

# HORIBA

# navi<sup>h</sup>

pH



DATA IN



DATA OUT



## INSTRUCTION MANUAL

pH METER  
**D-51**



**HORIBA Ltd.**

## Preface

Thank you for purchasing the D-51 pH meter .

This meter is designed with a compact body that can be held in one hand and features a water-resistant construction Note 1. It has a large-sized LCD display, which enables to use the varied functions by simple operations, and especially will be convenient to use on-location.

Carefully read this manual before using the meter.

Note 1: The water-resistant construction of this meter conforms to IP-67 of IEC 529, entitled "Water resistant testing and protection against penetration by solid matter for electrical machinery and equipment." To maintain the water-resistant construction of this meter, follow the instructions in this manual when using the meter.

IP-67 standards

- Dust does not get into internal parts.
- Water does not flow into internal parts when the meter is submerged 1 m below the surface of the water for 30 minutes, at a temperature differential between the water and the device of 5 °C or less.

## HORIBA's Warranty and Responsibility

Your meter is covered by HORIBA's warranty for a period of one (1) year, under normal use. Although unlikely, if any trouble attributable to HORIBA should occur during this period, necessary exchange or repairs shall be conducted by HORIBA, free of charge. The warranty does not cover the following:

- Any trouble or damage attributable to actions or conditions specifically mentioned to be avoided in the operation manuals
- Any trouble or damage attributable to use of the meter in ways or for purposes other than those described in the operation manuals
- If any repairs renovations, disassembly, etc. are performed on this meter by any party other than HORIBA or a party authorized by HORIBA
- Any alteration to the external appearance of this pH meter attributable to scratches, dirt, etc. occurring through normal use
- Wear and tear to parts, the exchange of accessories, or the use of any parts not specified by HORIBA

HORIBA also shall not be liable for any damages resulting from any malfunctions of this product, any erasure of data, or any other uses of this product.

## Unauthorized reprinting or copying of this operation manual

No unauthorized reprinting or copying of all or part of this operation manual is allowed. The utmost care has been used in the preparation of this operation manual. If, however, you have any questions or notice any errors, please contact the HORIBA customer service center printed on the back cover of this operation manual.

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## Precautions for use

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### CE Marking



This product is in conformity with the following directives and standards:

Directives: The EMC Directives 89/336/EEC  
The Electrical Product Safety Directive 73/23/EEC

Standards: EN61326: 1997+A1:1998  
(EMISSION: Class B, IMMUNITY Category: Minimum Requirement)  
EN61010-1: 2001

Installation Environment

This product is designed for the following environment.

- Pollution degree 2
- Measurement category

WARNING: Do Not use the equipment for measurements within measurement categories

, and .

### FCC Warning

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Precautions for use

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### Type and Definition of Signal Words

For the safety use, the meter is equipped with the Warning Labels to alert every operator and user to the possible risk and danger. Before using understanding each message.

The meaning of signal words are as follows:

- (WARNING)** This indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
- (CAUTION)** This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert unsafe practices.

### Safety Precautions

For the safety use, be sure to read the following precautions:

 **WARNING:**

Do not use any unspecified AC adapters.  
Heat or fire may occur to cause fire or accidents.  
Do not disassemble or modify the meter.  
Heat or fire may occur to cause fire or accidents.

 **CAUTION:**

Do not use the serial communication or AC adapter in the place that may possibly contact with moisture.  
It may cause fire, electric shock, or breakage.  
Part of the electrode is made of glass; handle with care not to break it.

## Precautions for use

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### Indication

#### **WARNING**

This indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

#### **CAUTION**

This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert unsafe practices.

#### — —

This mark indicates the operation requires a special care and attention.

#### — —

This mark indicates to which the reader should go for reference.

#### — **HINT!** —

This mark indicates reference information.

## Precautions for use

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### Cautionary Items

#### Precautions

Do not give physical shock to the meter like dropping or hitting.  
Do not immerse the meter into alcohol, organic solvent, strong acid, strong alkaline, and other similar solutions. The meter contains ABS resin, acrylic resin, and various rubber products in its body.

Do not use a hair-dryer for drying the meter. When the meter is dropped into water or get wet, wipe it using soft cloth.

Perform the key operation by the fingers, not by the hard object like metal stick or rod.

Be careful not to let water into the meter when the electrode connector is empty or the AC adapter or serial communications cable has been connected. In those states, the meter is not water-proof.

To disconnect the electrode cable or interface cable, pull them out with holding the connector part. Do not pull the cable part; it may cause a breakage.

Do not remove the battery gasket or twist it.

When opening the battery case, make sure that no foreign matter is attached to the battery gasket.

Do not use any unspecified batteries ; it may cause a breakage.

#### Location of use and storage

The place which room temperature is at 0 to 45

The place which relative humidity is under 80% and free from condensation

#### **Do not use or store the meter at;**

The place of much dust

The place with strong vibration

The place with direct sunlight

The place with corrosive gas generation

The place near from an air-conditioner

The place with direct wind

#### Move and Transportation of the meter

To transport the meter, use the packaging box at the delivery. Transportation by any unspecified packing methods may cause a breakage.

#### Disposal

Standard solution used for the calibration must be under neutralization before the disposal. As for the disposal of the meter, treat it as an industrial waste.

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# 1 Overview of the Meter

This chapter explains the part names, how to connect the electrodes, how to replace the batteries, and precautions when using the meter.

## 1.1 Package contents

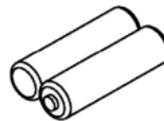
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The following items are shipped with each HORIBA pH meter package.

**Meter (main unit) 1 unit**



**Dry-cell batteries 2 pcs.**



**Strap**

**1 pc**



## 1 Overview of the Meter

### 1.1 Package contents

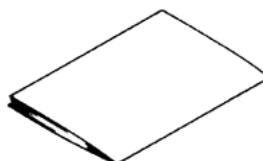
**Soft case**

**1 pc**



**Operation manual**

**1 book**



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**Note**

To take measurements, you will need electrode(s).  
Refer to “5.5 Spare and optional parts” page 79 when  
purchasing the electrode(s).

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## 1.2 Functions

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The D-51 features the following functions.

### Measurement items

Items	Required electrode/ standard solution
pH	pH electrode, pH standard solution
Temperature	-

### Functions

An overview of the functions found on HORIBA the D-51 is shown below.

