=0, NH4=1, NO3=2, CL=3, CA=4, F=5, K=6
⑭ Ion 3 actual packaging·····Display OFF=0, NH4=1, NO3=2, CL=3, CA=4, F=5, K=6, ORP=7
⑮ Backup 1（Always 0）
⑯ Backup 2（Always 0）
⑰ End code

< 7 > Request of set data (from PC to Terminal)

C	H	n	n	,	Q	m	m	CR	LF

① ② ③

(Note) CR is ODH of ASCII.
LF is OAH of ASCII.

① Channel code
CH00 : Another setting（another content）
CH01 – 14 : 1-14 Channel setting（SET contents）

② Request code
Q00 : All
Q01 - mm : Parameter NO.

③ End code

Response：Set data (from Terminal to PC)

C	H	0	0	,	Q	0	1	,		2					CR	LF

① ② ③ ④

① Channelcode
CH00 : Another setting（another content）
CH01 – 14 : 1-14 Channel setting（SET contents）

② ID code Q01 - mm : Parameter NO.

③ Set data

④ End code

Remark Refer to the Table 1 and 2 for Channel code, parameter No. and set data.

【Table 1】Channelcode 01 - 12（13 and 14 are for backup）

Channel	parameter No.	Indication	Set data								
			0	1	2	3	4	5	6	7	8
1	1	pH.ALML	-10000(OFF)／ 0.00 - 14.00(pH)／-2000 - 2000(ORP)								
	2	pH.ALMH									
	3	pH BUFFER	JIS	US							
	4	pH.SLCT	PH	ORP							
2	1	DO.ALML	-10000(OFF)／0.00 - 20.00(mg/L)／0 - 200(%)								
	2	DO.ALMH									
	3	DO.UNIT		mg/L (JIS) (JIS)	%	mg/L (SEA)					
	4	DO.SALT	OFF	ON							
	5	DO.PRES	OFF	ON	100 - 1999						
3	1	COND.ALML	-10000(OFF)／0.00 - 10.00								
	2	COND.ALMH									
	3	COND.RANG	AUTO	LO	MID	HI					
	4	TENP.COFF	0.00 - 5.00								
4	1	TURB.ALML	-10000(OFF)／0.0 - 800.0								
	2	TURB.ALMH									
	3	TURB.UNIT		NTU	mg/L						
5	1	TEMP.ALML	-10000(OFF)／-5.00 - 55.00								
	2	TEMP.ALMH									
	3	TEMP.DEC		1	2						
	4	TEMP.CALC	OFF	ON							
6	1	SALT.ALML	-10000(OFF)／0.00 - 4.00(NaCl)／0.0 - 40.0(SEA)								
	2	SALT.ALMH									
	3	SALT.DISP	OFF	ON							
	4	SALT.CALC		NaCl	SEA						
7	1	TDS .ALML	-10000(OFF)／0.0 - 100.0								

Channel	parameter No.	Indication	Set data								
			0	1	2	3	4	5	6	7	8
	2	TDS .ALMH									
	3	TDS .DISP	OFF	ON							
	4	TDS .FACT	0.50 - 0.99								
	5	TDS .FACT	AUTO	OFF							
8	1	σt.ALML	-10000(OFF)／0.0 - 50.0								
	2	σt.ALMH									
	3	σt.DISP	OFF	ON							
	4	σt.TEMP	σ0	σ15	σt						
9*	1	DEPT.ALML	-10000(OFF)／0.0 - 100.0								
	2	DEPT.ALMH									
	3	DEPT.DISP	OFF	ON							
10*	1	ION1.ALML	-10000(OFF)／0.0 - 62000(ION)／ 0.0 - 400.0(CHLO)								
	2	ION1.ALMH									
	3	ION1.DISP	OFF	ON							
	4	ION1.SLCT		NH4	NO3	CL	CA	F	K		CHLO
11*	1	ION2.ALML	-10000(OFF)／0.0 - 62000								
	2	ION2.ALMH									
	3	ION2.DISP	OFF	ON							
	4	ION2.SLCT		NH4	NO3	CL	CA	F	K		
12*	1	ION3.ALML	-10000(OFF)／0.0 - 62000(ION)／-2000 - 2000(ORP)								
	2	ION3.ALMH									
	3	ION3.DISP	OFF	ON							
	4	ION3.SLCT		NH4	NO3	CL	CA	F	K	ORP	

【Table 2】Channel code 00

Request code ID code	Indication	Set data		
		1	2	3
1	USE .MODE	RECODE	TERM.	PRINT
2	AUTO.OFF	OFF	ON	
3	REC .MODE	MANUAL	SETTING	ALWAYS
4	REC .START	2000/01/01,00:00 - 2099/12/31,23:59		
5	REC .END			
6	REC .INTVL	00:00 - 23:59		
7	CLOCK	2000/01/01,00:00 - 2099/12/31,23:59		
9	LATI.	N or S000.00.00 - N or S999.99.99		
10	LONGI.	E or W000.00.00 - E or W999.99.99		
11	ANALOG1	1 - 12		
12	ANALOG2			
13	KEY.LOCK	OFF	ON	

<8> Request of calibration history data (from PC to Terminal)

C	H	n	n	,	Q	4	0	CR	LF

① ② ③

(Note) CR is ODH of ASCII.
LF is OAH of ASCII.

