
User's Manual

Model SC72 Personal Conductivity Meter

IM 12D03D02-01E

Preface

Thank you for purchasing the Model SC72 Personal Conductivity Meter. Please read this manual thoroughly before using the meter.

The related documents (User's Manual) are as follows.

IM 12D03D02-01E Model SC72 Personal Conductivity Meter (this manual)

IM 12D03D02-02E Model SC72 Personal Conductivity Meter Quick Manual

* the "E" in the document number is the language code.

The following symbol marks are used for safety precautions in this manual.



WARNING

: Indicates that serious injury may result, if the user fails to follow instructions.



CAUTION

: Indicates that minor injury to personnel, or damage to the equipment, may result if the user fails to follow instructions.



WARNING

Do NOT use this instrument where there is a possibility of electrical shock.

Do NOT touch any part of the electrode immediately after using in very hot liquids — otherwise, you may get burned.



CAUTION

Do not apply physical shock or excessive force to the glass sensor, or it may break.

If the meter will not be used for an extended period of time, be sure to remove the batteries. Otherwise battery leakage may occur, causing damage to or malfunction of the meter.

The contents of this manual are subject to change without prior notice.

Yokogawa Electric Corporation assumes no liability for damage, defects, or loss of the product caused by any of the following:

- Misuse by the user;

- Inappropriate or out-of-specifications use of the product;

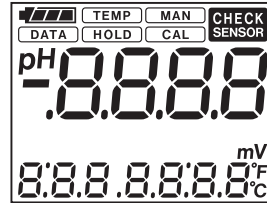
- Use in an unsuitable environment;

- Repair or modification of this or related products by persons other than Yokogawa-authorized engineers.

Liquid Crystal Display (LCD) Characters

On the LCD alphanumeric characters are displayed as follows.

Alphabet	Display	Alphabet	Display	Numerals	Display
A	<i>A</i>	N	<i>n</i>	0	<i>0</i>
B	<i>b</i>	O	<i>o</i>	1	<i>1</i>
C	<i>C</i>	P	<i>P</i>	2	<i>2</i>
D	<i>d</i>	Q	<i>q</i>	3	<i>3</i>
E	<i>E</i>	R	<i>r</i>	4	<i>4</i>
F	<i>F</i>	S	<i>S</i>	5	<i>5</i>
G	<i>G</i>	T	<i>t</i>	6	<i>6</i>
H	<i>H</i>	U	<i>U</i>	7	<i>7</i>
I	<i>I</i>	V	<i>V</i>	8	<i>8</i>
J	<i>J</i>	W	<i>W</i>	9	<i>9</i>
K	<i>K</i>	X			
L	<i>L</i>	Y	<i>y</i>		
M	<i>M</i>	Z	<i>Z</i>		



All display segments

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Note Regarding Panels Shown in this Manual:

Panels shown in this manual should be regarded as examples. Actual panel format may vary depending on parameter settings and on type of connected sensor.

Flashing Displays

Flashing messages, numbers and digits on the display are indicated in gray in this manual.

Flashing state: *10.0*

Lit state: 10.0

■ Warranty and Service

Yokogawa products and parts are guaranteed to be free from defects in workmanship and materials under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer.

Individual sales units may offer different warranty periods, so the original purchase order should be consulted for the conditions of sale. Damage caused by normal wear and tear, inadequate maintenance, corrosion, or due to chemical processes, is excluded from this warranty coverage. In addition, performance deterioration of the sensor caused by the operating environment mentioned above is not considered to be a defect. Yokogawa cannot carry out repairs in such a case so please replace the sensor.

In the event of a warranty claim, any items that are considered to be defective should be sent (freight paid) for repair or replacement (at Yokogawa discretion) to the service department of the relevant sales unit. The following information must be included in a letter accompanying the returned items:

- Model code and serial number

- Copy of original purchase order showing the date

- Length of time used, and the measuring environment

- Fault symptoms, and circumstances of failure

- Statement whether service under warranty or out-of-warranty service is requested

- Complete shipping and billing instructions for return of goods, plus the name and phone number of a contact person who can be reached for further information

Goods that have been in contact with process fluids must be decontaminated / disinfected before shipment, and a statement to this effect should be included. Safety data sheets for all process components that the goods have exposed to should also be included.

■ How to replace and dispose the batteries:

This is an explanation about the new EU Battery Directive (DIRECTIVE 2006/66/EC). This directive is only valid in the EU.

Batteries are included in this product.

When you remove batteries from this product and dispose them, discard them in accordance with domestic law concerning disposal.

Take a right action on waste batteries, because the collection system in the EU on waste batteries are regulated.



Battery type: Alkaline dry cell

Notice:

The symbol (see above), which is marked on the batteries, means they shall be sorted out and collected as ordained in ANNEX II in DIRECTIVE 2006/66/EC.

How to remove batteries safely: Refer to subsection "2.1 Installing the Batteries".

■ How to deipose this product (This directive is valid only in the EU.)

This product complies with the WEEE Directive marking requirement.

This marking indicates that you must not discard this electrical/electronic product in domestic household waste.



Product Category

With reference to the equipment types in the WEEE directive Annex I, this product is classified as a "Monitoring and Control instruments" product.

Do not dispose in domestic household waste. When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

■ Authorised Representative in EEA

The Authorised Representative for this product in EEA is Yokogawa Europe B.V. (Euroweg 2, 3825 HD Amersfoort, The Netherlands).

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Contents

1. Outline

The Model SC72 Personal Conductivity Meter is an accurate, portable, easy-to-use conductivity meter. It includes not only self-diagnostic functions, to help ensure validity of readings, but also data storage functions to allow users to check past data. The meter is of waterproof construction so that it can safely be used outdoors on a rainy day, and can also withstand being accidentally dropped into water.

1.1 Features

Water resistant case

When this meter is used with its dedicated sensor, it meets the requirements of class IP67 according to “Degree of Protection Provided by Enclosure” in IEC 60529.

Wide measurement range, and convenient “Auto Range” function

Sensors are available to cover measurement ranges between 0 to 2.000 $\mu\text{S}/\text{cm}$ and 0 to 2 S/cm . Auto-range functions automatically set the optimum measurement range, making measurement easy.

Automatic temperature compensation

Automatic temperature compensation functions are provided for liquid measurement. Conductivity referenced to 25°C can be obtained in solutions with temperature coefficients between 0.00 and 9.99%/°C. The temperature coefficients for NaCl solutions are already stored in the meter.

Calendar and time functions

Internal time functions allow “one-touch checking” of measurement date and time.

Data storage function

Up to 300 conductivities and temperature measurements, and their measurement date and time, can be saved. This function allows you to check past measurement data.

Automatic power off function

The meter will power off automatically if not operated during a preset time interval. The time interval can be set in one-minute increments in the range 1 to 120 minutes to meet your application requirements. This automatic power off function can also be disabled, but it is wise to leave it enabled to conserve the batteries.

Simple alarm clock function

The meter can issue an alarm signal at a specified time. Even when meter power is turned off, the internal clock can issue an alarm signal.

Internal self-diagnostic functions display messages when appropriate.

Bright easy-to view large LCD

Displays liquid conductivity, liquid temperature, temperature coefficient, date and time.

1. Outline

1.2 Specifications

Measurement:	Conductivity of solution	
Measuring range:		
Conductivity;	<ul style="list-style-type: none">● General-purpose type (Cell Constant: 5 cm⁻¹) 0 to 20 μS/cm, 0 to 200 μS/cm, 0 to 2 mS/cm, 0 to 20 mS/cm, 0 to 200 mS/cm● For high purity water measurement (Cell Constant: 0.05 cm⁻¹) 0 to 2 μS/cm, 0 to 20 μS/cm, 0 to 200 μS/cm● Chemical-resistant type (Cell Constant: 5 cm⁻¹) 0 to 20 μS/cm, 0 to 200 μS/cm, 0 to 2 mS/cm, 0 to 20 mS/cm, 0 to 200 mS/cm● For high conductivity measurement (Cell Constant: 50 cm⁻¹) 0 to 2 mS/cm, 0 to 20 mS/cm, 0 to 200 mS/cm, 0 to 2 S/cm	
Resistivity;	0 to 40.0 MΩ·cm (for sensor for high purity water measurement) *1	
Temperature;	0 to 80°C*2	
Resolution:	Conductivity;	0.05% of full scale *3
	Resistivity;	0.1 MΩ·cm
	Temperature;	0.1°C
Repeatability:	Conductivity;	±2% (±5% when general-purpose type sensor is used in the range of 0 to 200 mS/cm)
Accuracy:	Temperature;	±0.7°C (0 to 70°C) ±1°C (above 70°C)
Display:	Digital LCD	
Indication:	Conductivity or resistivity, solution temperature and temperature coefficient (simultaneously), various messages	
Range switching:	Automatic/manual	
Temperature compensation:	Temperature coefficient (0 to 9.99%/°C) or NaCl coefficient, reference temperature at 25°C	
Ambient temperature:	0 to 50°C	
Wetted Material:	<ul style="list-style-type: none">● General-purpose type (Cell Constant: 5 cm⁻¹) Titanium (sensor), fluoro rubber (O-ring), PVC (cable), polyphenylene sulfite resin, polypropylene resin (insulated area, clear cover)● For high purity water measurement (Cell Constant: 0.05 cm⁻¹) SUS316 (electrode element), fluoro rubber (O-ring), polypropylene resin (insulated area), PVC (cable)● Chemical-resistant type (Cell Constant: 5 cm⁻¹) Glass, platinum black (electrode element), PVC (cable)● For high conductivity measurement (Cell Constant: 50 cm⁻¹) Glass, platinum black (electrode element), PVC (cable)	
Construction:	Protection class IP67 (IEC 60529)	
Dimensions:	Approximately 150(H) x 61(W) x 42(D) mm (not including connector part)	
Weight:	Approximately 220 g (without sensor)	
Power source:	2x AA batteries (LR6) Auto power off function (time configurable: 1 to 120 minutes)	

1. Outline

Battery life: Approximately 200 hours*4 of continuous use (battery type and operating condition dependent)
 Functions: Data memory (300 points), alarm clock
 EMC Compliance: EMI (Emission): EN 61326-1 Class B

Test Item	Frequency Range	Basic Standard
Electromagnetic radiation disturbance	30 to 1000 MHz	CISPR 16-1 and 16-2

EMS (Immunity): EN 61326-1 Table 2 (For use in industrial locations *5)

No.	Test Item	Test Specification	Basic Standard	Performance Criteria*
1	Electrostatic discharge	4 kV (contact) 8 kV (air)	IEC 61000-4-2	A
2	RF amplitude modulated electromagnetic field	80 to 1000 MHz, 10 V/m (unmodulated) 80% AM (1 kHz)	IEC 61000-4-3	B**
		1.4 to 2.0 GHz, 10 V/m (unmodulated) 80% AM (1 kHz)		A
		2.0 to 4.0 GHz, 3 V/m (unmodulated) 80% AM (1 kHz)		A

* A: Normal performance within the specification limits: ±20% of the measured value.
 B: Temporary degradation or less of function or performance which is self-recoverable.
 ** Display value may be affected by strong electromagnetic field.

EMC Regulatory Arrangement in Australia and New Zealand (RCM)
 EN 61326-1 Class B, Table 2

Korea Electromagnetic Conformity Standard Class B 한국 전자파적합성 기준
 B급 기기 (가정용 방송통신기자재)
 이 기기는 가정용 (B급) 전자파적합기기로서
 주로 가정에서 사용하는 것을 목적으로 하며,
 모든 지역에서 사용할 수 있습니다.

Environmental resistance:
 Compliant with RoHS*6, WEEE, and EU battery directive

- *1: Resistivity can be measured for reference. In that case repeatability is determined by conductivity.
- *2: Display range is from -10 to 120°C. 0 to 50°C when the sensor cable is immersed in water.
- *3: When measuring range is set to full scale.
- *4: When alkaline batteries are used.
- *5: Display value may be affected by strong electromagnetic field.
- *6: RoHS: EN IEC 63000 (Style 2.03 and later)

1. Outline

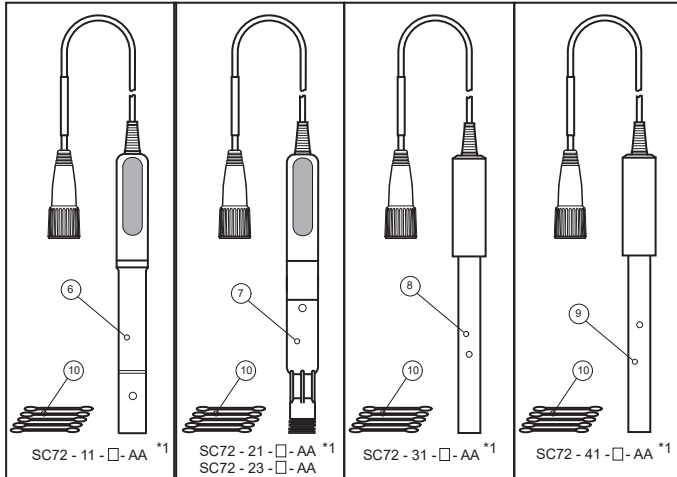
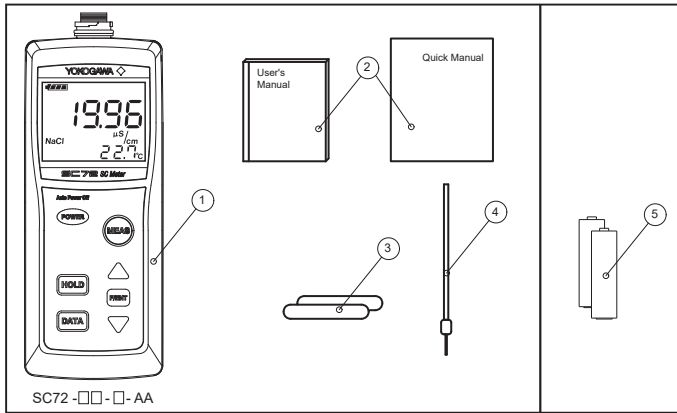
1.3 When You Receive This Conductivity Meter

Confirm that all SC72 meter package components (refer to Contents of Model SC72 Personal Conductivity Meter Package in Section 1.4 and sensor models described in Sec. 1.6, "Sensor Part Names and Functions.") have been received. Carefully inspect the meter and sensor, referring to Section 1.5, "Component Names and Functions" when assembling meter and sensor.