Function	Explanation	Page No.
Data memory	Stores the data of measured values and temperature to the memory (max. 300 items)	page 29
pH repeatability check	Displays the difference between the calibration value and measured value after calibration.	page 26
pH calibration history display	Displays the date of calibration and the asymmetrical potential and sensitivity.	page 32
Clock	Displays the time on the screen and recorded data.	page 29
Auto Power OFF	Automatically turns off power if no operation is made after 30 minutes.	page 47
AC adapter connection	The meter can be AC-powered.	page 13

## Setting Items

Function	Explanation	Page No.
pH standard solution setting	Enables standard solution used for calibration to be changed to NIST and US specifications settings.	page 37
Temperature compensation	Toggles between Automatic Temperature Compensation (ATC) mode that measures the sample temperature using the temperature sensor built-in the electrode and Manual Temperature Compensation (MTC) mode that uses user-specified temperature.	page 41

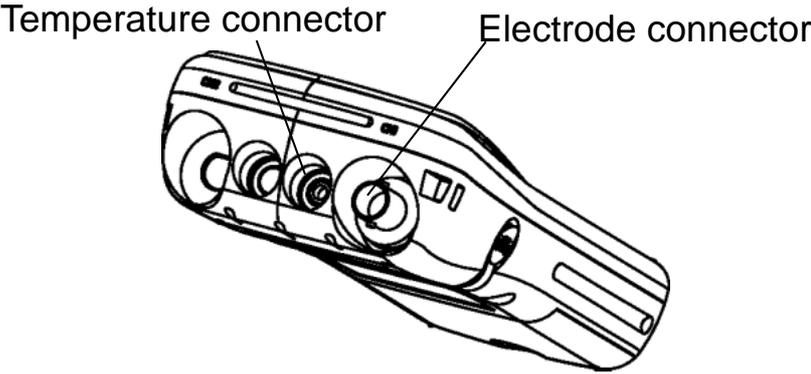
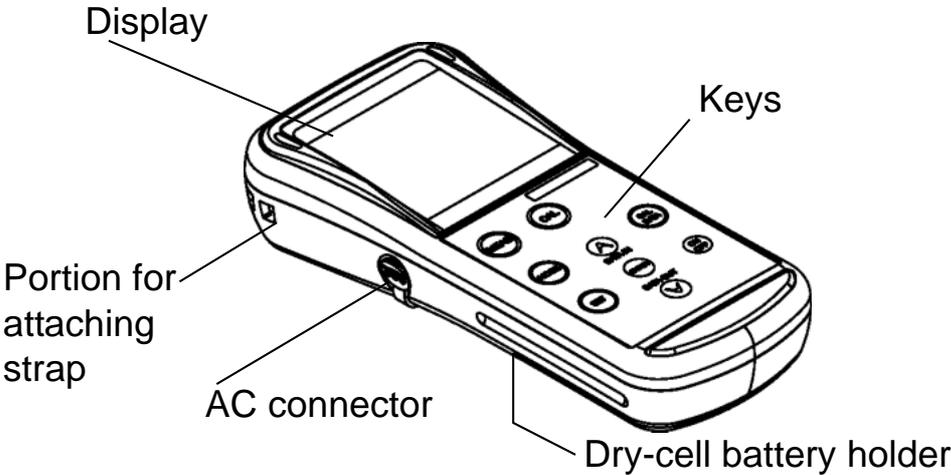
## Functions in Maintenance mode

Function	Explanation	Page No.
LCD check	Enables check for whether or not all LCD segments are displayed.	page 44
Battery voltage check	Enables simple check of battery voltage.	page 45
Temperature display calibration	Adjusts the display of the temperature sensor to the actual temperature.	page 46
Auto Power OFF	Sets the function that automatically turns the power OFF if no keys are touched 30 minutes.	page 47
Remaining data memory	Displays the remaining memory.	page 48
Data memory clear	Deletes data in memory.	page 48
Initializing settings	Initializes all settings to the default values.	page 49

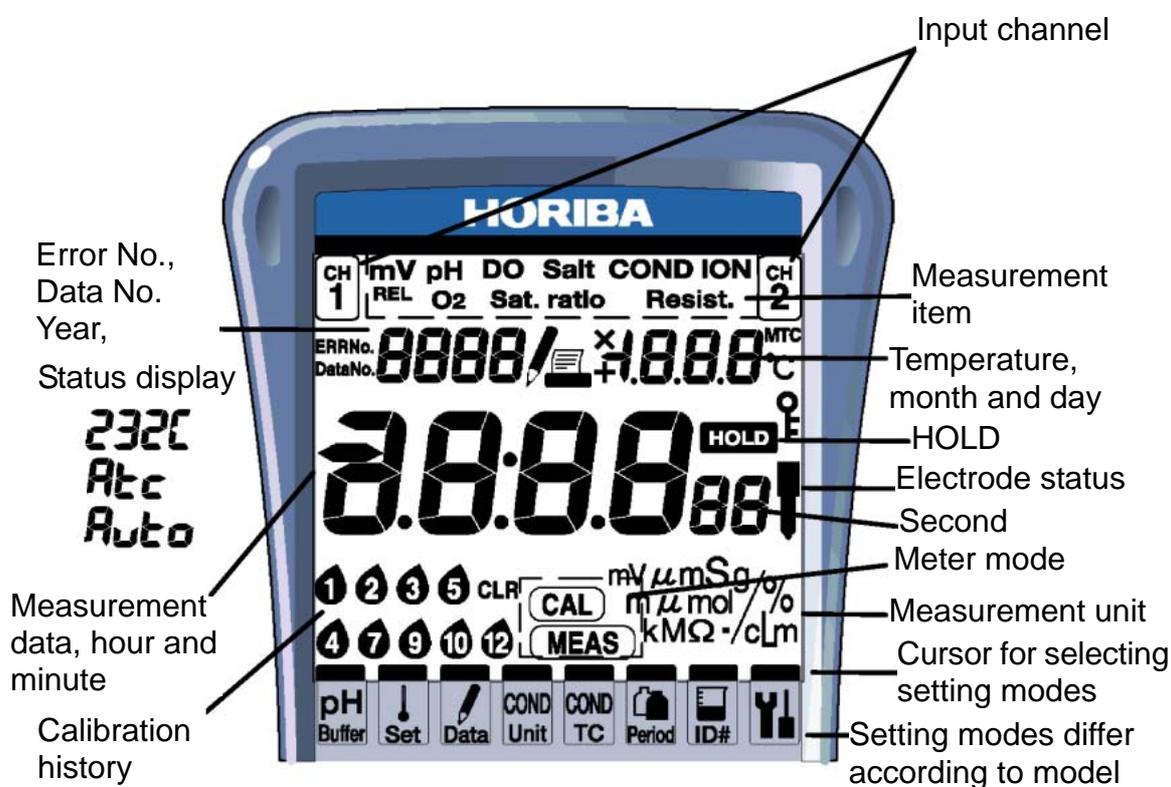
### 1.3 Part names

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The D-51, pH meter has the following parts:



## 1.4 Explanation of display



Part name	Display	Contents
Input channel Measurement item		Input channel 1
	<b>pH</b>	Displayed when measuring pH
Error No.	<b>ERRNo.</b>	Displayed when an error is generated
Data No.	<b>DataNo.</b>	Displayed when the data number has been set.
Status display - - -	<b>00 1</b>	Shows error number and data number.
	<b>Atc</b>	Displayed when temperature compensation function or automatic temperature compensation has been set.