① Channel code
CH01 – 14 : 1-14 Channel setting（There is no 00）

② Request code
40-42 : 40=4 or Z, 41=7 or S, 42=9

③ End code

Response：Calibration history data (from Terminal to PC)

- When requested pH 4 calibration history;

C	H	0	1	,	Q	4	0

① ②

2	0	0	2	／	0	5	／	2	5	,	1	1	:	1	5

③

,		4	.	0	1		,		1	7	3	.	5	CR	LF

④ ⑤ ⑥

① Channel code 01：ｐH
② ID code 40：ｐH４
③ Calibration time data
④ pH4 calibration data
⑤ pH4 calibration electromotive force (after ATC)
⑥ End code

- When requested dissolved oxygen calibration history;

C	H	0	2	,	Q	4	0

① ②

2	0	0	2	／	0	5	／	2	5	,	1	4	:	0	1

③

,		0	.	0	0		,	−	1	.	0		

④ ⑤

CR	LF

⑥

① Channel code 02：DO
② ID code 40：Zero calibration
③ Calibration time data
④ Calibration zero (Z) data
⑤ Current sensitivity (after nA, ATC)
⑥ End code

Note Put "0" to the item that has no calibration history.

When performed one-point calibration only, old data shall be returned as for other

calibration points, if any.

Other that pH and Do, data before calibration shall be returned to ⑤.

Remark Refer to Channel code table 1.

（2）Setting of data

CAUTIONS

- Make sure to do setting by command on the Measurement screen MEAS. .

<1> Setting of set data (from PC to Terminal)

C	H	n	n	,	X	m	m	,	D	D	D	D	D	D	CR	LF
①					②				③						④	

(Note) CR is ODH of ASCII.
LF is OAH of ASCII.

① Channel code

CH00 : Another setting

CH01 - 14 : 1-14 Channel setting

② Request code

X01 - mm : Parameter NO.

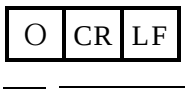
③ Set data : Above parameter range

④ End code

Remark Refer to the Table 1 and 2 as for the channel code, parameter No. and set data.

Response：Response data (from Terminal to PC)

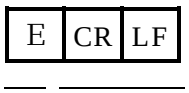
- When the setting is OK;



① OK code

② End code

- When the setting is NG;

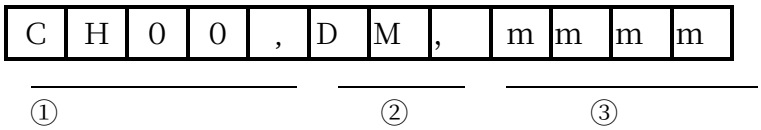


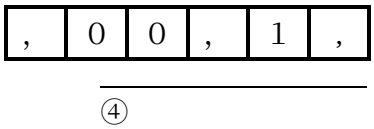
① Error code

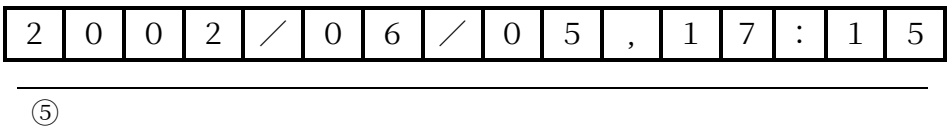
② End code

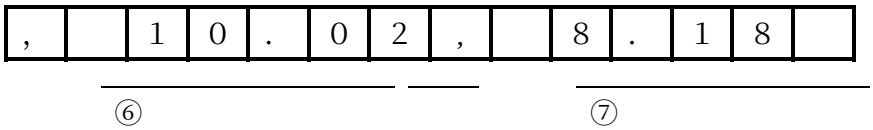
（3）Data output format on ＴＥＲＭ. mode

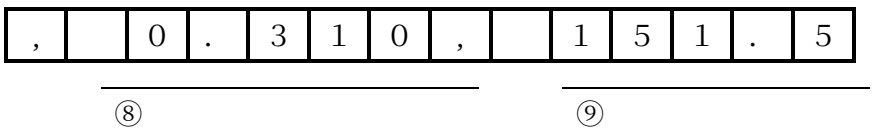
Response only (from Terminal to PC)