Particular attention should be taken:

- Not to twist or force the cable.
- Not to hit or drop the meter.
- Not to get the sensor connector dirty.

1.4 Contents of Model SC72 Personal Conductivity Meter Package



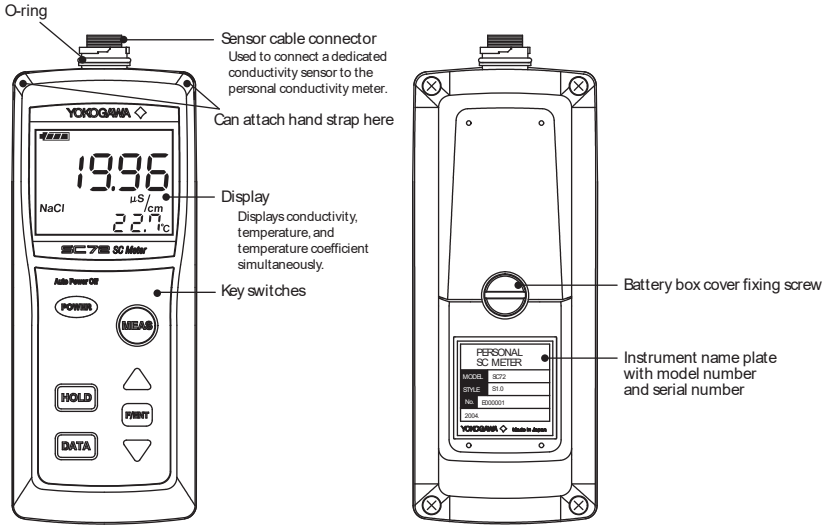
Model	Suffix code	Specification	No.	Name
SC72	-----	Personal conductivity meter	1	Personal conductivity meter
Connecting	-00	Without sensor	2	User's Manual and Quick Manual
Sensors	-11	With sensor for high purity water measurement (cable length: 0.75m)	3	Non-slip pads (2 pcs)
	-21	With general-purpose type sensor (cable length: 0.75m)	4	Hand strap
	-23	With general-purpose type sensor (cable length: 3m)	5	Dry batteries, 2x AA batteries
	-31	With chemical-resistant type sensor (cable length: 0.75m)	6	Sensor for high purity water measurement
	-41	With sensor for high-conductivity measurement (cable length: 0.75m)	7	General-purpose type sensor
Label language	-J -E	Japanese English	8	Chemical-resistant type sensor
Country	-AA	Global except South Korea and Malaysia (with batteries)	9	Sensor for high-conductivity measurement
	-NB	South Korea and Malaysia (without batteries) *2	10	Cotton swabs for sensor cleaning

*1 The meter model number and cell constants, as well as the sensor model no. (SC72SN-□□-AA), are shown on the nameplate.

*2 In South Korea and Malaysia, primary battery is limited by regulations. Prepare batteries with the authorized certification mark for each country.

1. Outline

1.5 Component Names and Functions



1.6 Sensor Part Names and Functions

Four types of sensors are available for use with the Model SC72 Personal Conductivity Meter:

- (1) sensor for high purity water measurement (cell constant 0.05 cm^{-1}),
- (2) general-purpose sensor (cell constant 5 cm^{-1}),
- (3) chemical-resistant sensor (cell constant 50 cm^{-1}), and
- (4) sensor for high-conductivity measurement (cell constant 50 cm^{-1}). Check the model number and cell constant on the name plate to confirm which type of sensor you have.

Model number and cell constants display plate example

MODEL	SC72SN	CELL CONST			
SUFFIX	-11-AA	NO.	000001	STYLE	S1.0
YOKOGAWA		Made in Japan			

Cell constants

SC72SN Conductivity sensors for personal conductivity meter

Model	Suffix code	Specification	Remarks *1
SC72SN	-----	Conductivity sensor for personal conductivity meter	
Type	-11	Sensor for high purity water measurement (cable length: 0.75m)	K9221XB
	-19	Sensor for high purity water measurement (cable length: 0.75m) *2	
	-21	General-purpose type sensor (cable length: 0.75m)	K9221XA
	-23	General-purpose type sensor (cable length: 3m)	
	-29	General-purpose type sensor (cable length: 0.75m) *2	
	-31	Chemical-resistant type sensor (cable length: 0.75m)	K9221XC
	-39	Chemical-resistant type sensor (cable length: 0.75m)	
	-41	Sensor for high conductivity measurement (cable length: 0.75m) *2	
	-49	Sensor for high conductivity measurement (cable length: 0.75m) *2	K9221XD
—	-AA	Always -AA	

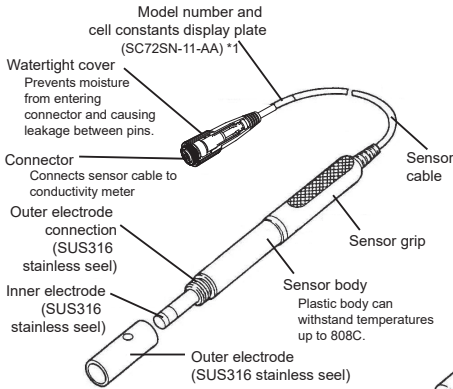
*1: Part number of SC82 (previous model).

*2: Conductivity sensor for SC82 (previous model). Waterproofing is not guaranteed if you use SC82-type sensor in conjunction with SC72 meter.

1. Outline

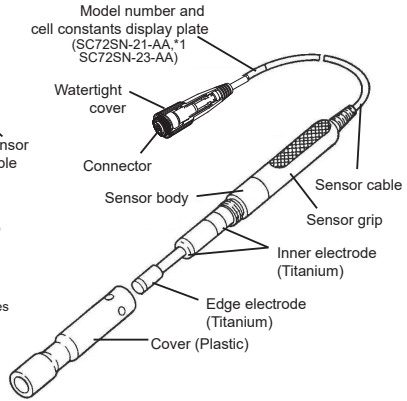
Sensor for high purity water measurement

SC72 - 11 - □ - AA *1



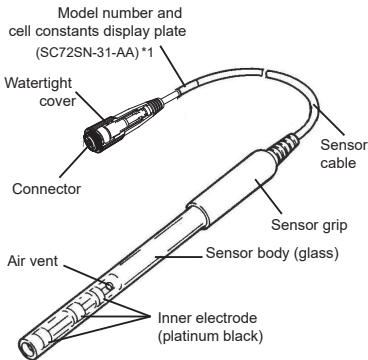
General-purpose sensor

SC72 - 21 - □ - AA *1
SC72 - 23 - □ - AA



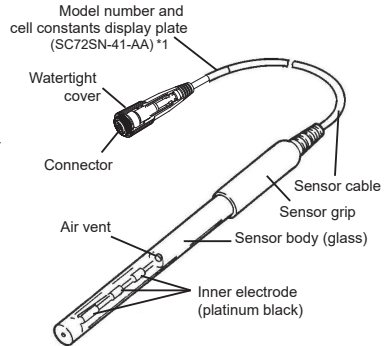
Chemical-resistant sensor

SC72 - 31 - □ - AA *1



Sensor for high-conductivity measurement

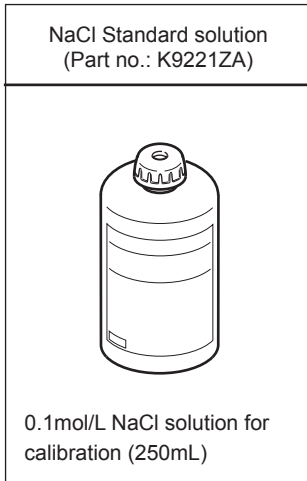
SC72 - 41 - □ - AA *1



*1 SC72SN-□ will be described on sensor's name plate for the model number.

1.7 Options (Available Separately)

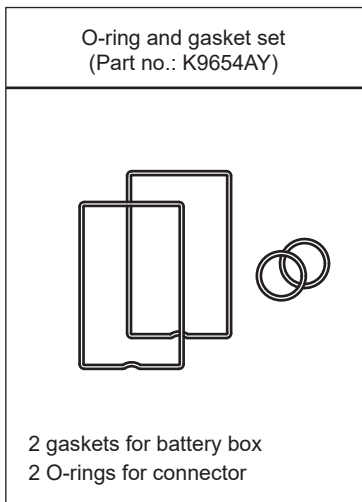
The following options are available for the Personal Conductivity Meter for your convenience. When ordering, specify part number shown below.



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1.8 Spare Parts

O-rings and gaskets are important parts to ensure that the SC72 meter is water resistant. Replace these parts as required. Refer to Section 5.5, "Storage and O-ring/Gasket Replacement" for replacement.



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1. Outline

2. Preparation

2.1 Installing the Batteries

Install the batteries first.

In South Korea and Malaysia, primary battery is limited by regulations. Please use batteries with the authorized certification mark for each country.



CAUTION

Select a relatively moisture-free location when installing batteries in the meter.

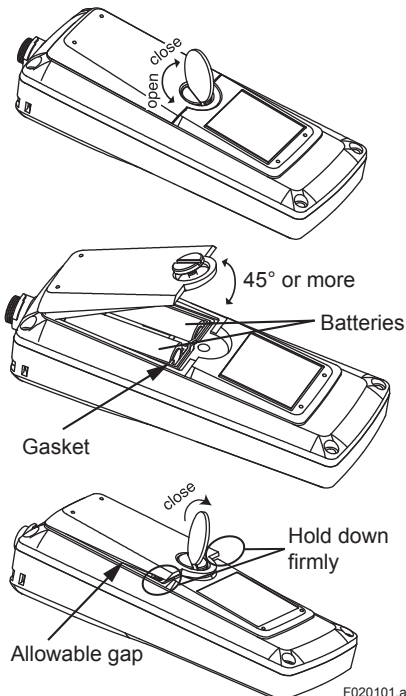
When installing batteries, observe correct polarity (battery orientation). Failure to do so may damage to the meter.

Remove batteries from the meter if it is to be stored for an extended period of time.

Do not leave dead batteries in the meter. They may leak and cause meter failure or erratic operation of the meter.

When replacing batteries, replace both batteries at the same time. If only one battery is replaced, which may leak chemicals and damage the meter.

If the battery box gasket is damaged or dirty then the unit may no longer be waterproof; replace the gasket in this case.



- (1) Loosen the screw holding the battery box cover using a coin or similar object.
- (2) Remove the battery box cover, and then install the batteries observing polarity diagram inside.
- (3) Make sure the gasket on the inside rim of the battery box is free of foreign material.
- (4) Put the cover back on. Insert the tabs on the top of the cover into the slots at an angle of at least 45° and lower the cover into position.
- (5) Hold both sides of the cover down firmly and fasten the screw with a coin or similar object. Tighten the screw in a vertical direction. The head of the screw does not align with the cover. If you feel resistance, stop tightening, loosen the screw, and then try to retighten it. A small gap should remain between the cover and the body even after tightening (due to a gasket).

2. Preparation

2.2 Connecting the Sensor Cable

Connect the sensor cable.

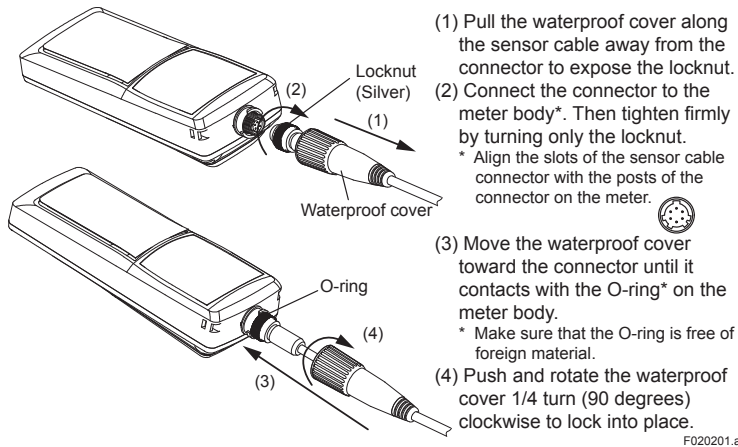


CAUTION

Select a relatively moisture-free location when connecting the sensor cable.