Part name	Display	Contents
		Displayed during data memory function (for 3 sec.). Displayed while data in memory is being called up and when manual data memory is being called up, or blinks when automatic data memory is being called up.
	<b>MTC</b>	Displayed during manual temperature compensation. Not displayed during automatic temperature compensation.
HOLD		Displayed while the data is held (HOLD status). Blinks during measurement or calibration.
Electrode status		(Only in pH Measurement mode) Not displayed: Normal Blinking: Cleaning is needed. Constant display: Replacement time is approaching.
Calibration history		Calibration history display: Displayed after calibration for pH and ION electrodes as calibration history.
	<b>CLR</b>	When no calibration data is available: Displayed when no calibration has been performed for pH and ION electrodes.
Meter mode		Displayed when in Measurement mode.
		Displayed when in Calibration mode.

## 1.5 Operation keys

This section describes the functions of the keys.

	Name	Description
	MEAS key	Returns to the Measurement mode. Starts measurement.
	MODE key	Selects measurement item.
	SET key	Selects setting item.
	CAL key	Enters the Calibration mode. Starts calibration.
	UP key	Executes the data memory function. Increases numerical value.
	ENTER key	Establishes the setting.
	DOWN key	Calls up data memory. Decreases numerical value.
	CAL DATA key	Calls up calibration data.
	ON/OFF key	Turns ON/OFF the power. This key takes effect only after pressed for one second to prevent accidental operation.

### Note

The automatic power-off function is a default setting for this meter. The power is automatically turned OFF if no operation is performed after a period of approximately 30 minutes.

## 1.6 Connecting the electrodes

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Connect the electrodes to the meter using the following procedure:

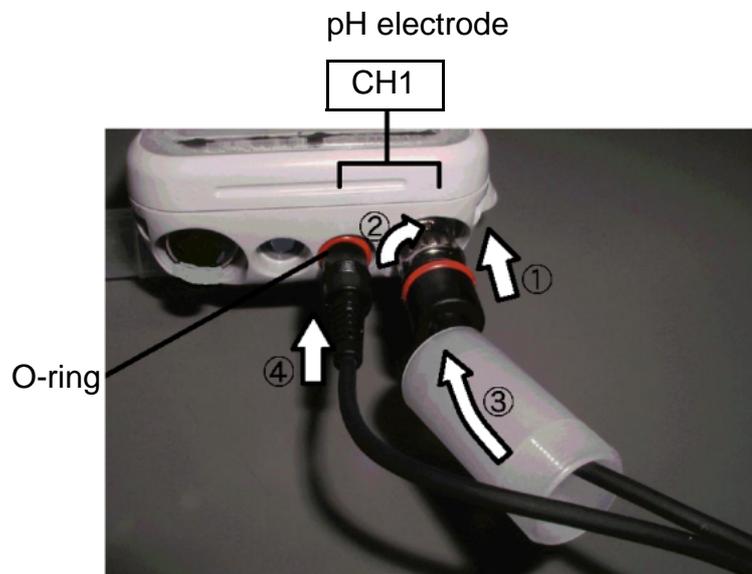
**Note**

- Do not allow any water to come into contact with the connector.
- Do not touch the connector with uncleaned hands.
- Hold the metal portion when turning the electrode connector.

The following connectors are used depending on electrode type:

CH1 Electrode connector:	pH electrode
Temperature connector:	Temperature electrode for CH1

### Electrode connector (G-R electrode)



1. Insert the electrode connector, making sure to align the connector grooves with the pins in the connector port on the main unit (see photo, ). Do not push the electrode with undue force when the pins are not properly aligned.

2. Push the electrode connector into the connector port while turning it clockwise, following the grooves (see photo, and ).
3. Push the connector cover over the connector (see photo, ), being careful to push it straight on without turning it.

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**Note**

The meter will be waterproof only if this cover is placed properly over the connector.

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## Temperature connector

1. Insert the temperature connector into the jack on the main unit until the O-ring on the electrode cannot be seen at all (see photo, ).

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**Note**

The meter will not be waterproof if the electrode is not inserted properly.

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**Note**

When the temperature electrode is not connected (or is connected improperly), the automatic temperature compensation (ATC) will be 25°C.

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## 1.7 Inserting/replacing the dry-cell batteries

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The dry-cell batteries are not placed in the meter before shipping. To insert the batteries, follow the procedure below.

Note that if “ERR 2” appears on the display while using the meter, it indicates that the charge of the dry-cell batteries is running low. When this occurs, replace the batteries promptly.

Dry-cell battery type: AA alkaline

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### Note

- Insert the batteries, paying attention to the orientation of the battery poles ( “ + ” and “ - ” ).
  - Removing the batteries will erase the clock data. To save the clock data, remove and replace the batteries while the meter is connected to the AC adapter (sold separately).
  - Replace the batteries only after turning the power OFF. Any saved data will not be lost.
  - When opening and closing the battery cover, be careful that no water gets inside the meter.
  - Check that the rubber packing is not twisted and no foreign matter is stuck to it. Otherwise the meter may no longer be waterproof.
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### Note

The life of the batteries included with the meter may be short because the batteries were used for the operation check before shipping.

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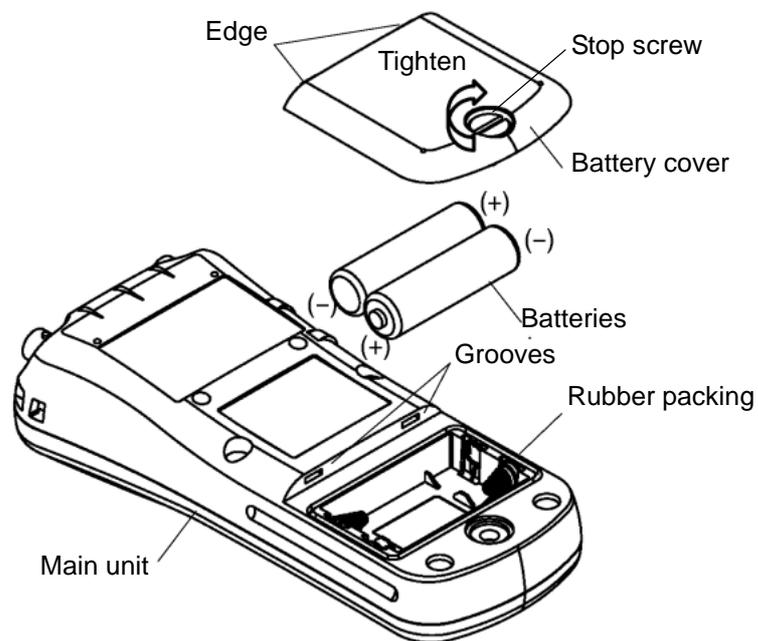
### To insert/replace the batteries

1. Loosen the screw of the battery cover by using a coin or screwdriver, etc. The cover is constructed so that the stop screw cannot be completely removed and lost.
2. Pull up the screw, and remove the battery cover by sliding it out.