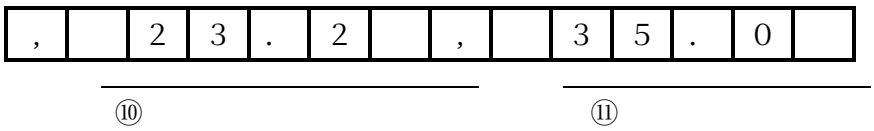


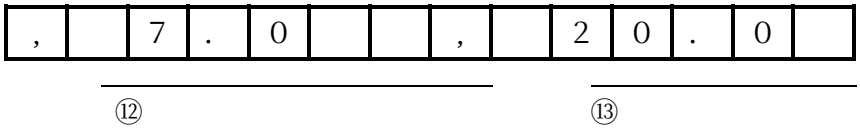


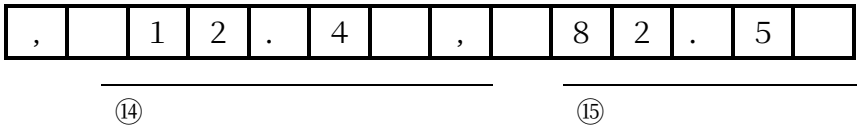


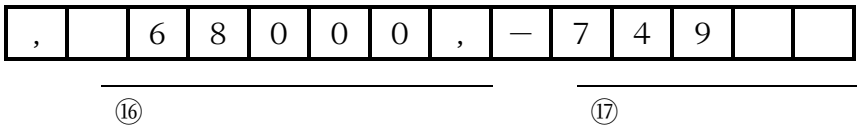


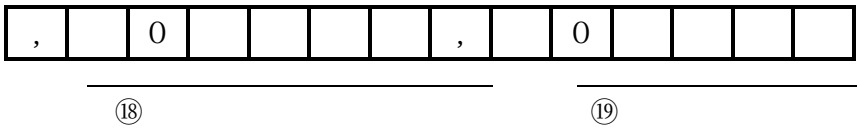


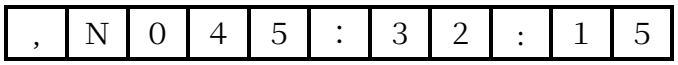


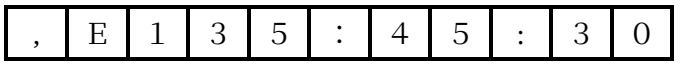


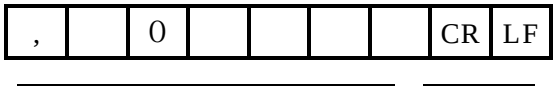












① Channel code ② ID code ③ Sample No.
④ 00 fixed, 1 fixed ⑤ Year/Month/Date/Hour/Minute ⑥ pH memorized value
⑦ Dissolved oxygen memorized value ⑧ Specific electric conductivity memorized value
⑨ Turbidity memorized value ⑩ Water temperature memorized value
⑪ Salt memorized value ⑫ Total dissolved solids memorized value
⑬ Sea water specific gravity memorized value ⑭ Water depth memorized value

⑮ Ion 1 memorized value ⑯Ion 2 memorized value ⑰ Ion 3 memorized value

⑱ Backup 1 (always 0) ⑲ Backup 2（always 0） ⑳ GPS longitude data

㉑ GPS latitude data ㉒ Error code ㉓ End code

Attention Datum always becomes 0 if Display OFF was set.

（4）External system command

This command is to output the data set on *TERM.CMD* (from Terminal to External output).

Transmission only

S	,	0	4	2	2	5	3	5	1	1	6			CR	LF
①		②												③	

(Note) CR is ODH of ASCII.
LF is OAH of ASCII.

① System command code

② Set characters

Data area ＋ Item area

Above is the example of the transmission of 0422535116-- (-- is substitution of the space).

③ End code

Data package software

We have prepared the Data package software **WQC-LOG** as an option to download the measured data to PC.

With the **WQC-LOG** you can easily download the data to your PC and store them by CSV format.

You can also make figures and graphs using a commercially available spreadsheet software.

Please contact us as for the detail.

10. Maintenance and check

10.1 Terminal

(1) Stain on the Terminal

To get rid of stain on the Terminal, wipe it out with dried cloth or wiper made of soft material. When the stain was heavy, use a cloth once put in the water with a little bit of mild detergent and squeezed one to wipe it out.

CAUTIONS

- Do not use the organic solvent such as thinner to wipe out the stain on the Terminal. It may tarnish the wiped portion.

(2) Check of the Cover

Check whether there is no dust, fiber or something abnormal in the groove or rubber packing of the Battery case cover and Output case cover when replacing batteries. Use your fingers to take out the dust. Use of the cloth might help to attach fiber dust and deteriorate the waterproof performance. If the packing was twisted, refit it correctly.
If the packing had a scratch, replace it with new one.

(3) Long-term storage (longer than two months)

Take out batteries to store the Terminal long term.

10.2 Sensor module

(1) Contamination of sensor module

① Thoroughly clean the whole unit with purified water, tap water. Remove hardly removable dirt by lightly rubbing with sponge.
② Remove the protection tube and the outer cylinder of electric conductivity cell
③ Thoroughly clean the electrode and cells with purified water, tap water. Wash severe contamination carefully using sponge and neutral detergent and remove the detergent with tap water or purified water. Don't rub the DO electrode separating membrane.
④ If aquatic organism is deposited, remove it with care not to damage cells and electrode.

(2) Normal storage

Clean the electrode and cells with purified water. Place a protective cap to which a small

amount of purified water is filled on the pH electrode and ORP electrode and store them.
Remove the ion electrode chip and wipe off the moisture. Store it in a dry and light-shielded place.
The ion comparing electrode should be stored by firmly pushing a rubber plug which is supplied with it and place a cap to which a small amount of purified water is filled.

（3）Long-term storage (longer than two months)

DO electrode: Take off the Diaphragm set, clear off the contained liquid and wash it off with purified water. Store it in dried up condition.