When connecting the sensor cable, tighten by turning only the silver locknut, do not turn the cable or waterproof cover. Also take care not wet or contaminate the connector.

Model SC82 sensors can be connected, but these are not guaranteed to be waterproof when used with this meter.



Note: It is recommended that the sensor be kept connected to the meter to avoid contamination of the connectors.

2.3 Setting the Date and Time

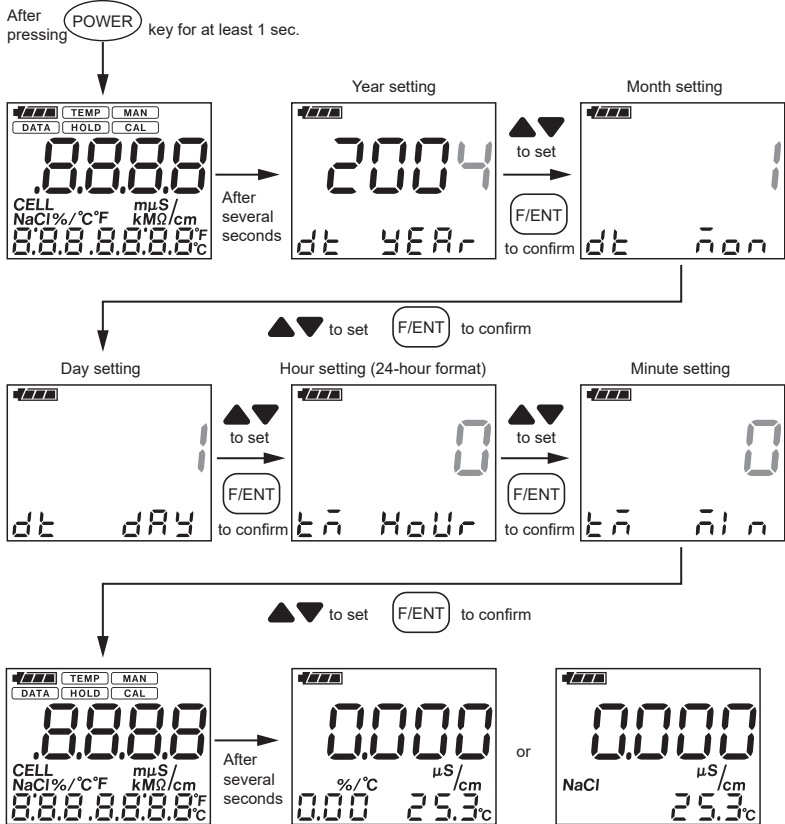
After installing the batteries, set the date and time. Note that if the power is turned off before completing minute setting, start with the date setting when you turn on the power next time. By replacing the batteries, the date setting is not affected but the time setting is. So the time must be reset.

Note: If a sensor cable is not connected to the meter, fluctuating readings or an error message may appear. Before pressing **POWER** key, make sure that a sensor has been connected.

● Setting Procedure

After installing the batteries, press and hold **POWER** key for at least one second. All LCD segments appears momentarily and then the date setting display starts automatically. Set year, month, day, hours, and minutes following the flowchart below.

Note: If you attempt to abort the setting procedure before completing, the meter will beep three times and reject the attempt. Continue until the minute setting is completed.



2.4 Setting Temperature Unit

Default temperature units are $^{\circ}\text{C}$. To change to $^{\circ}\text{F}$, refer to Sec. 4.3 (13) Set temperature units (tP.U) panel.

2. Preparation

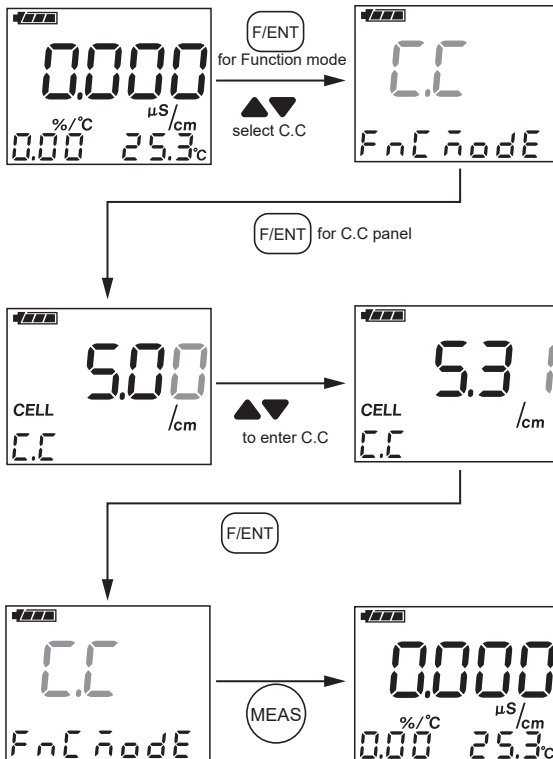
2.5 Setting Cell Constant

Even for sensors of the same type, each sensor has its own distinct cell constant. So, set the proper cell constant as indicated on the sensor cable.

Whenever sensors are replaced, be sure to change the cell constant setting in the meter accordingly. Cell constants once set are stored in non-volatile memory and are not lost even when the batteries are replaced.

● Setting cell constants

Press the **(F/ENT)** key to switch to function mode. Then select the C.C display with the **▲▼** keys and access the cell constant setting display with the **(F/ENT)** key. Use the **▲▼** keys to set the cell constant, then press the **(F/ENT)** key to confirm it. Refer to Sec. 4.3 (4).



You can abort this procedure at any time by pressing **(MEAS)** to revert to measurement mode.

2.6 Setting Temperature Compensation Coefficient

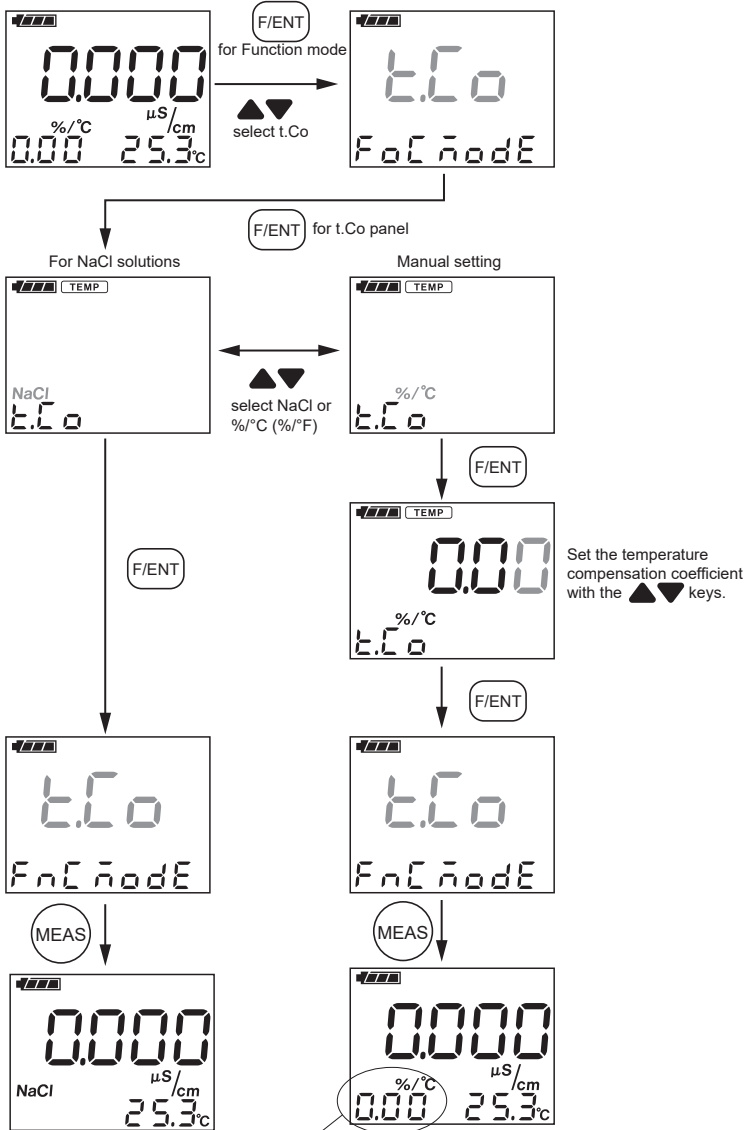
As described in Section 7.3, liquid conductivity varies with liquid temperature. Therefore, if concentration is measured by conductivity, the conductivity must be converted to equivalent conductivity at a certain temperature. This instrument incorporates standard temperature conversion functions to convert liquid conductivity measurements to equivalent conductivity at 25°C. To display equivalent liquid conductivity at 25°C, set the temperature compensation coefficient as described in this section.

Temperature coefficient for NaCl solutions is stored in this instrument. If any other solution is used, set the temperature compensation coefficient manually.

Refer to Sec. 4.3 (2) Temperature compensation setting (t.Co) panel.

2. Preparation

● Set the temperature compensation coefficient



The temperature coefficient you set is displayed here

3. Measurement

3.1 Precautions

- (1) Be sure to check that the cell constant and the temperature coefficient are set correctly.
- (2) Check that the plastic cover (for general-purpose sensor) and outer electrode (for high purity water measurement) are secure.
- (3) Do not use the SC72 meter to measure liquids with temperatures over 80°C. (If the sensor grip is immersed, liquid temperature shall be below 50°C.) Do not use the meter to measure extremely corrosive liquids such as solutions of hydrofluoric acid.
- (4) Remove dirt and stains from the meter with soft tissue. If necessary, wipe the meter case with neutral detergent.
- (5) If any problem with the meter arises during measurement, refer to the Troubleshooting section later in this manual to determine the cause.
- (6) After finishing measurement, flush stains on the sensor and measured solutions with water, and store the meter (refer to Chapter 5, "Maintenance").

When the meter is used on a table:

The meter is designed as a portable instrument; however, to use it on a table, attach non-slip pads (supplied with the instrument) at top and bottom of the meter to stop it from moving when the sensor is moved.

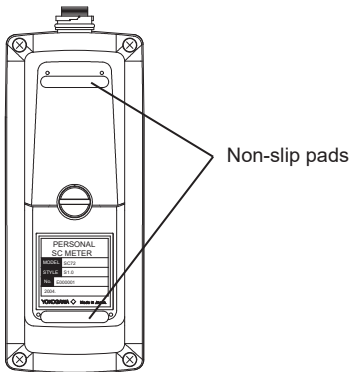


Figure 3.1 Position of Non-slip Seats

3. Measurement

3.2 Measurement Procedures

Dipping sensor into liquid

To help avoid errors due to air bubbles around the sensor element (inner electrode), immerse the sensor into the liquid to be measured so that its air vent is below liquid level. To dislodge any air bubbles from the inner electrode, dip the sensor into the liquid and move it up and down two or three times.

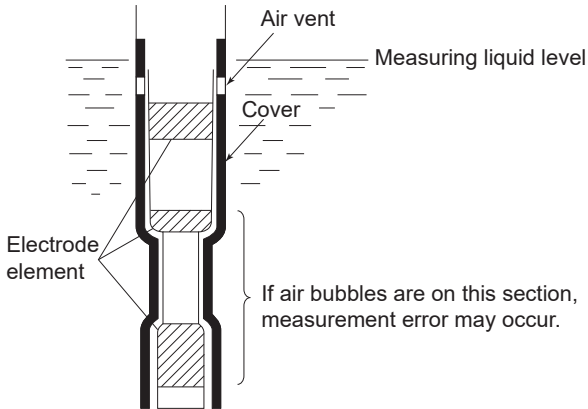


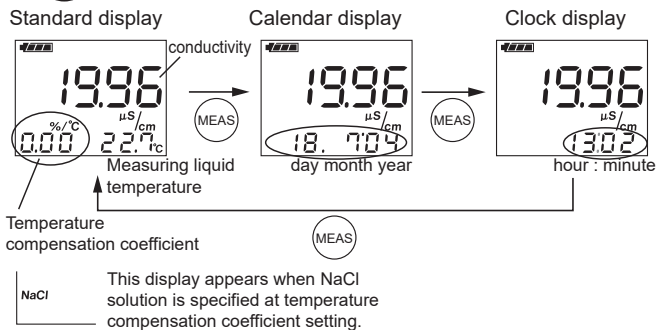
Figure 3.2 Dipping Sensor in Liquid (for general-purpose sensors)

3.3 Measurement Display Panel

When immersing the sensor in a sample solution, a measured conductivity value will be shown on the display.

There are three types of measurement display panels: the standard, calendar, and clock display panels.

Use **MEAS** key to cycle through these display panels.