## 1 Overview of the Meter

### 1.7 Inserting/replacing the dry-cell batteries

3. If there are old batteries inside, remove them.
4. Place the new batteries in the meter, verifying the orientation of the poles (“+” and “-”).
5. Check that the rubber packing is not twisted and no foreign matter is stuck to it.
6. Insert the edge of the battery cover into the grooves on the meter, and then tighten the stop screw.



#### Note

Check that the rubber packing is twisted and no foreign matter is stuck to it. Otherwise the meter may no longer be waterproof.

#### Battery life

The table below shows the battery life of alkaline batteries during continuous use. The life of manganese batteries is about a half of the alkaline batteries.

Battery life	approx. 200 hours
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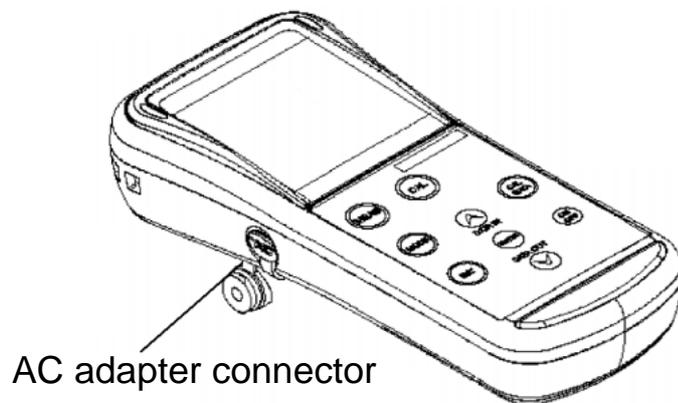
## 1.8 Connecting the AC adapter

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When using the meter with an AC power supply, use the designated AC adapter (option).

AC adapter specifications

Supply voltage range	100 - 200 V AC
Frequency range	50/60 Hz
Current rating	Max 370 mA
Class2 Power supply	
Equipment protected by double insulation	
Indoor use only	
Supply voltage fluctuations allowed up to $\pm 10\%$	



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**Note**

When the AC adapter is connected, the meter is no longer waterproof.

Be careful not to let water get into the meter.

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**1 Overview of the Meter**  
**1.8 Connecting the AC adapter**

# 2 Taking Measurements

This chapter explains how to take basic measurements.

## 2.1 Turning the meter ON/OFF

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Pressing the ON/OFF key turns the power on/off. The ON/OFF key functions when it is pressed continuously for about one second to protect against accidental operation.

## 2.2 Settings required before measurement

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The built-in clock allows you to record the date of calibration and data memory storage. When using the meter for the first time, be sure to set this clock.

— Ref. —  
“3.3 Displaying and setting the clock” page 34

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## 2.3 Measurement modes

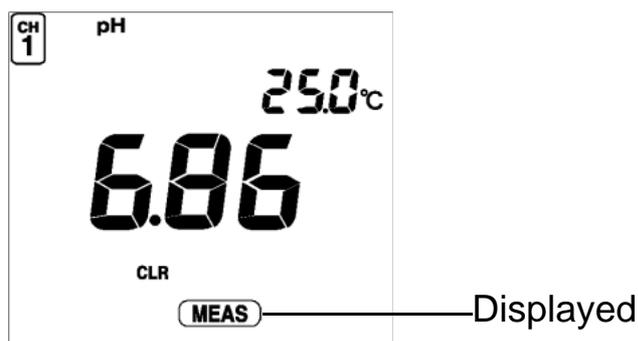
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The D-51, pH meter has an Instantaneous Value Measurement mode and an Auto Hold Measurement mode for all components of the solution being measured.

### Instantaneous Value Measurement mode

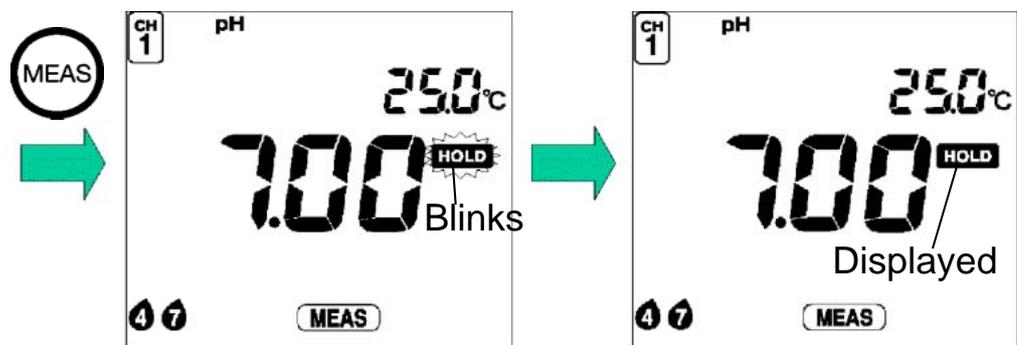
The D-51, pH meter performs instantaneous value measurement as the default measurement mode when the power is first turned ON and when the auto hold measurement is cancelled or cleared.

For this reason, the screen displayed when the meter is in the Instantaneous Value Measurement mode is called the "initial screen" in this manual.



## Auto Hold Measurement mode

Auto Hold Measurement mode maintains the display of the value measured when the meter automatically judges that the measured value has stabilized. Press the MEAS key with the initial screen displayed to make “ HOLD ” blink on the display. When the measured value becomes stable, “ HOLD ” will stop blinking and remain displayed, and the measured value will remain displayed. To clear the hold status or “ stabilized ” value (when “ HOLD ” is blinking), press the MEAS key.