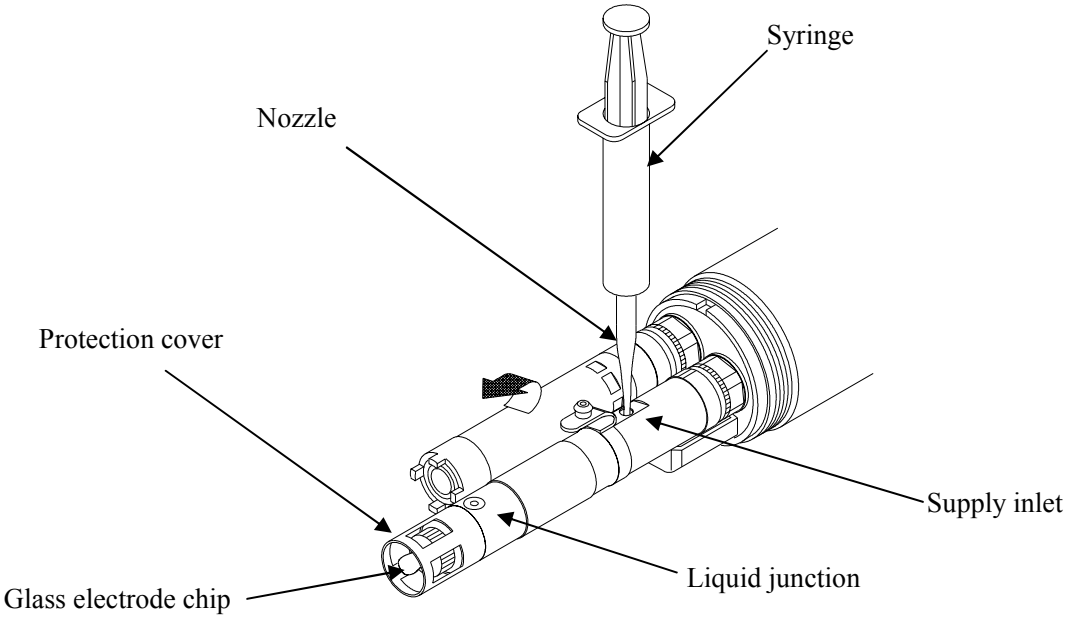
CAUTIONS

- Once taken off Diaphragm set is not available to use.
- Save necessary data prior to removal of batteries
- When submerging the sensor module, remove the rubber cap of comparing electrode and mount a electrode chip or remove the comparing electrode and mount a dummy cap. Submerging with a rubber plug attached may cause penetration of water into the connector to the electrode chip

10.3 Maintenance and check of the pH electrode

（1）Replacement of the contained liquid

Replace it with attached Reference electrode gel liquid once in three months (Model type:143F235).



① Open the Supply inlet.

② Apply the attached Syringe and Nozzle to take off the ole Reference electrode gel liquid from the Supply inlet as illustrated above. Make sure that remained volume became less than one third.

③ Put the standard attachment Refernce electrode gel liquid into the Supply inlet with the Sylinge and Nozzle so as not to keep bubble inside.

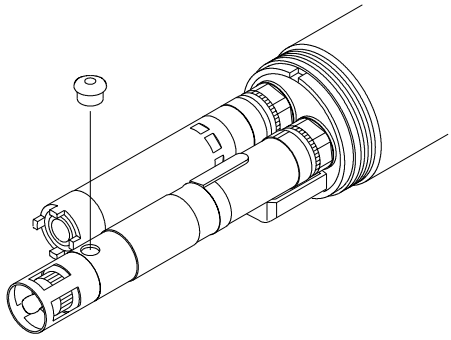
④ If once bubbles came in, tip over the module to let bubbles come aroud the Supply inlet, then put the liquid in so as to push bubbles out.

⑤ Tighten the Cap of Supply inlet correctly to finish.

（2）Replacement of the Liquid junction section

Replace it as needed when that section was dirty or tarnished (Model type: 6784580K).

Apply a pair of tweezers to take it off if necessary.



（3）Maintenance of electrode chip

When slow response, low sensitivity, poor repeatability and other symptoms appear due to contamination of the electrode chip, take measures in accordance to the type of electrode chip as follows:

When the performance is not recovered yet, replace the electrode chip.

【Glass electrode (pH electrode)】

Wipe off the end with gauze impregnated with the neutral detergent and clean with purified water.

【ORP electrode, fluoride ion electrode, and chloride ion electrode】

Polish with soft paper such as filter paper or cloth until a mirror surface is attained.

CAUTION

- Don’t polish with sand paper or emery paper

【Nitrate ion electrode, potassium ion electrode, and calcium ion electrode】

Submerge for several hours in a thin standard solution to which water or ion intensity adjustment agent is added

（4）Replacement of the Glass electrode chip

Replace the electrode when it is cracked, broken, inside of it is hollowed, or the performance is not recovered after maintenance.

① Turn the Protection cover counterclockwise and take it off.

② Hold the end of the Glass electrode chip (made of polyvinyl chloride, having grooves), turn it counterclockwise and take it off.

CAUTIONS

Do not hold the glass section.

It might break and give you an injury.

③ Hold the end of new Glass electrode chip and tighten it to the end on turning it counterclockwise.

④ Put the Protection cover on as the way it was.

CAUTIONS

- Perform the calibration before use when replaced the Glass electrode chip.

（5）Replacement of the Reference electrode

If the performance of the module is not recovered even replaced the Reference electrode gel liquid, Liquid junction section and Glass electrode chip, then replace the Reference electrode unit (Model type: ELR001-Y).