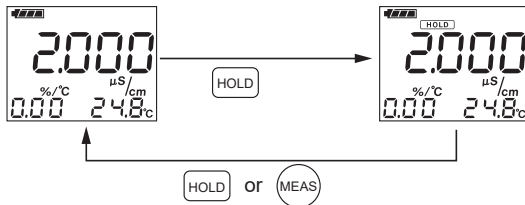


3.4 Saving a Measured Value

There are two ways to save a measured value: holding temporarily and storing as a record in nonvolatile memory. Measured values stored in nonvolatile memory are not deleted even by replacing the batteries.

(1) HOLD

If **HOLD** key is pressed during measurement, the currently measured value is held temporarily and the displayed value no longer changes. Press **HOLD** or **MEAS** key to return to the measurement mode.



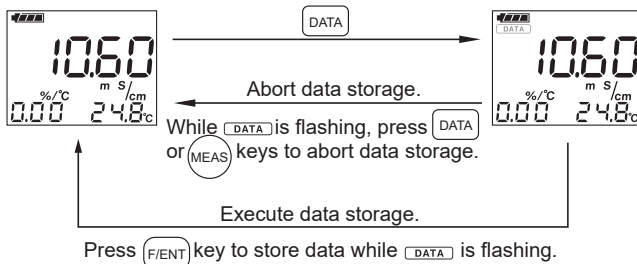
(2) Data storage

If the **DATA** key is pressed during measurement, **DATA** mark starts flashing.

Press the **F/ENT** key, then currently measured data can be stored in nonvolatile memory. Data stored are measured conductivity, measured temperature, date and time. Up to 300 data including individually deleted data can be stored. If you attempt to store more data, **FULL** will be displayed.

If **FULL** is displayed before the data number has reached 300, run defrag referring to Section 4.3 (15), "Defrag memory (dFLG) panel." This will free up memory occupied by deleted data, allowing data to be stored newly. To check stored data, refer to Section 4.3 (1), "Display stored data (dAt) panel."

Pressing **DATA** or **MEAS** key while **DATA** mark is flashing cancels data storage and returns the meter to measurement mode.



3. Measurement

4. Keypad and Display Functions

There are seven membrane keys on the keyboard of the Personal Conductivity meter. The following key functions are provided.

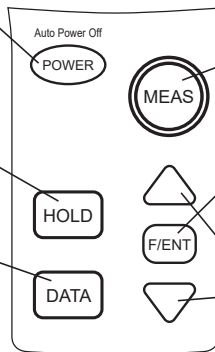
- Display the conductivity, measured temperature and temperature coefficient.
- Display the conductivity, date and time.
- Hold conductivity and temperature measurements.
- Store conductivity and temperature measured data.
- Other functions such as parameter setting.

When meter is OFF, press for at least 1 sec. to turn on power. When meter is ON, press for about 2 sec. to turn off the power. Automatic Power OFF function default: 20 min. inactivity.

If you press this key during measurement, **[HOLD]** mark is displayed, and present measured values are held. To cancel, press **[HOLD]** or **[MEAS]** keys.

If pressed during measurement, **[DATA]** mark flashes.

Press **[ENT]** key to store measured values in memory. To abort data storage and return to MEAS mode, press **[DATA]** or **[MEAS]** key again while **[DATA]** mark is flashing.



Press to start measurement mode. If already in MEAS mode, it switches the display panel.

If pressed while in MEAS mode, switches to function mode. Also used to enter set value.

Change set value.

4.1 Keypad Functions


[POWER] : Power On/Off key








Pressing and holding this key for at least one second when nothing is displayed on the LCD, will turn the meter on. The meter will be turned off by pressing and holding this key for at least two seconds when the meter is on. If no keys are pressed for a preset time, the meter turns off power automatically (refer to Section 4.3 (10), "Set Auto Power Off time (A.oFF) panel").

[HOLD] : HOLD key

When pressed during measurement, **[HOLD]** mark turns on and the currently displayed measured conductivity value and temperature are held. Pressing **[HOLD]** or **[MEAS]** key will turn **[HOLD]** mark off and return the meter to measurement mode.

4. Keypad and Display Functions

 : **DATA key**


When pressed during measurement,  mark flash and the currently displayed measured conductivity value and temperature are held temporarily. Pressing  key while  mark is flashing, will store the held data in memory. After the data is stored successfully, the meter returns to measurement mode automatically. To cancel data storage, press  or  key while  mark is flashing.  mark will turn off and the meter will return to measurement mode.

 : **Measurement key**

In measurement mode each press of this key cycles through three measurement display panels (refer to Section 3.2, "Measurement Procedures"). Pressing this key in other modes will return the meter to measurement mode. If you want to cancel any operation, press this key to return to measurement mode.

 : **Setting change keys**

Used to change settings.

 : **Entry key**

Pressing this key during measurement moves the display to function mode (refer to Section 4.3, "Function Modes"). This key is also used to confirm data entry.

Beep sound

When a key is pressed, the meter acknowledges it using a beep sound.

(1) One beep

The meter will beep once confirming a valid key entry.

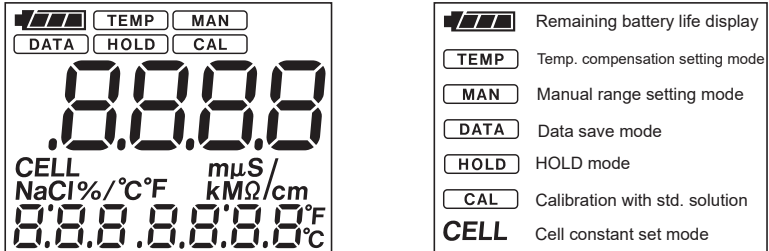
(2) Three beeps

The meter will beep three times if the key entry is invalid.

To disable the beep, refer to Section 4.3 (11), "Set beep on/off (bZ.o) panel." Note that the volume of the beep sound is not adjustable.

4.2 Display Items

Display items and their descriptions are provided below.



(1) Remaining battery life display

Indicates the level of the remaining battery life stepwise. means that there is plenty of life left. A flashing means that the batteries are low and need to be replaced immediately.

To replace the batteries, first press **POWER** key to turn off power and make sure the display has been turned off, and then replace referring to Section 2.1, "Installing the Batteries."

(2) Temperature compensation setting mode

This mark appears when temperature compensation is being set (refer to Section 4.3 (2), "Temperature compensation setting (t.Co) panel").

(3) Manual range setting mode

Normally autoranging is used, and optimum range is selected automatically, but if fixed (manual) range setting is used then this mark appears (refer to Section 4.3 (3), "Range selection (rnG) panel").

(4) Data save mode

Appears when measured data are stored or when stored data are accessed (refer to Section 4.1, "Keypad Functions," and Section 4.3 (1), "Display stored data (dAt) panel").

(5) HOLD mode

Appears while measured data are being held temporarily (refer to Section 4.1, "Keypad Functions").

(6) Calibration with standard solution

This mode display appears when the calibration with standard solution is conducted (refer to Section 4.3 (5), "Calibration with standard solution (CAL) panel").

(7) Cell constant set mode **CELL**

This mode display appears when the sensor cell constants are manually set (refer to Section 4.3 (4), "Cell constant setting (C.C) panel").

4. Keypad and Display Functions

4.3 Function Mode

● Outline

Various functions are supported by function mode. Press **(F/ENT)** key while the meter is in measurement mode to move to function mode.

Note: The last selected and executed item is displayed when you move to function mode. Use **▲▼** keys to cycle through the items listed in Table 4.1 in that order.

● Setting Procedures

Use **▲▼** keys to move to the desired item. While the desired item is flashing, press **(F/ENT)** key to access that item panel. To return from function mode to measurement mode, press **(MEAS)** key anytime.

Table 4.1 Function Mode Item List

Item *1	Description	Default *2	For details, refer to:
dAt dAt	Display stored measurement value	no dAtA	Item (1)
t.Co t.Co	Temperature compensation setting	0.00 %/ 8C	Item (2)
rnG rnG	Range selection	Auto	Item (3)
C.C C.C	Cell constant setting	Standard cell constant *3	Item (4)
CAL CAL	Calibration with standard solution	—	Item (5)
dEL.A dEL.A	Delete all stored measuring data	—	Item (6)
dAtE dAtE	Date setting	2004, January, 1	Item (7)
tIME tIME	Time setting	0 hour 0 minute	Item (8)
ALM ALM	Alarm time setting	oFF	Item (9)
A.oFF A.oFF	Set Auto Power Off interval	20 min	Item (10)
bZ.o bZ.o	Set buzzer ON/OFF	on	Item (11)
SC.U SC.U	Set measurement unit	S/cm	Item (12)
tP.U tP.U	Set temperature unit	°C	Item (13)
VEr VEr	Version number display	—	Item (14)
dFLG dFLG	Defragment stored data	—	Item (15)

*1: Numeric display used to simulate alphabetic character display.

*2: —: This data is not user-settable

*3: The standard cell constant for the connected sensor is displayed.

T0401.EPS

Operating procedures on each panel are described below.

(1) Display stored data (dAt) panel

Shows stored data on the LCD with **(DATA)** mark. When you access this panel, the last stored conductivity value and temperature will be displayed with the data number flashing at the lower left of the display.

4. Keypad and Display Functions

Pressing ▲▼ keys scrolls through all stored data. If no data are stored, “no dAtA” is displayed at the bottom of the display. Each press of **DATA** key cycles through the day/month, year, and time of the stored data, and “Delete stored data” panels.

• Individual Deletion

By pressing **F/ENT** key when “dEL” appears underneath the value, the currently displayed stored data can be deleted. First **dEL** is flashing. Use ▲▼ keys to switch to flashing **YES** and then press **F/ENT** key. The stored data with the number to the left of “dEL” will be deleted.

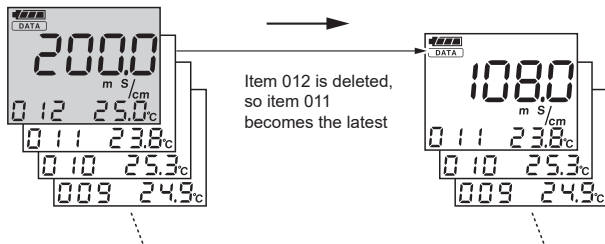
• Data Numbering after Deletion

The number displayed at the bottom left indicates the stored data number relative to the beginning of the data store. This number does not necessarily represent the number of stored data. If a data item is deleted, item numbers of data that follow it will be decreased by one.

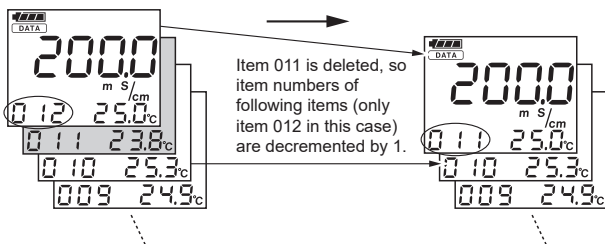
• Data Display after Deletion

If a data item is deleted, the data item after it is displayed. If there is no data after the deleted data item (i.e., it was the last stored data item), the data item before the deleted data item is displayed.

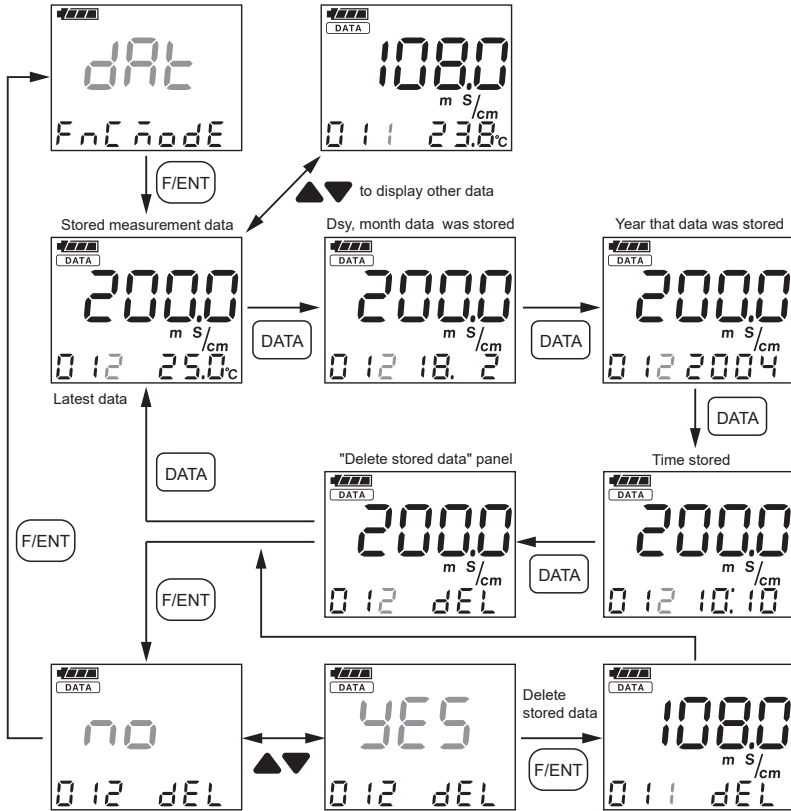
When data item 012 (lastest data) is deleted:



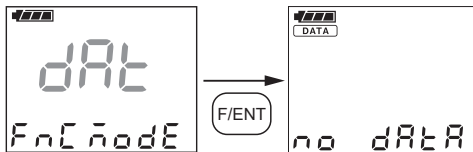
When data item 011 is deleted



4. Keypad and Display Functions



When no stored data.