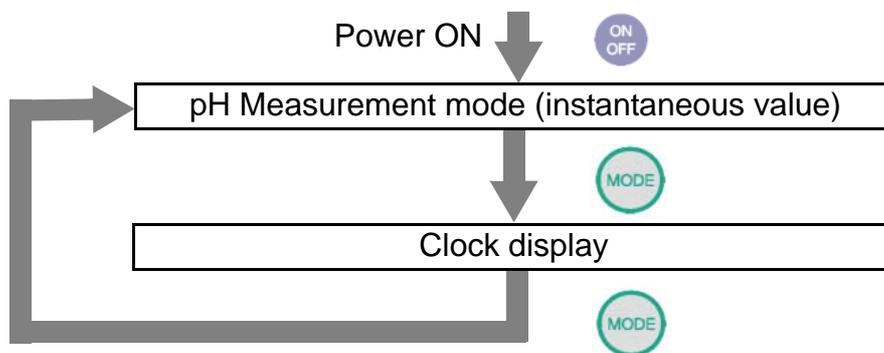
### Criteria for judging stability

pH, ORP, ION measurement	: Within $\pm 1$ mV variance in potential after 10 seconds
Temperature measurement	: Within $\pm 2^{\circ}\text{C}$ variance after 10 seconds

## 2.4 Selecting the measurement modes

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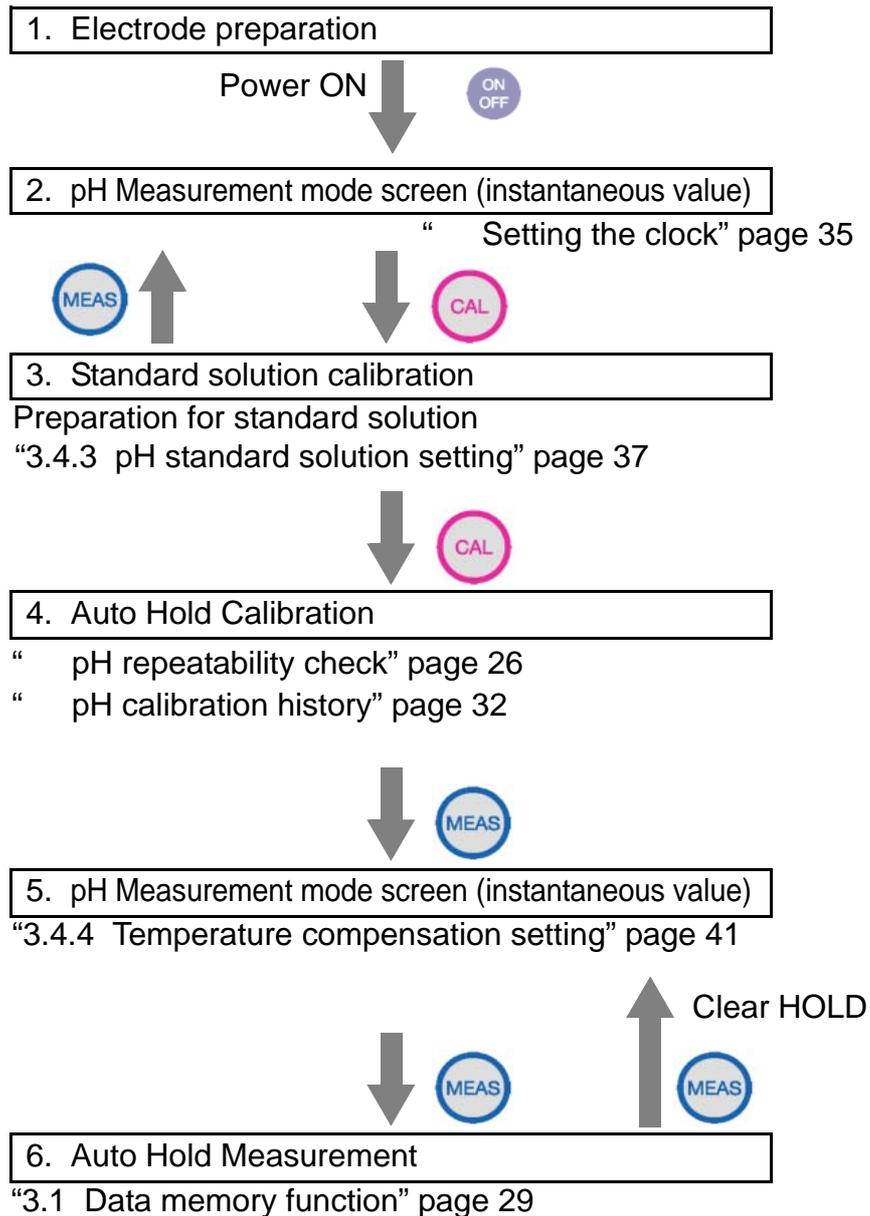
Pressing the MODE key changes the measurement mode. The last measurement mode item is the clock display. Pressing the MODE key once more returns the display to the first measurement mode.



## 2.5 Measuring pH

The following shows the operational flow for pH measurement.

### Measuring pH: basic operational flow



## Electrode preparation

Refer to the electrode instruction manual and make sure you have the necessary electrode(s).

Plastic-body pH electrode: 9621-10D

Glass-body pH electrode: 9611-10D

pH (micro) electrode: 9669-10D

pH (sleeve) electrode: 9677-10D

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### Chemical solution



The liquid inside the electrode is highly concentrated potassium chloride (3.33 mol/L KCl). If the internal solution in the electrode comes in contact with your hands or skin, wash immediately with water. If the internal solution comes in contact with your eyes, flush immediately with large amounts of water and seek treatment by a physician.



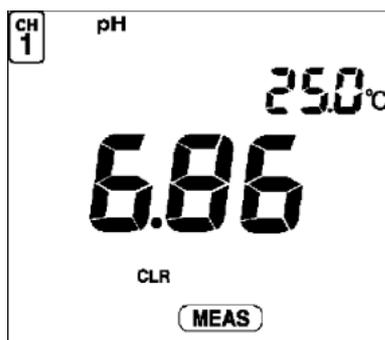
### Glass fragments

Glass fragments can cause injury. The outer tube of the electrode and the tip of the electrode are made of glass. Use care not to break them.

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## Entering the pH Measurement mode

1. Press the ON/OFF key.  
The initial screen will appear.



## Standard solution calibration

Perform a one-point calibration for making simple pH measurements; for more accurate measurements, perform at least a two-point calibration.

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### Note

Up to three points can be used for calibration. If you perform calibration for a fourth point, “ERR06 Calibration point error” is displayed.

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Standard solutions for calibration are defaulted to pH 2, pH 4, pH 7, pH 9, and pH 12.

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### Ref.

“3.4.3 pH standard solution setting” page 37

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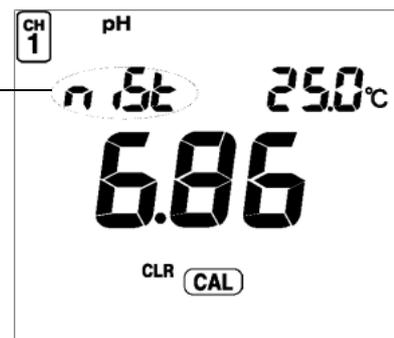
This section will explain how to conduct a two-point calibration using pH 7 and pH 4 standard solutions.

## Calibration procedure

1. Press the CAL key while in the pH Measurement mode.

The meter enters the Calibration mode and >CAL< is displayed.

Displayed item differs depending on the standard solution setting.