<Reference> p.3-5 Name and function of components Sensor unit ④ in the figure

① Turn counterclockwise the fixture nut of the Reference electrode end to loosen it with the special wrench on pushing it tight.

② When the nut is loosen, take out the Reference electrode.

③ Check that new Reference electrode is filled with Reference electrode gel liquid.

④ Apply the standard attachment Silicon grease lightly on the O-ring of the Reference electrode connector.

⑤ Put the Reference electrode into the Sensor module. Turn it lightly to meet slots.

⑥ Push in the Reference electrode and tighten the fixture nut clockwise with fingers.

⑦ Keep tightening to the end.

⑧ Put on the Glass electrode chip and Protection cover.

CAUTIONS	
	Take off the Glass electrode chip before replacing the Reference electrode. It may break and give you an injury.
	Turn OFF the Power Supply to replace the Reference electrode .
	Pay attention not to put water drop on the Connector when replacing the Reference electrode. It may cause electrical shock, fire or failure.

（6）Maintenance of ammonium electrode

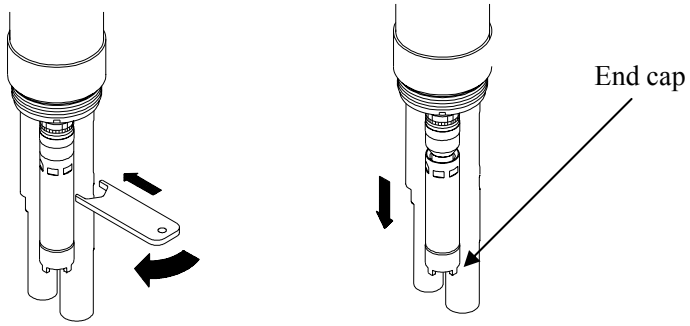
【For operation】

Fill with sufficient quantity of the ammonium electrode inner liquid.

Remove the protection cap for operation

When the response is slow, replace the separating membrane set.

【Makeup of inner liquid and replacement of separating membrane set】



① Turn the outer tube of ammonium electrode anti-clockwise to remove it. When it is hardly removed, turn it using the spanner attached to it to remove it. Discard the inner liquid.

② To replace the separation membrane cartridge, turn the end cap anti-clockwise.

③ Remove packing and the separating membrane cartridge from inside of end cap.

④ Mount new packing and separating membrane cartridge to the end cap.

⑤ Mount the end cap on the outer cylinder

⑥ Fill the outer cylinder with the inner liquid as attached

⑦ Mount the outer cylinder filled with the inner liquid to the main unit of electrode. Slowly

screw in until it is lightly stopped while overflowing the inner liquid so that no bubble is left inside.

⑧ Remove the electrolytic solution remaining around it using the purified water or tap water.

【Storage】

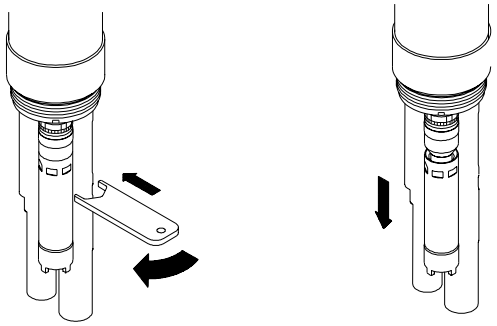
When it is not used for one month or longer, discard the inner liquid and clean it. Store it in a dry condition.

10.4 Maintenance and check of DO ELECTRODE

（1）Replacement of DO ELECTRODE electrolyte and Diaphragm set

Replace the electrolyte and Diaphragm set of the DO ELECTRODE once in four months.

(Model type: Electrolyte set: OBG00007, Diaphragm set: 6748580K)



① Turn the DO ELECTRODE Outer sheath counterclockwise and take it off. Apply the attached special wrench when necessary.

② Clear off the contained liquid.

③ Turn the Diaphragm set counterclockwise and take it off.

④ Wash away lightly the Electrode unit and Outer sheath with purified water.

⑤ Wipe out tightly the Anode (a dull colored metal bar) of the Electrode unit with a cloth or wiper.。

⑥ Attach a new Diaphragm set to the Outer sheath. Turn it lightly to tighten to the end.

⑦ Put fully the electrolyte into the Outer sheath. Make sure that no air bubble remains inside the Outer sheath or screw portion. If the air bubble remained, take it away on tapping it or discharge the electrolyte and put it again.

⑧ Attach the Outer sheath filled with electrolyte to the Electrode main body. Screw it in slowly on overflowing the electrolyte until it stops lightly so that no air bubble remains.

⑨ Leave it approx. five minutes so that remaining air bubbles come together. Take off the Outer sheath slowly and fill the electrolyte fully so as to drive away the bubbles and attach the Outer sheath again to the Electrode main body slowly to the end.

⑩ Wash away adherent overflowed electrolyte with purified water or running water.

CAUTIONS

- Remained bubbles might bother correct measurement.
- Pay attention to handle the Electrode as its inside has weak portion by structure.
- Replace also the Diaphragm set when replaced the electrolyte.
- Once taken off Diaphragm set is not available to use.

（2）Polishing the DO ELECTRODE

If the calibration is not available or response is remarkably weak even replaced the electrolyte and Diaphragm, polish lightly the Anode (a dull colored metal bar of the Electrode unit) with a sand paper of #400 - 600 or a sponge and cleanser.