(2) Temperature compensation setting (t.Co) panel

This panel is used to change the temperature compensation type and temperature coefficient setting. The **TEMP** mark appears on the panel.

- **Automatic temperature compensation for NaCl solution**

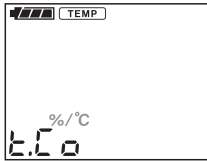
Press the **▲▼** keys to select NaCl . Then press the **F/ENT** key.

• **Manual temperature compensation coefficient setting**

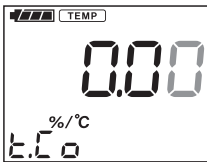
Press the ▲▼ keys to select %/°C (or %/°F). Then press the **F/ENT** key. Use the ▲▼ keys to set the temperature coefficient. Then press the **F/ENT** key.



F/ENT



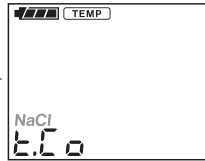
F/ENT



For manual setting: When %/°C (or %/°F) is displayed, set the temperature coefficient with

▲▼ keys. Press **F/ENT** key to complete the temperature coefficient setting.

Use ▲▼ keys to select



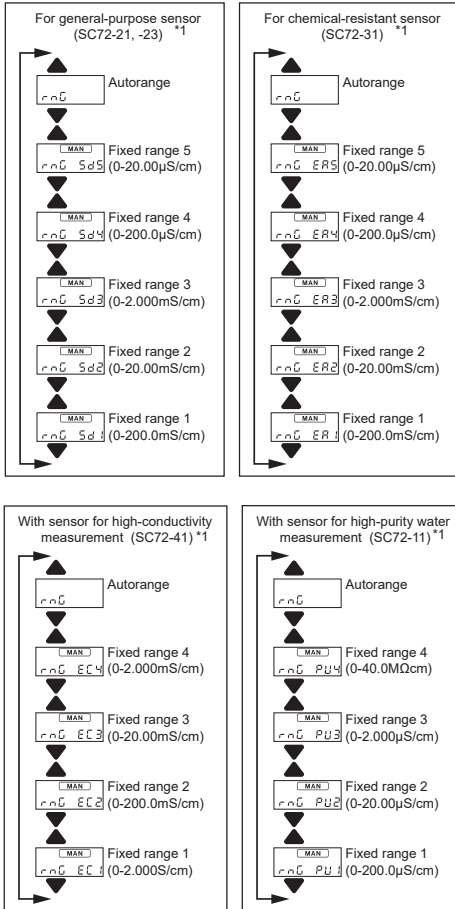
For NaCl: When NaCl is displayed, press **F/ENT** key to confirm.

(3) Range selection (rnG) panel

Change the current measuring range. Use the ▲▼ keys to change between autoranging and fixed range. For fixed range, **MAN** mark appears.

4. Keypad and Display Functions

Relationships between automatic and fixed ranges for different sensors

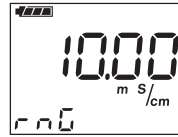


(Example)
For general-purpose sensor (SC72-21, -23)
used with 0-200.0mS/cm



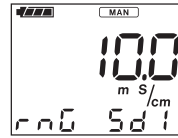
F/ENT

Aurorance



Press ▲ key
or ▼ key
five times

Fixed range 1



F/ENT

Set range 1 fixed.

Refer to Relationships between automatic and fixed ranges... (above left)

*1: Model no. of sensor alone is SC72SN-□. (refer to Sec. 1.6)

(4) Cell constant setting (C.C) panel

This panel with the **CELL** mark is used to set the cell constant manually.

Use the ▲▼ keys to set the cell constant. Then press the **F/ENT** key.

Typical cell constants are as follows:

For pure water sensor (SC72-11): 0.05 cm⁻¹

For general-purpose (SC72-21, -23) and chemical-resistant sensors (SC72-31): 5 cm⁻¹

Sensors for high-conductivity measurement: 50 cm⁻¹

When setting the cell constant, you should check the nameplate (attached to sensor cable) for the model number and cell constant.

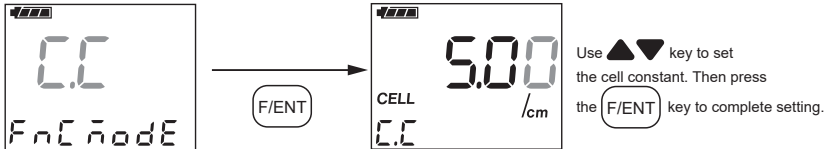
4. Keypad and Display Functions

The cell constant can be set in the range $\pm 20\%$ of standard cell constant. For example, for general-purpose sensors with standard cell constant of 5 cm^{-1} , a cell constant ranging from 4.00 to 6.00 can be set.

Once the cell constant is set, it remains stored in memory even when batteries are removed.

The general-purpose cell has the same cell constant whether used with SC72-21 or SC72-23 type.

Refer to Sec. 2.4 for cell constant setting procedure.



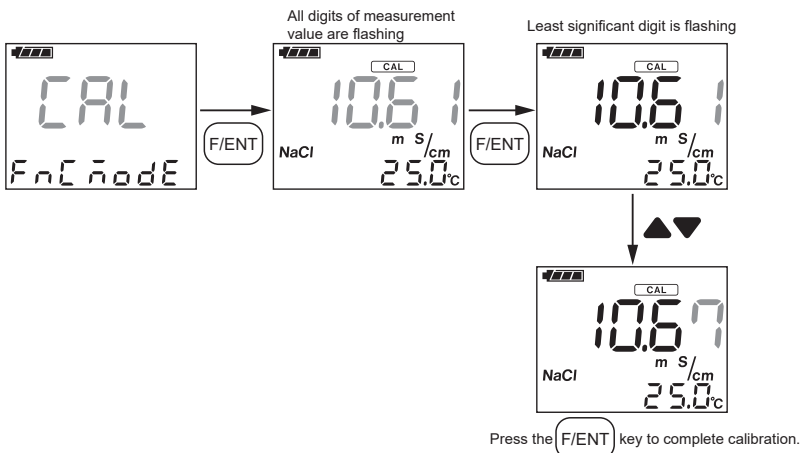
(5) Calibration with standard solution (CAL) panel

This panel is used for calibration with standard solution. Refer to Sec. 5.4 for a description of the calibration procedure. In CAL mode, the CAL mark appears at the top of the panel and all digits of the present measurement value flash.

After the measurement stabilizes, press the F/ENT key to display the measured value at that time. Only the least significant digit flashes. Use the \blacktriangle \blacktriangledown keys to set the desired calibration value, then press the F/ENT key to complete the calibration.

The meter internal cell constant is changed after completing calibration with standard solution. Referring to (4) cell constant setting (C.C) panel, confirm the updated cell constant value and rewrite the cell constant (refer to the value on the plate attached to the sensor cable). Rewritten cell constants remain even if batteries are removed.

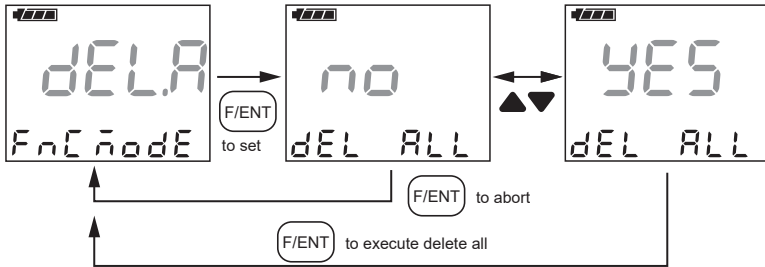
To abort calibration using standard solution, press the MEAS key to return to measurement mode.



4. Keypad and Display Functions

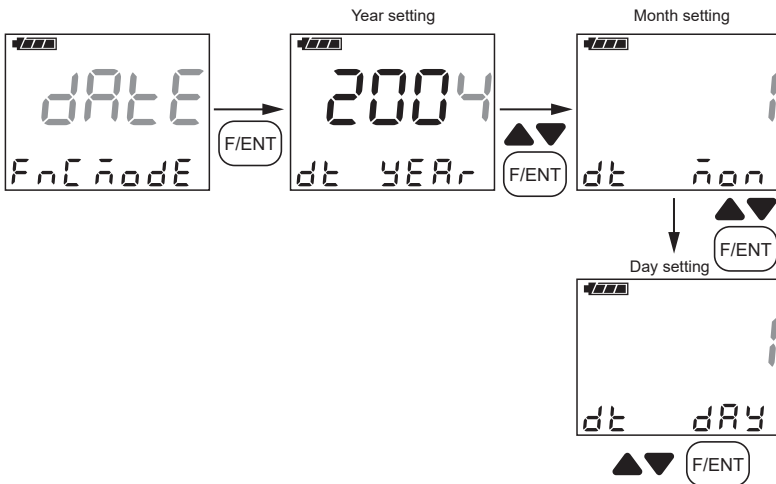
(6) Delete all stored data (dEL.A) panel

Used to delete all stored data. Press **F/ENT** key on the flashing “dEL.A” panel. **no** will be flashing. Use **▲▼** keys to select **YES**. Press **F/ENT** key to delete all stored data completely.



(7) Date setting (dAtE) panel

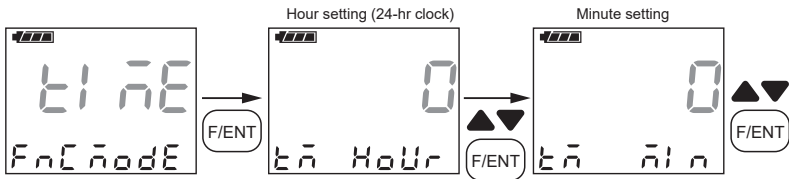
Used to set the year (four digits), month and day in this order. Use **▲▼** keys to set the year, month, and day, and press **F/ENT** key to confirm each entry.



The calendar function will be valid through to year 2090.

(8) Time setting (tIME) panel

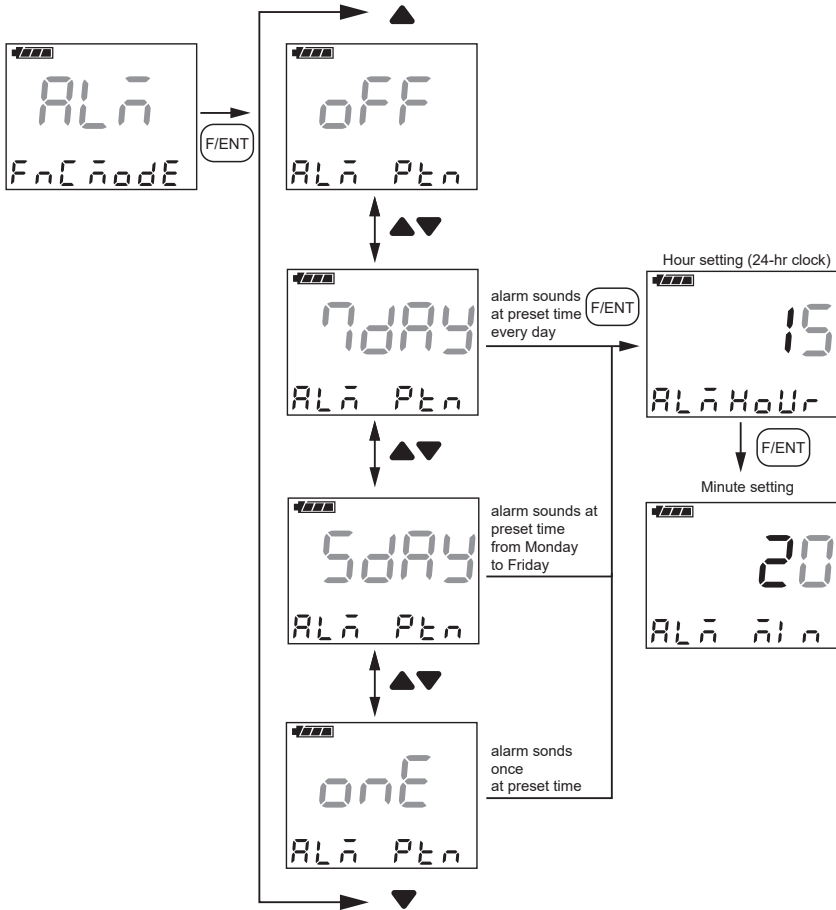
Used to set the time — hour (24-hour format) and minute in this order. Use **▲▼** keys to set the time and press **F/ENT** key to confirm each entry.