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### Note

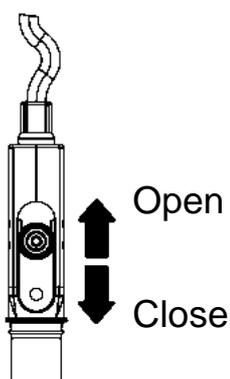
The mode cannot be changed during Auto Hold calibration (while “HOLD” is blinking or continually displayed).

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2. Wash the tip of the electrode well with pure (de-ionized) water, and then wipe with filter paper or tissue paper.

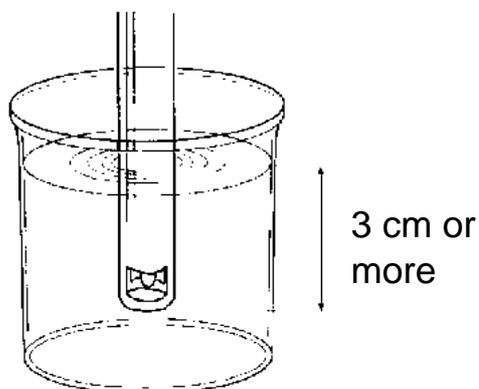


3. Open the internal solution filler port.  
Leave the port open while calibration is taking place.



### Calibration at first point

1. Immerse the tip of the electrode in a beaker containing pH 7 standard solution.  
Immerse the pH electrode in the sample at least three centimeters.



2. Press the CAL key to start calibration.



The measured value will be displayed, and “ HOLD ” will blink until the reading stabilizes.

When the value stabilizes, “ HOLD ” will stop blinking and the calibrated value will be displayed.

The 7 bottle mark will be displayed, indicating that calibration was conducted with pH7 standard solution

---

**Note**

**To stop the calibration:**

Press the CAL key while the HOLD mark is blinking.

**To establish the calibration:**

Press the ENTER key while the HOLD mark is blinking.

**To redo the calibration:**

Press the CAL key after the HOLD mark is displayed.

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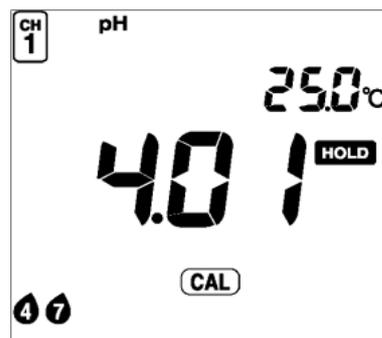
### Calibration at second point

1. Wash the electrode well again with pure (de-ionized) water, and then wipe with filter paper or tissue paper.
2. Immerse the tip of the electrode in a beaker containing pH 4 standard solution.
3. Press the CAL key to start calibration.

The measured value will be displayed, and “ HOLD ” will blink until the reading stabilizes.

When the value stabilizes, “ HOLD ” will stop blinking and the calibrated value will be displayed.

The 4 bottle mark will be displayed, indicating that calibration was conducted with pH 4 standard solution.



4. Press the MEAS key to return to the pH Measurement screen.

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#### Note

While calibrations are being performed in the Calibration mode, redoing a calibration only updates the calibration data for the pertinent standard solution. If a calibration is redone after the meter is returned to the Measurement mode, however, the calibration is conducted on the initial status of the meter; i.e., all the previous calibration data is cleared.

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**Note**

The example of calibration at second point has explained the calibration process using the order from pH 7 to pH 4. However, the calibration order of the standard solutions can be arbitrarily chosen.

**Electrode status**

You can check the status of the electrode after calibration.

Item	Description
 ,ERR Not displayed	The electrode is in good condition. Electrode sensitivity is from 93% to 100%.
 Blinking	Electrode sensitivity has dropped to the level of 90% to 93%. <ul style="list-style-type: none"> <li>• Make sure that you are using the right standard solution.</li> <li>• Clean the electrode.</li> </ul> “ Washing the electrodes” page 54
 Displayed	Electrode sensitivity has dropped to the level of 85% to 90%. “ ERR No.05 Electrode sensitivity error (pH)” page 59
ERR No.04	Asymmetrical potential error “ ERR No.04 Asymmetric potential error” page 58
ERR No.05	Sensitivity error “ ERR No.05 Electrode sensitivity error (pH)” page 59

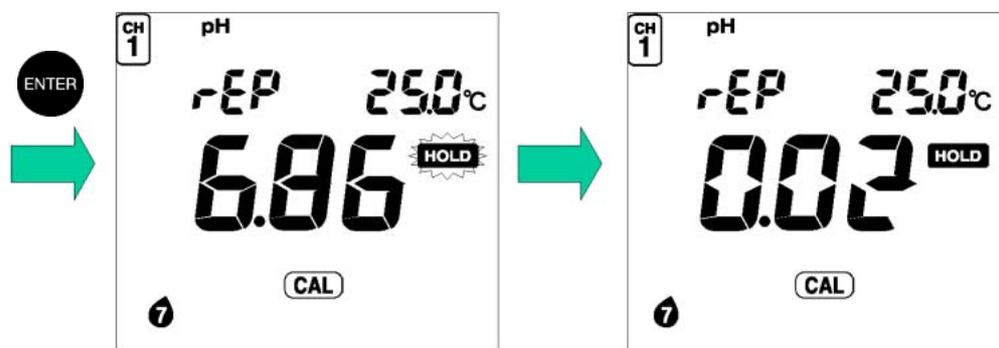
## pH repeatability check

The repeatability of the calibration can be checked if the calibration has been performed with pH 7 standard solution of NIST or US.

The repeatability check is operable only once after calibration.

1. After calibration and while still in the Calibration mode, immerse the electrode in pH 7 standard solution and press the ENTER key.

The difference between the calibrated value and measured value is displayed.



### Note

There is no problem in measurement accuracy if the difference is within  $\pm 0.05$  pH.

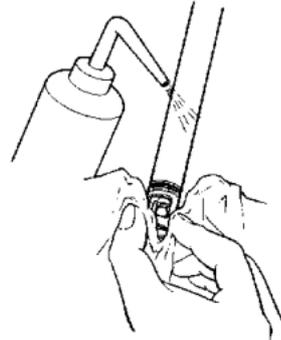
## Clearing calibrated values

To clear all the calibrated values:

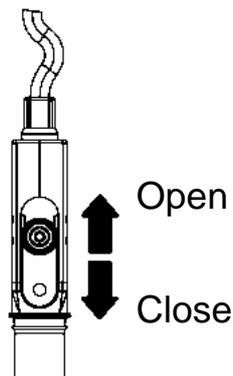
1. Set the pH meter to the Calibration mode.
2. Press the CAL key while holding the SET key down.