Wash the Electrode thoroughly with purified water.。

CAUTIONS

- Over polishing would wear the Electrode and shorten its lifetime.
- Initial drift may occur after polishing. Leave the Electrode one day after having set the electrolyte and Diaphragm before calibration and use.

（3）Replacement of the DO ELECTRODE

Replace the DO ELECTRODEiftheperformance of the module is not recovered even replaced the electrolyte and Diaphragm, or polished it (Model type: ELD001-Y).

① Turn counterclockwise the fixture nut of the DO ELECTRODE end with the special wrench to loosen it.

② Take out the DO ELECTRODE when the nut is loosen.

③ Put a new Diaphragm onto the DO ELECTRODE and fill it with the electrolyte.

④ Apply lightly the standard attachment Silicon grease on the O-ring of the Electrode connector.

⑤ Put the DO electrode into the Sensor module and tighten the fixture nut clockwise with fingers.

⑥ Hook fingers onto the slot of Diaphragm set on the DO ELECTRODE top, push the Electrode in, and turn clockwise the fixture nut with fingers.

⑦ Keep on tightening to the end.

CAUTIONS

Pay attention not to hold the Outer sheath when pushing in the DO Electrode. Your finger s might slip off and get scratched with four claws of the Diaphragm set edge.

Make sure to hook fingers onto the slot of edge claws to push in. This time also pay attention not to hit your palm onto claws.

Turn OFF the Power Supply before replacing the DO Electrode.
Pay attention not to put water drop on the Connector when replacing the DO Electrode.

It may cause electrical shock, fire or failure.

10.5 Maintenance of Specific electric conductivity/Turbidity cell /chlorophyll cell and Termo-sensor

CAUTIONS

- Specific electric conductivity cell, Turbidity cell and Thermo-sensor cannot be dismounted. Never try to dismount them.

（1）Washing the Specific electric conductivity cell

Follow the procedure below to wash the cell when necessary. Make sure to clean it in the same way before storing it long time.

<Reference> p.3-5 Name and function of components Sensor unit ⑫ in the figure

① Turn counterclockwise the Cell cover and take it off.
② Wash away stains and dusts in the Electrode and Cell cover.
③ Use a soft cloth or wiper immersed with thin mild detergent to wash them with caution. Pay attention not to rub too hard.
④ Wash away the detergent with running water, then wash with purified water.

CAUTIONS

- Never use sand paper or polishing agent. It may cause error in data.
- Pay attention not to give damage to the Cell cover inside.

（2）Washing the Turbidity cell and chlorophyll cell

Follow the procedure below to wash it once a week.

<Reference> p.3-5 Name and function of components Sensor unit ⑫ in the figure

① Wash off the Light path face wuth running water.

② Use a soft cloth or wiper immersed with thin mild detergent to wash it with caution. Pay attention not to rub too hard.

③ Wash away the detergent with running water, then wash with purified water.

CAUTIONS

- Too hard rubbing would give damage to the Light path face and give effect to the data.

（3）Washing the Thermo-sensor

Use a soft cloth or wiper to wipe out the Thermo-sensor if it is dirty.

Apply the mild detergent or ethanol when necessary.

＜Reference＞ p.3-5 Name and function of components Sensor unit ⑬ in the figure

10.6 Replacement of batteries

Replace batteries with new ones when BATT. mark was displayed on the Measurement screen.

When the Terminal batteries are used up, BATT. lights up and ERROR 97 is displayed.

When the Sensor module batteries are used up BATT. lights up and ERROR 98 is displayed.

Priority is given to display ERROR 98 than ERROR 97.

Refer to **4.2. Setting of batteries** as for the replacement of batteries.

CAUTIONS	Connect the Sensor module to the Terminal to have battery power when replacing the module batteries. There is a risk that memorized data are accidentally deleted. It is recommended to output the memorized data before replacing batteries.

11. How to deal with troubles

11.1 Safety precautions on anomalies

Follow the precautions below when an anomaly occurred.

WARNING	
	Turn OFF the Power Supply immediately after you have noticed an anomaly. There is risks of fire, internal burst and so on if you have done wrong operation, noticed burning smell, smoking and so on. Make sure that the fire or smoke is put out, then contact the dealer or us. Do not try to repair by yourself. It is dangerous. Operation in abnormal condition may cause the fire and electrical shock.

11.2 Error indication

This equipment has an Error indication function to let you know the operation error or trouble.

If an error occurred, ERROR indication lights up in the Display and the Error No. is displayed on the Month indication.

When more than one error occurred, the error with larger error No is first indicated.

When the printer, RS232C are set, the error with larger error No. is first indicated.

Once the Error No. is displayed, take an appropriate action on referring to the Error indication list below.