(9) Alarm time setting (ALM) panel

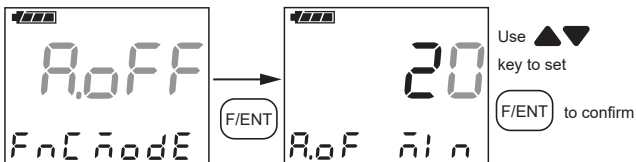
Used to enable/disable the alarm clock and set the alarm clock in minutes and seconds. Use ▲▼ keys to select the desired alarm cycle: 7 days (everyday), 5 days (weekdays) or once. See Item (8), "Time setting (tIME) panel" for setting the time for alarm. The alarm sounds for about 15 seconds. Acknowledge the alarm by pressing any key. The alarm sound will stop. If no key is pressed (no acknowledgement), the alarm sounds for 15 seconds again 3 and 6 minutes after the preset alarm time. Note that the day of the week is not displayed.

4. Keypad and Display Functions



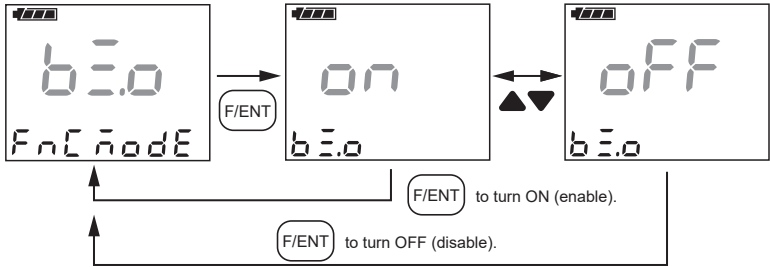
(10) Set Auto Power Off time (A.oFF) panel

Used to set the automatic power off time. The meter turns off power automatically if no key is pressed during this preset time. The time range is from 1 to 120 minutes. If 0 is set, the Auto Power Off function will be disabled. Use the meter taking care to conserve the batteries.



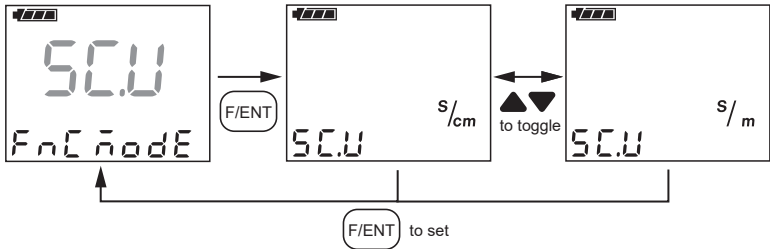
(11) Set beep on/off (bZ.o) panel

The beep sound on key press can be enabled/disabled in this panel. Use ▲▼ keys to select on or off and press **F/ENT** key to confirm. Note that this beep setting does not affect the alarm sounding (see Item (9)).

**(12) Set measurement unit (SC.U) panel**

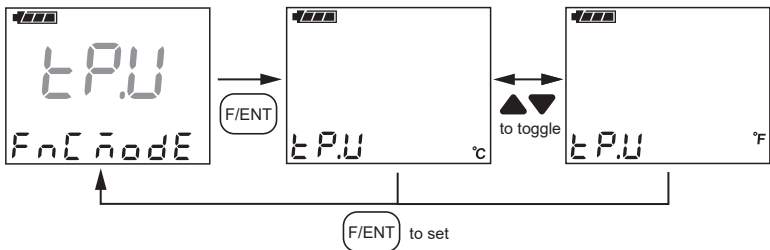
Toggle the measurement value units between [S/cm] and [S/m].

Use the ▲▼ keys to toggle the measurement value units. Then press the **F/ENT** key to complete setting.

**(13) Set temperature unit (tP.U) panel**

Used to select the temperature unit: Celsius (°C) or Fahrenheit (°F).

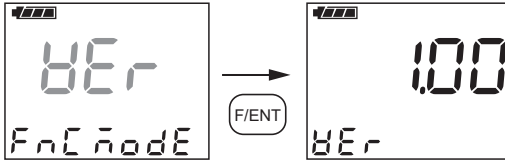
Use ▲▼ keys to select the desired temperature unit and press **F/ENT** key to confirm.



4. Keypad and Display Functions

(14) Check version number (VEr) panel

Used to check the version number of the program. This is not user configurable.



(15) Defrag memory (dFLG) panel

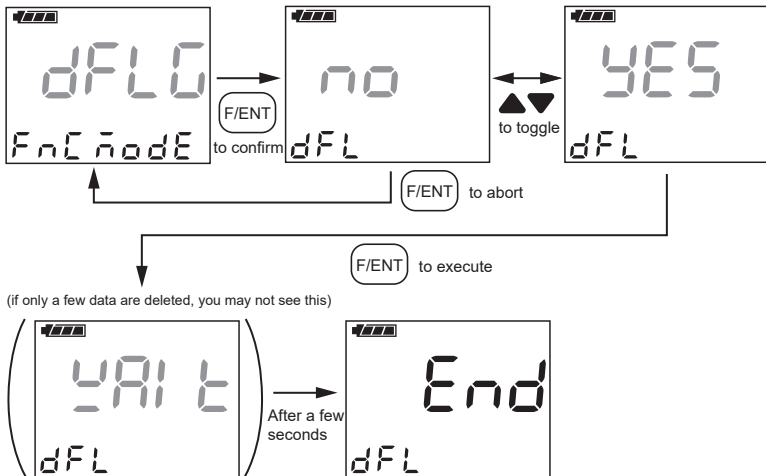
Up to 300 data can be stored. Unnecessary data can be individually deleted (refer to Item (1), "Display stored data"), but this individual deletion does not free up memory occupied by deleted data. Therefore, **FULL** may be displayed even though less than 300 data are stored. In such a case, use the defrag function to consolidate data and free up the space occupied by deleted data, thereby allowing up to 300 data to be stored.

While memory defrag is in progress, do NOT turn off the power. In addition, before starting memory defrag check that there is enough battery life left to avoid battery shutoff during memory defrag.

- **Procedure**

Press **F/ENT** key on the flashing "dFLG" display. **no** will be flashing.

Use **▲▼** keys to select **YES**, then press **F/ENT** key. While defrag is in progress, "WAI t" may flash. It may not flash depending on the amount of deleted data. When defrag is complete, "End" appears.



5. Maintenance

5.1 For Optimum Meter Performance

The SC72 meter appears to be very simple, but is a precision instrument. To ensure that measurement accuracy is maintained, observe the following precautions regarding preliminary setting, measurement, maintenance, and storage.

Preliminary setting, measurement, maintenance and storage:

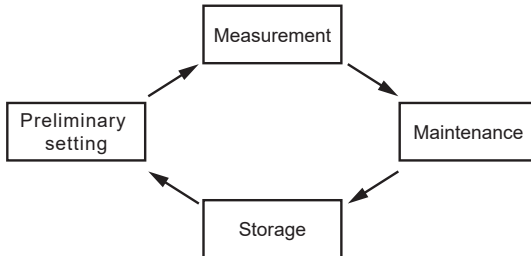


Table 5.1 Observe the following precautions

Preliminary setting	<p>Setting cell constant</p> <ul style="list-style-type: none"> Set specific electrode cell constant. <p>Setting temperature coefficient</p> <ul style="list-style-type: none"> Set liquid temperature coefficient when the standard temperature conversion is required (see Section 2.5) If standard temperature conversion is not required, set 0.00.
Measurement	<ul style="list-style-type: none"> Select one of the three conductivity measurement ranges (0 to 200μS/cm, 0 to 200mS/cm, or 0 to 2S/cm) corresponding to the type of electrode used. Temperature measuring range is 0 to 80°C.
Maintenance	<ul style="list-style-type: none"> When measurement is completed, thoroughly wash electrode to remove the measured liquid. If the electrode gets stained or deformed, its cell constant may change. In this case, calibrate the meter with standard solution (see Section 5.4).
Storage	<ul style="list-style-type: none"> Avoid high-temperature, high-humidity storage locations.

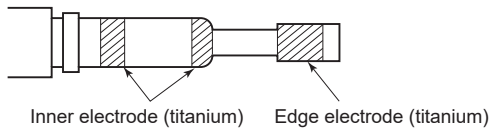
5.2 Washing the Electrode

Dirt or stains on the electrode may have an adverse effect on the cell constant, thereby making accurate conductivity measurement impossible. Therefore, after measurement, rinse the electrode in clean water (for example, tap water) to remove stains. Even if staining is not apparent, the sensor performance may have changed. If so, wash the electrode by moving the sensor up and down in hydrochloric acid (about 0.1 mol/l) or water with a little neutral detergent dissolved in it. [For general-purpose and pure-water sensors: if the electrodes are difficult to clean, wipe them gently from top to bottom with a cotton wool swab.] After cleaning the electrode, rinse it in water.

● General-purpose sensor

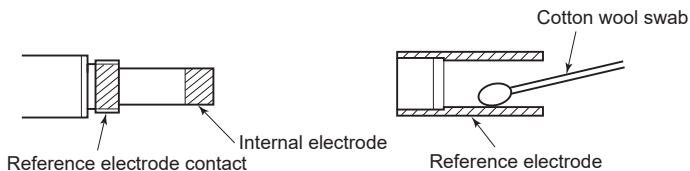
(The figure below shows the general-purpose sensor with the cover removed).

Remove the cover, and wipe stains off the electrodes (inner electrode and tip element) with a cotton swab. Rinse in a cleaning solution consisting of water containing a little neutral detergent, to remove stains from the electrode. After cleaning, wipe the electrode element (inner and edge electrodes) with tissue paper or cotton wool.



● Sensor for high-purity water measurement

Remove the reference electrode part, and wipe the electrode elements (the shaded parts in the figure) with tissue paper or cotton wool.

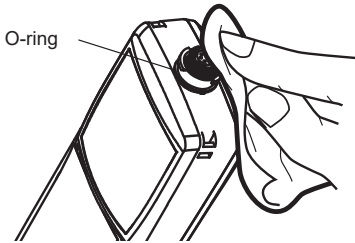


* Corrosion-resistant sensors and sensors for high-conductivity measurements

Use a beaker or the like containing water, dilute hydrochloric acid, or weak neutral detergent; move the sensor up and down so it is immersed up to the air vent, and wash in tap water to clean out the air vent.

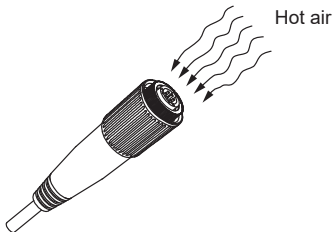
5.3 Cleaning and Drying Connectors

Deteriorated insulation between connector pins can cause inaccurate readings. To remove stains and/or moisture that may cause deteriorated insulation, clean the connector with a dry cloth or a cloth moistened with anhydrous alcohol. If necessary, use a dryer.



Wipe off stains and/or moisture on meter connector with a dry cloth.

Check that there are no stains on the O-ring.



Use a hair drier if necessary to remove moisture from connector of sensor cable.



CAUTION

Use anhydrous alcohol to clean the connectors so no moisture remains. Dry connectors completely.

5. Maintenance

5.4 Calibration with Standard Solution

Note: Calibration with standard solution means to measure a standard solution of accurately-known conductivity and to adjust SC72 meter so that the displayed measured value is the same as the known conductivity value of the standard solution.

If the sensor has been used for a long time, and does not look clean despite washing, recalibrate the SC72 meter with standard solution to check if cell constant is normal.

If "E r r 3" occurs during calibration with standard solution, replace the sensor.

Note that if calibration with the standard solution shows that the cell constant has changed, update the cell constant value on the sensor cable with the new data.

Notes for calibration with standard solution:

Types of standard solution

Use NaCl (sodium chloride) or KCl (potassium chloride) solutions.

(1) NaCl (sodium chloride) solution

When NaCl solution is used, the temperature coefficient of NaCl is built into the temperature compensation functions of the meter so conductivity converted to 25°C can be readily obtained regardless of liquid temperature. Standard NaCl solution of 0.1 mol/l (normal unit expressing concentration of solution) is available as an option from Yokogawa. For more details, see Section 1.7.

When the sensor for high purity water measurement is used, dilute the standard solution with pure water to obtain 0.001 mol/l solution of conductivity 1 µS/cm.

Conductivity is as follows:

0.1 mol - NaCl solution: conductivity 10.67 mS/cm at 25°C

0.001 mol/l - NaCl: conductivity 123.9 µS/cm at 25°C

(2) KCl solution

Table 5.2 describes how to make KCl solution of different concentrations, and lists their conductivities.

Table 5.2 How to make KCl solutions, and their conductivities (based on JIS K 0102)

KCl solution	How to make	KCl standard solution, µS/cm		
		0°C	18°C	25°C
A	Dissolve 74.2460g of KCl in water to get 1l at 20±1°C.	65176	97838	111342
B	Dissolve 7.4365g of KCl in water to get 1l at 20±1°C.	7138	11167	12856
C	Dissolve 0.7440g of KCl in water to get 1l at 20±1°C.	773.8	1220.5	1408.8
D	Dissolve 100ml of standard solution C above in water to get 1l at 20±1°C			146.93

- * Before calibrating the meter with standard solution, check that the electrode is clean. If stains are found, clean the electrode first. Also check that the cover (of general-purpose sensor) and outer electrode (of sensor for high purity water measurement) are secure. Cell constant is affected by stains or loose cover.
When calibrating, ensure that measuring range is set so that you can enter conductivity to as many digits as possible. For example, in the table above, the conductivity of standard solution C at 25°C is 1408.8. If the meter is set to autorange, or to a manual range of 0 to 2,000 mS/cm, you could set this as 1.409 (four digits). However if the range were set to 0 to 200.0 mS/cm, you could only enter conductivity value as 1.4 (only two digits accuracy, which is inadequate for calibration with standard solution).