## Measuring pH

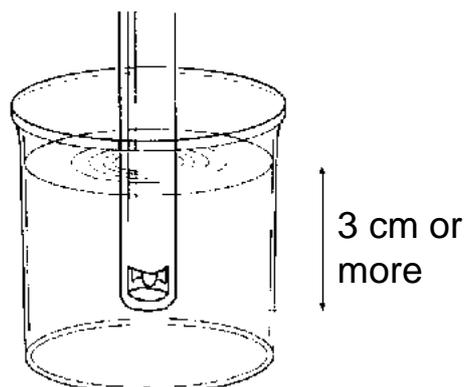
1. Wash the tip of electrode well with pure (de-ionized) water, and then wipe with filter paper or tissue paper.



2. Open the internal solution filler port.  
Leave the port open while measurement is taking place.



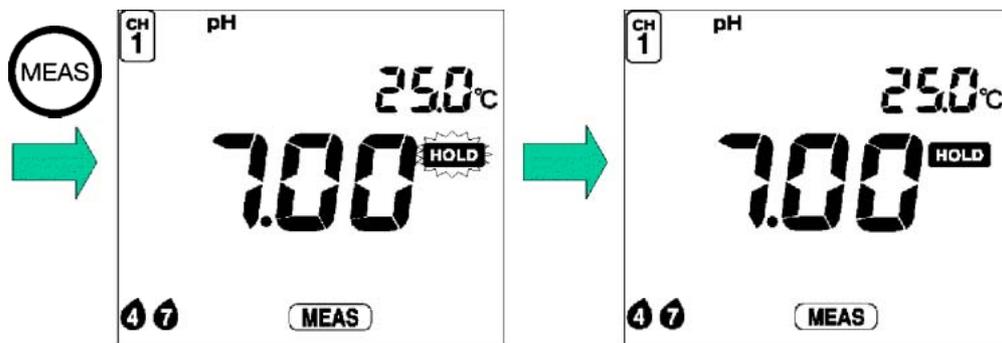
3. Immerse the electrode all the way in the sample.  
Immerse the pH electrode in the sample at least three centimeters.



4. Press the MEAS key with the initial screen displayed.

“ HOLD ” will blink until the reading stabilizes.

When the indicated value stabilizes, “ HOLD ” will stop blinking and will be displayed. The indicated value will remain displayed continually.



---

**Ref.**

Refer to the “ Criteria for judging stability” page 17 for the criteria for judging the stability of the readout.

---

---

**Note**

When measurement data is held using Instantaneous Value Measurement or Auto Hold Measurement, you can store that data in the memory by pressing the key. See “3.1 Data memory function” page 29.

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# 3 Functions

This chapter describes the various functions of the pH meter.

## 3.1 Data memory function

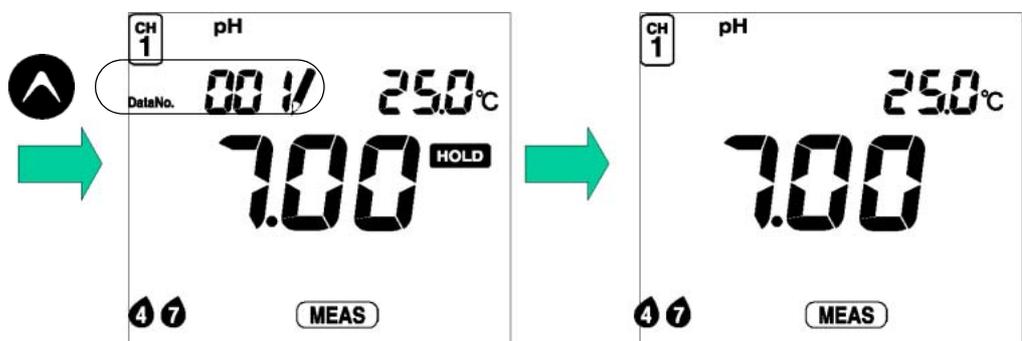
---

### Data memory

In all measurement modes, you can store data when the instantaneous value is measured or the measured value is held (HOLD status) during the Auto HOLD measurement by pressing the  key.

The measurement reading is stored along with the temperature, data, HOLD value/instantaneous value, ATC/MTC and calibration point, at the time the measurement was taken.

After the data number is displayed, the screen returns to the initial screen. Up to 300 items of data can be stored in the memory. If the number of data items exceeds the maximum limit, ERR 10 is displayed and no more data can be stored.



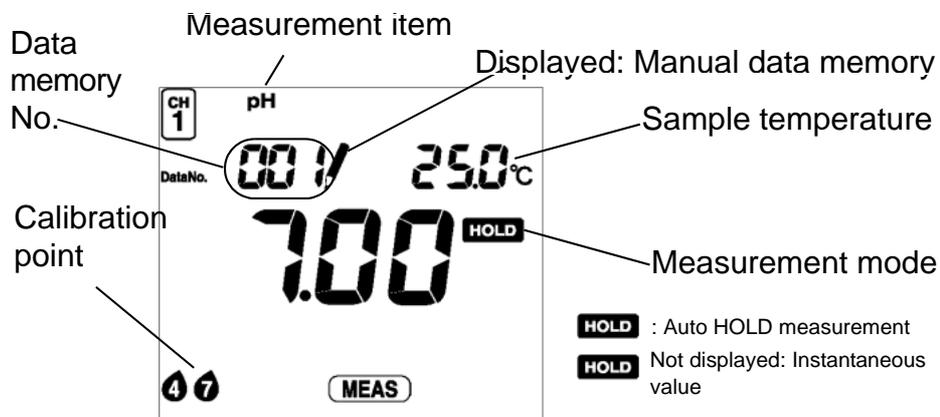
**Note**

Data cannot be stored unless the value has stabilized or in the CAL mode.

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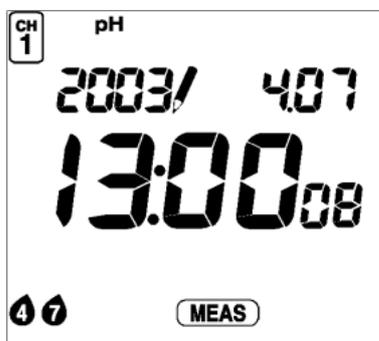
## Calling up memory data

1. Press the  key in the Measurement mode to load measurement data.



Select and load the desired memory data item using the  and  keys. The displayed number returns to 0 after 300, the maximum number.

2. Press the MODE key to display the data and time.



Select the desired data item using the  and  keys.

3. Press the MODE key to display the ID.

Select the desired data item using the  and  keys.

---

**Note**

If an error occurs while a data number is being displayed, the error number will NOT be displayed. When using a printer (sold separately), press the ENTER key while in the DATA OUT mode to print the data.