<Error indication list>

NO	Contents	Cause / Action
01(Note)	ION 3 error（Gauge pointer over）	Out of measurable range
02(Note)	ION 2 error（Gauge pointer over）	Out of measurable range
03(Note)	ION 1 error（Gauge pointer over）	Out of measurable range
04(Note)	Water depth error(<-1m or >100m)	Out of measurable range
05	Temperature error(<-5d℃ or >55℃)	Out of measurable range
06	Turbidity error(>800NTU or >800mg/L)	Out of measurable range
07	Dissolved oxygen error(>20mg/L or >200%)	Out of measurable range
08	pH error(<pH0 or >pH14)	Out of measurable range
09(Note)	ION 3 calibration error	
10(Note)	ION 2 calibration error	
11(Note)	ION 1 calibration error	
12	DO calibration error	Leave until it gets stabilized. Replacement of the electrolyte and Diaphragm. Polishing the Electrode.
13	ｐH calibration error	Replacement of the Reference electrode gel liquid. Replacement of the Liquid junction section.
95	The abnormalities in a memory and initialized memory	Check the battery.
96	Memory shortage（Remaining Memory less than 71 data）	Delete unnecessary data.
97	Voltage down of Terminal batteries	Replace batteries.
98	Voltage down of Sensor module batteries	Replace batteries.
99	Sensor module connection error	Do again connection of the cable.

(Note) Not displayed on the standard Sensor module as this is an option.

11.3 Miscellaneous troubles and countermeasures

Described here are troubles other than error indications and their causes and countermeasures. In case where the performance is not recovered even taken necessary actions, or a trouble not described here has occurred, or you want to ask repair, check Model type and Manufacture No. of your Terminal and Sensor module and contact the dealer or us.

（1）Troubles on operation and setting

Trouble	Cause	Countermeasure
Nothing displayed after turned ON the Power Supply	Batteries are not set, or used up.	Replace batteries.
	Batteries are not correctly set.	Reset batteries correctly.
No operation on pressing a key	Key lock function is set ON. (LOCK indication lights up in the Display.)	Release the Key lock function.
	Abnormal action of the software.	Turn ON again the Power Supply. Reset batteries correctly. Do the System reset.

（2）Troubles on measurement

Trouble		Cause	Countermeasure
pH	Indication does not change	Protection cap is not taken off.	Take off the Protection cap.
		Reference electrode gel liquid is not filled in.	Put in the Reference electrode gel liquid.
		Glass electrode chip is not connected correctly.	Tighten the pH electrode chip.
		Electrode and Sensor module are not connected correctly.	Attach again the Electrode.
		Glass electrode has a crack.	Replace the Glass electrode chip.
	Indications not stable. Response is slow. Indicated value error.	Deterioration or shortage of the Reference electrode gel liquid.	Replace the Reference electrode gel liquid.
		Stain on the Liquid junction section.	Replace the Liquid junction section.
		Glass electrode has a crack. Glass electrode is broken. Deterioration of Glass electrode.	Replace the Glass electrode chip.
		Deterioration of Reference electrode.	Replace the Reference electrode.
		Stain on Glass electrode.	Wash the Glass electrode or replace it.
		Electrode is not fully immersed with the sample.	Put it in the sample until its upper hole or more.
DO	Indication does not change	Reference electrode gel liquid is not filled in.	Put in the Reference electrode gel liquid.

11. How to deal with troubles

Trouble		Cause	Countermeasure
		Electrode and Sensor module are not connected correctly.	Take off the Electrode and attach it again.
	Indication is not stable. Response is slow. Indicated value error	Diaphragm is dirty. Diaphragm is broken. Deterioration of electrolyte.	Replace the Diaphragm after electrolyzation.
		Bubbles are attached to the Diaphragm surface.	Discharge the electrolyte and fill it again.
		Diaphragm surface is dirty.	Wipe out the Diaphragm surface with a wet wiper with caution.
		Deterioration of Electrode surface.	Wipe out the Anode, polish the Cathode.
		Deterioration of Electrode.	Replace the Electrode.
	Calibrationis not performed.	(Other than description above) Calibration condition is not appropriate.	Perform calibration with wet air.
Turbidity, Temp. Spec. Elec. conduc.	Indication is not stable. Response is slow. Indicated value error	Cell and/or Sensor is(are) dirty. Dust in Specific electric conductivity y Protection cover.	Wash the Cell and Sensor.
Ion	Indication is not changed	Protection cap is mounted	Remove protection cap
		Comparing electrode gel inner liquid is not charged	Make up comparing electrode gel inner liquid
		Connection of electrode chip is incomplete	Tighten electrode chip
		Connection of electrode and sensor module is incomplete	Mount electrode again
		No inner liquid is charged	Replace electrode chip Fill inner liquid (Ammonium electrode)
	Indication is unstable Response is slow Indication is abnormal	Deterioration or loss of comparing electrode gel inner liquid	Replace comparing electrode gel inner liquid
		Contaminated liquid junction unit	Replace liquid junction

Trouble		Cause	Countermeasure
		Electrode chip is cracked Membrane of electrode chip is broken	Replace electrode chip
		Deteriorated comparing electrode	Replace comparing electrode
		Contaminated electrode chip	Clean or replace electrode chip
		Insufficient submersion of electrode in sample	Submerge in sample to the upper hole of protection tube
Ion		(Ammonium electrode)	Replace membrane, inner liquid
Chloro phyll	Indication is unstable Indication is abnormal	Cell is contaminated	Clean cell

11.4 How to reset the System

If the System stopped the operation or error occurred in the display, sometimes that returns normal by doing System reset.

CAUTIONS

- By doing the System reset, every setting is initialized and calibration data are deleted. Perform every setting and calibration after having reset the System.

POWER key : Power Supply OFF

↓

On pressing CAL／ENT key, press POWER key.