Before calibrating the meter with standard solution

Check and set the following items before calibrating the meter with standard solution.

(1) Check sensor for stains

Check that there are no stains on the sensor. Also check that the meter cover (for general-purpose sensor) or outer electrode (for sensor for high purity water sensor) are not loose.

(2) Setting temperature coefficients

When the meter is calibrated with a NaCl solution, set a temperature coefficient (indicated by "NaCl") for NaCl solution. When it is calibrated with a KCl standard solution, set a temperature coefficient of 0.00 (%/°C).

(3) Standard solution temperature

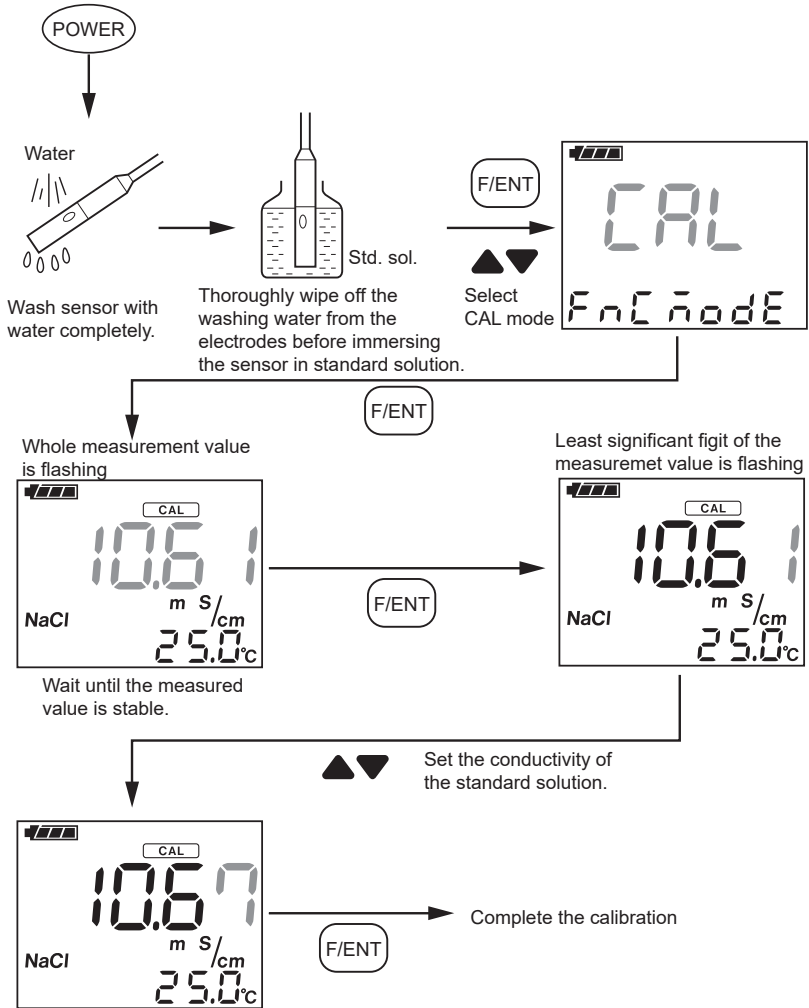
For a NaCl standard solution, check that the standard solution temperature is in the range 25°C ±10°C.

For a KCl standard solution, stabilize its temperature at 25°C ±1°C or 18°C ±1°C.

If it is difficult to maintain the above temperatures, set the temperature coefficient of KCl standard solution in the meter. To find the temperature coefficient, refer to table 5.2 above and to Section 7.3, "Temperature Compensation and Finding Temperature Compensation Coefficient."

5. Maintenance

Procedures for calibration with standard solution



Refer to Section 4.3, "Function Modes," for temperature coefficient and cell constant settings.

5.5 Storage and O-ring/Gasket Replacement

● Storage Precautions

Care is required when storing the meter and sensor. To maintain in good condition, observe the following:

- (1) Before storage, wash off remaining sample solution from the sensor with water.
- (2) Leave the sensor connected to the meter body to protect the connectors and O-ring from staining. Contamination may cause deteriorated insulation of connectors or poor water resistance by the O-ring.
- (3) Do not place any object on top of the sensor or on the top of the SC72 meter.

● Storage Location

When not in use, store the meter and sensor in a safe place. If it is to be stored for a long period, store it in a place:

- With low humidity at or near normal temperatures
- Not exposed to direct sunlight or water
- No corrosive gases are present

● Replacing the O-ring and Gasket

A gasket in the battery box and an O-ring on the sensor connector of the meter can be replaced. Heavily contaminated or damaged gasket and/or O-ring should be replaced.

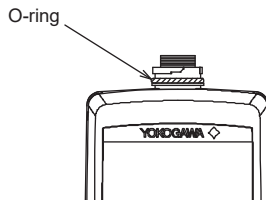


CAUTION

When installing an O-ring and gasket, clean them and their mounting surfaces with a cloth moistened with alcohol so that they are free from dirt. Otherwise, water resistance may not be assured.

(1) Replacing the O-ring

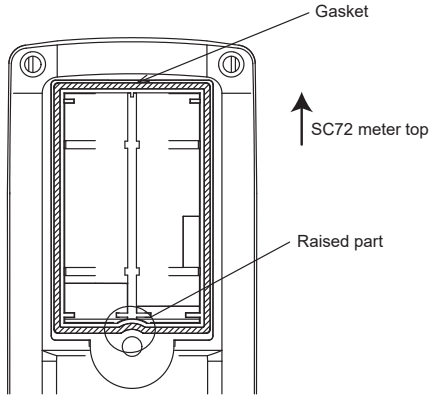
Install the O-ring on the cylindrical flat part of the connector, as shown below.



5. Maintenance

(2) Replacing the Gasket

Install the gasket on the groove on the battery box so the raised part fits in place as shown below. The gasket is symmetrical right to left and front to back.



6. Troubleshooting

6.1 Causes of Abnormal Conductivity Display

The measured temperature is stable, but the conductivity reading is unstable, or an unrealistic value is displayed, check the following:

- (1) Is maintenance required, and has handling of the meter been adequate?
- (2) Does the battery need replacement?
- (3) Is SC72 meter unserviceable?

If any problem is evident, follow the procedure shown in Section 6.2 to determine the cause and fix the problem. If you cannot fix it, contact your nearest Yokogawa sales office.

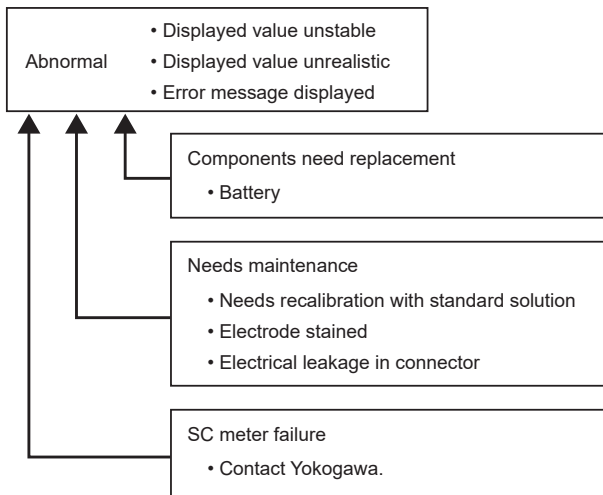


Figure 6.1 Causes of abnormality

6.2 Error Messages and Corrective Action

Table 6.1 Error Message

Error Message *1	Description
Err1 <i>Err1</i>	Temperature compensation computation value out of range
Err2 <i>Err2</i>	Out of temperature measurement range
Err3 <i>Err3</i>	Calibration error
Err6 <i>Err6</i>	Meter electronics failure
or <i>or</i>	Out of measuring range

*1: For displayed digital characters, see Alphanumeric Display Table in Preface.

6. Troubleshooting

(1) Err1 Temperature compensation computation value out of range

Possible Causes:

When the standard temperature conversion is made to conductivity at 25°C, this instrument performs temperature compensation computation based on the preset temperature coefficient.

Err1 is displayed in cases where temperature compensation computation is impossible because the preset temperature coefficient is improper or a solution with a large temperature coefficient is measured at temperatures lower or higher than 25°C.

Corrective Actions:

- Reset the temperature coefficient to the correct value.
- Measure solution at about 25°C.

(2) Err2 Out of temperature measurement range

Possible Causes:

This error occurs if the measurement liquid temperature is outside the range -10 to 120°C, or if sensor cables are disconnected.

Note: The liquid temperature should never be outside the range 0 to 80°C.

Corrective Actions:

- Set the liquid temperature to 0 to 80°C.
- Replace the sensor. (Refer to Sec. 1.6)

(3) Err3 Calibration error

Possible Causes:

When the calibration with standard solution is made, each time cell constants are changed. Err3 occurs if the conductivity of the standard solution is wrong, or changed cell constants are beyond $\pm 20\%$ of the standard cell constant, due to a damaged sensor.

Corrective Actions:

- Use correct standard solution conductivity. (Refer to Sec. 5.4)
- Replace the sensor. (Refer to Sec. 1.6)

(4) Err6 Meter electronics failure

Possible Causes:

Err6 occurs if the meter electronics fails.

Corrective Actions:

- Contact your nearest Yokogawa sales office.

(5) or Out of measurement range**Possible Cause:**

Conductivity is over the maximum value on the range.

Corrective Action:

For manual ranging, select an appropriate range. If value exceeds maximum of highest range (or when on autorange), use a more appropriate sensor (see Sec. 4.3 (3)).

6.3 Causes of Abnormal Measured Value

If error messages do not occur, but measured values seem incorrect, check the following:

- Are cell constants and temperature coefficients correctly set?
- Is the sensor properly connected to the meter?
- Are bubbles attached to the electrode portion?
- Is the sensor damaged or dirty?

6.4 Other Conditions**• An alarm sounds**

The alarm is set to sound at the preset alarm time. Refer to Section 4.3 (9), "Alarm time setting (ALM) panel."

• Beeps

The beep sound to acknowledge a key press can be enabled/disabled. Refer to Section 4.3 (11), "Set beep on/off (bZ.o) panel."

6. Troubleshooting

7. Measuring Principles of this Instrument

7.1 What Is Conductivity?

Conductivity of a solution is defined as the ability of the solution to conduct electric current. It is the reciprocal of the resistance between two sensors (both of areas 1 m^2) at a distance of 1 m apart in the solution.

$$1 \text{ S/cm} = 100 \text{ S/m}$$

Figure 7.1 shows the conductivities of typical solutions.

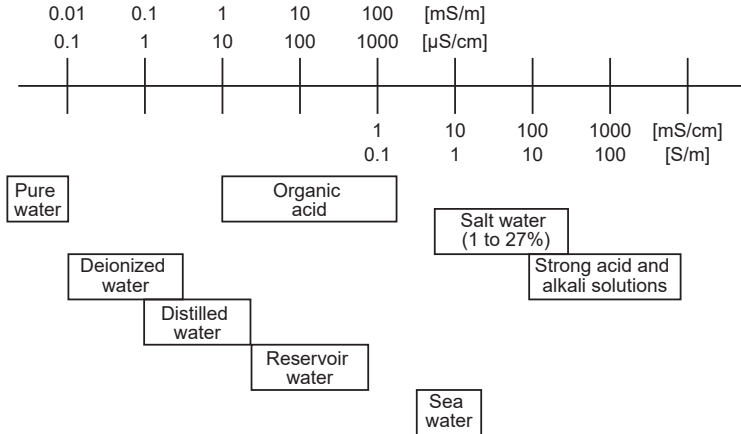


Figure 7.1 Conductivity of Typical Solutions

7. Measuring Principles of this Instrument

7.2 Principles of Operation

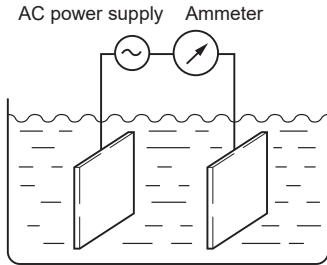


Figure 7.2 Operational Schematic

Dip two metallic plates (used as sensor electrodes) in a solution and apply a certain voltage to flow current (I):

$$I = \frac{E}{R_c} \dots\dots\dots (1)$$

where R_c = solution resistance between two sensors

The relationship between R_c and conductivity K is expressed by:

$$R_c = J \cdot \frac{1}{K} \dots\dots\dots (2)$$

where J = constant (also called cell constant) — determined by sensor and distance between two sensors

From equations (1) and (2) above, we obtain:

$$K = \frac{J}{E} \cdot I \dots\dots\dots (3)$$

E and J are constant, so the conductivity (K) can be obtained by measuring the current (I).