↓

pH. ZERO

↓

SELECT／CLEAR key

↓

INITIAL1

↓

Press CAL／ENT key (approx. five sec) until a bleep sounds.

↓

0 is displayed, **Reset** starts.

↓

0 0 is displayed, **Reset** completes.

↓

POWER key Power Supply OFF

↓

POWER key Power Supply ON

↓

Perform setting and calibration.

12.Parts/Consumables/Option list

Order the dealer you have purchased the equipment for the purchase of various parts and options. Please be noted to advise parts name, model type and quantity.

pH/ORP

Part name	Model type	Unit	Remarks
Phtalate reference solution pH4.01	143F191	1	500mL
Neutral phosphoric acid reference solution pH6.86	143F192	1	500mL
Boric acid reference solution pH9.18	143F193	1	500mL
Color pH reference solution pH4.01	pH4.01CL	1	500mL
Color pH reference solution pH6.86	pH6.86CL	1	500mL
Color pH reference solution pH9.18	pH9.18CL	1	500mL
Reference electrode gel liquid	143F235	1	50mL
Liquid junction section	6784580K	1	
Glass electrode chip	ELP-023	1	
Reference electrode	ELR-001	1	
ORP electrode chip	ELM-004	1	
ORP reference solution	143F196	1	500mL

DO

Part name	Model type	Unit	Remarks
Electrolyte set(50mL×3)	0BG00007	1	
Diaphragm set(2 pcs)	6789790K	1	
EO electrode	ELD-001	1	
Sodium sulfite	NA2SO3-5	1	50g

Terminal, Sensor module, Electrode

Part name	Model type	Unit	Remarks
Battery cap	6806730K	1	With O-ring
Battery cap O-ring	115A832	1	
Connector cap	6801710	1	
Dummy cap	6806740K	1	Used to put when operating ontaking off the Electrode.

Part name	Model type	Unit	Remarks
O-ring for Electrode	115A831	1	For replacement. Common use with the Dummy cap.
Silicon grease	141D002	1	5g
Special wrence	67628000	1	For Electrode, Battery cap and Connector cap.
Special driver	0OZ00001	1	For Battery cover and Output cover.
Reinforced band	67826300	1	
Caliblation cup	67659900	1	standarad
Caliblation cup(chlorophyll)	68433100	1	For chlorophyll module
Protecive sheath	6851520K	1	standarad
Protecive sheath(chlorophyll)	6851600K	1	For chlorophyll module
Protecive sheath guide	6851590K	1	For ion/chlorophyll module

Other options and consumables

Part name	Model type	Unit	Remarks
Connection cable 2m	6801640K	1	Standard attachment
Connection cable 10m	6801850K	1	
Connection cable 30m	6801860K	1	
Connection cable 100m	6801870K	1	
RS-232C cable 1m	0GC00005	1	
RS-232C cable 2m	0GC00006	1	
RS-232C cable 4m	0GC00007	1	
RS-232C cable 10m	0GC00008	1	
Data package software	WQC-LOG	1	English Version
Analogue output cable	6548270K	1	1.5m
Printer	EPS-G	1	With a cable
Printer sheets (20 packs)	P000119	1 pack	For EPS-G
Ink ribbon	0RD00001	1	For EPS-G
Ink ribbon(10 pcs)	P000124	1pack	ForEPS-G
AC adapter	134G002	1	100Vonly
GPS unit	6812970K	1	With RS-232C cable

Ion-related

Product name	Model name	Marketing unit	Remarks
Comparing electrode	ELR-001	1	

Product name	Model name	Marketing unit	Remarks
Comparing electrode gel inner liquid	143F235	1	50ml
Liquid junction section	6784580K	1	
Ammonium electrode	ELX-002	1	With reference electrode
Ammonium electrode inner liquid	0BG00005	3	50ml
Ammonium electrode embrane cartridge	6846620K	3	
Fluoride ion electrode chip	F-200	1	
Chloride ion electrode chip	CL-200B	1	
Nitrate ion electrode chip	N-300	1	
Potassium ion electrode chip	K-300B	1	
Calcium ion electrode chip	CA-300	1	
Ammonium ion standard solution	NH4-1000	1	
Ammonium form nitrogen standard solution	NH4-N	1	1000mg/L 500ml
Fluoride ion standard solution	F-1000	1	1000mg/L 500ml
Chloride ion standard solution	CL-1000	1	1000mg/L 500ml
Nitrate ion standard solution	NO3-1000	1	1000mg/L 500ml
Nitrate form nitrogen standard solution	NO3-N	1	1000mg/L 500ml
Potassium ion standard solution	K-1000	1	1000mg/L 500ml
Calcium ion standard solution	CA-1000	1	1000mg/L 500ml
Ion intensity adjusting agent for ammonium	ISA-NH	1	500ml
Ion intensity adjusting agent for fluorine ion	TISAB-01	1	500ml
Ion intensity adjusting agent for fluorine ion	TISAB-11	1	500ml
Ion intensity adjusting agent for chlorine ion	ISA-CL	1	500ml
Ion intensity adjusting agent for nitrate ion	ISA-NO	1	500ml
Ion intensity adjusting agent for potassium	ISA-K	1	500ml
Ion intensity adjusting agent for calcium ion	ISA-CA	1	500ml

Revision History

WQC24-D6-01	June, 2003	Original
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