7.3 Temperature Compensation and Finding Temperature Compensation Coefficient

- **Temperature Compensation**

Table 7.1 shows the conductivity ratio at each liquid temperature when the conductivity of a NaCl solution at 25°C is 1.

Table 7.1 Conductivity Ratios at Different Temperatures in NaCl solutions

0°C	25°C	50°C	75°C	100°C
0.542	1	1.531	2.103	2.677

As shown in the above table, liquid conductivity changes with liquid temperature. So, in order to compare conductivities, conductivity values at a fixed liquid temperature are needed. This SC72 meter includes standard temperature conversion functions, to display a liquid conductivity value converted to 25°C, so this meter can be used for such conductivity measurement comparisons. Temperature compensation coefficients of an NaCl solution are stored in the SC72 meter. No other temperature coefficient setting is required (for NaCl solutions).

Table 7.2 shows temperature coefficients of various electrolytic solutions.

Table 7.2 Temperature Coefficients of Electrolytic Solutions

Solutions	Temperature coefficient (%/°C)		
	1mol/l	1/10mol/l	1/1000mol/l
Lithium benzoate solution	---	2.28	2.28
Sodium acetate solution	2.20	2.20	2.20
Potassium chloride solution	1.74	---	1.98
Sodium hydroxide solution	1.74	---	1.87
Sulfuric acid	1.07	---	1.38

• Finding Temperature Coefficient

If temperature coefficient tables containing the liquid to be measured can not be found, measure conductivity twice at two liquid temperatures between 10 and 30°C with temperature coefficient set to 0.00 and use the equation shown below to find approximate temperature coefficient (α).

$$\text{Temp. coef. } \alpha = \frac{K_2 - K_1}{K_1 (t_2 - 25) - K_2 (t_1 - 25)} \times 100 \text{ (%/}^\circ\text{C)}$$

where t_1, t_2 : liquid temperature (°C)
 K_1 : conductivity at t_1
 K_2 : conductivity at t_2

(Calculation example)

To find the temperature coefficient of liquid with conductivity - 124.5 (S/cm at liquid temperature 18.0°C and 147.6 (S/cm at liquid temperature 31.0°C, substitute $t_1 = 18.0$, $t_2 = 31.0$, $K_1 = 124.5$, $K_2 = 147.6$ in the equation above, thus we can obtain:

$$\begin{aligned} \alpha &= \frac{147.6 - 124.5}{124.5 \times (31.0 - 25) - 147.6 \times (18.0 - 25)} \times 100 \\ &= \frac{23.1}{747.0 - (-1033.2)} \times 100 \\ &= 1.298 \end{aligned}$$

Set the temperature coefficient 1.30 in the SC72 meter (as meter allows three digits to be entered).

7. Measuring Principles of this Instrument

- **Checking if meter is working correctly**

When the temperature coefficient already set is accurate, the conductivity displayed should be constant regardless of liquid temperature (within permitted temperature range).

Check that the temperature coefficient already set is accurate. When the liquid temperature is lowered, if a larger conductivity is indicated, the temperature coefficient already set is too small; whereas, if a smaller conductivity is indicated, the temperature coefficient already set is too large. In such a case, change the temperature coefficient such that the measured conductivity does not change with temperature.

7.4 Wetted Part Materials of Sensors

- **For general-purpose sensor**

Titanium (sensor)

Polyphenylene sulfite resin, Polypropylene resin (insulated area and cover)

Fluoro rubber (O-ring)

- **Sensor for high purity water measurement**

SUS 316 stainless steel (electrode element)

Polypropylene resin (insulated area)

Fluoro rubber (O-ring)

- **Chemical-resistant sensor**

Glass, platinum black (electrode element)

- **Sensor for high-conductivity measurement**

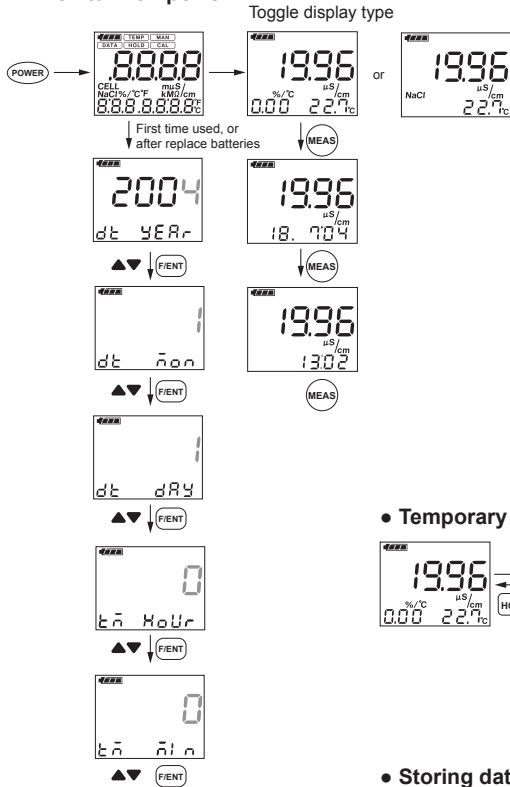
Glass, platinum black (electrode element)

Appendix

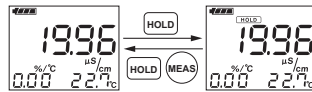
Key-Operation Flow Chart (for reference)

Typical screens are shown. Refer to the corresponding section in the body of the manual for details.

• When turn on power



• Temporary hold



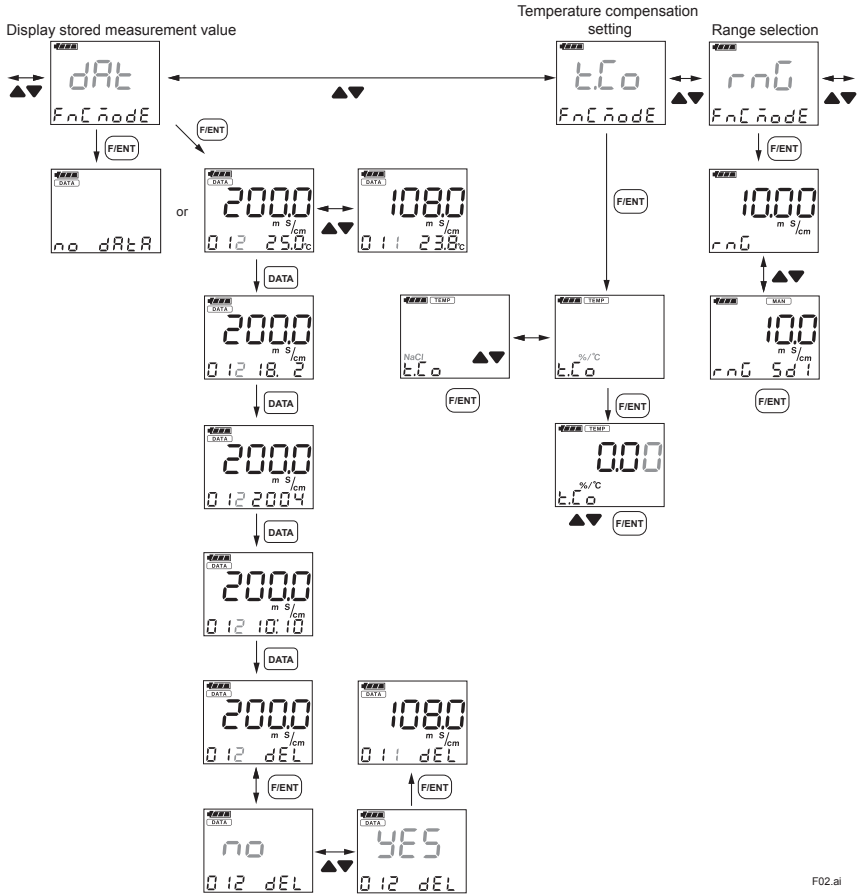
• Storing data



F01.ai

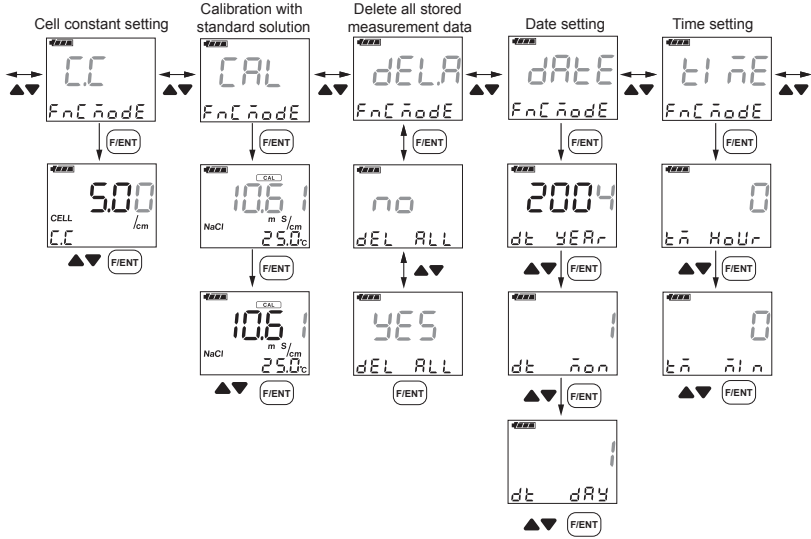
Appendix

• Function Mode

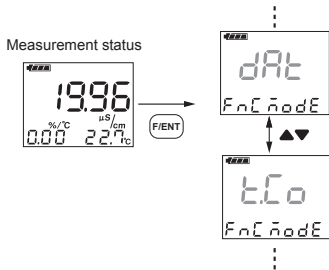


F02.ai

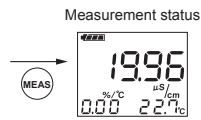
• Function Mode



• Switching to Function Mode



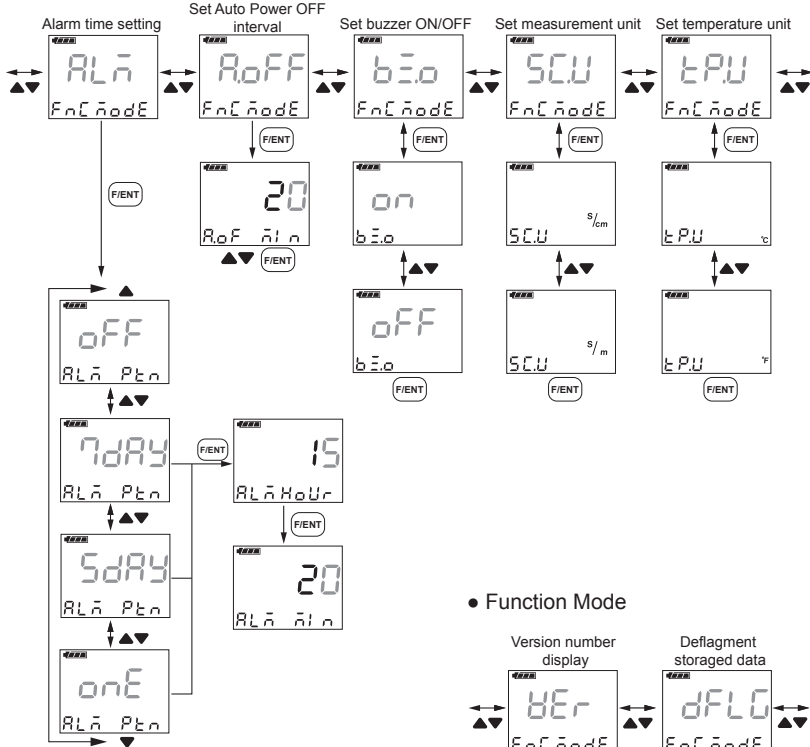
• Reverting to Measurement Mode



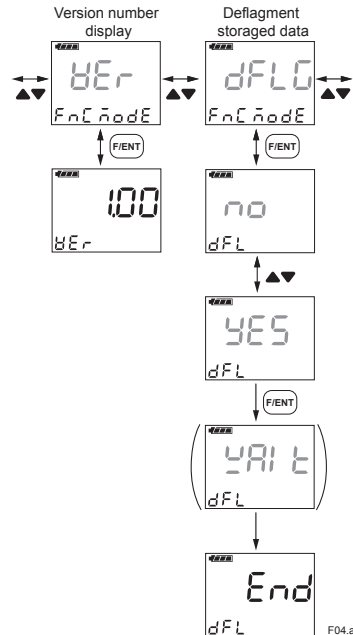
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Appendix

• Function Mode



• Function Mode



F04.ai

Revision Record

Manual Title : Model SC72 Personal Conductivity Meter

Manual Number : IM 12D03D02-01E

Edition	Date	Remark (s)
4th	June 2021	Change of accessories, deletion of optional accessories, revision of specifications (RoHS conformity standards), etc., full review
3rd	Aug. 2009	Change of information on EMC compliance: P.1-3
2nd	Apr. 2008	Addition of information on EMC compliance: P.1-3 Addition of CAUTION: P2-2 Correction: P.1, 1-2, 1-6, 2-1, 2-3, 3-1, 3-3, 4-1. 4-5, App-1, App-4
1st	Aug. 2004	Newly published