---

## 3.2 pH calibration history display

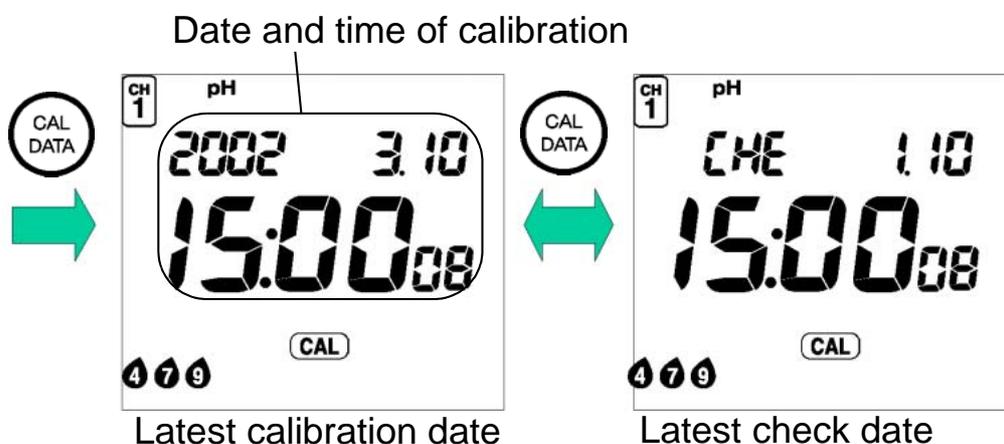
---

The latest calibration and repeatability check information can be checked.

— **Ref.** \_\_\_\_\_  
Refer to “ pH repeatability check ” on page 26.  
\_\_\_\_\_

### pH calibration history

1. Press the CAL DATA key in the pH Measurement mode.



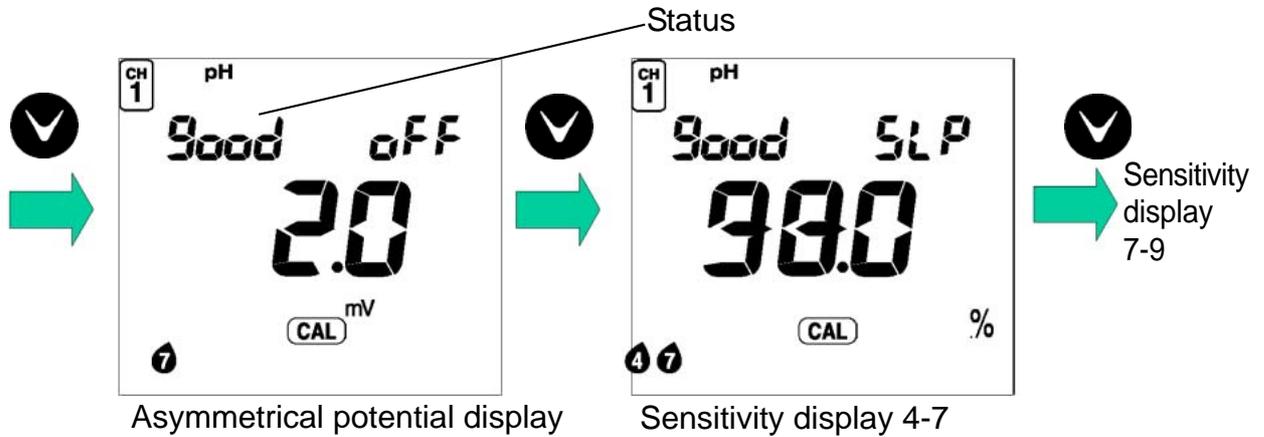
2. Pressing the CAL DATA key toggles between the latest calibration date and the latest check date.

— **Note** \_\_\_\_\_  
The latest check date is not displayed if no repeatability check has been performed.  
\_\_\_\_\_

### Latest calibration data

1. Press the  key with latest calibration date displayed.

The asymmetrical potential will be displayed.



### Example of 3-point calibration

2. Press the  key to show sensitivity display.

### Status display

**Good** When the meter is in a good condition

**WHE** When the electrode needs washing

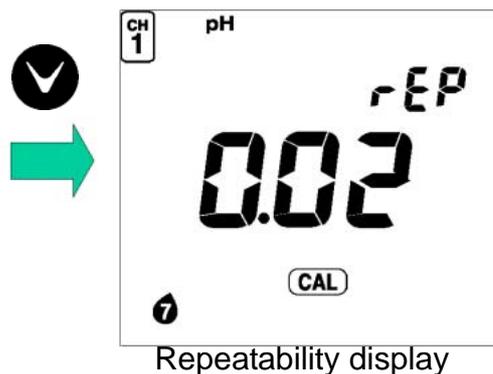
**WRD** When the electrode is old and is going bad

**Ref.** \_\_\_\_\_  
Refer to "Asymmetrical potential display" on page 71.

### pH latest check data

1. Press the  key with latest check date displayed.

The repeatability display will appear.



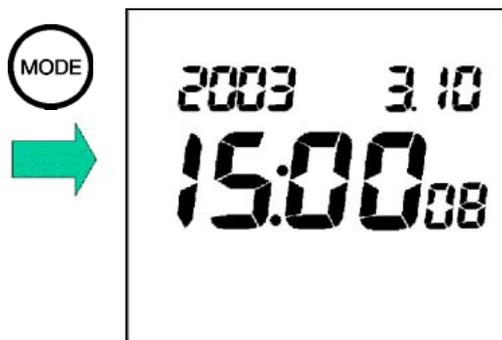
## 3.3 Displaying and setting the clock

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The clock needs to be when the meter is used for the first time or after replacing the batteries.

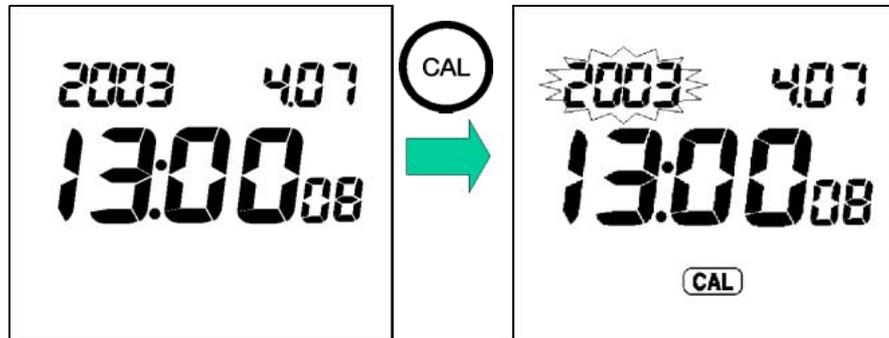
### Displaying the clock

Press the MODE key in the Measurement mode to display the clock.



## Setting the clock

1. Press the CAL key when the Clock Display screen is displayed to show the Setting screen for the clock.



2. Switch the display to year, month, day, hour, minute, and second using the ENTER key. You can set a numerical value using the and keys.

**Note**

Set the seconds to "00" sec. Pressing the ENTER key sets it to "00".

3. After setting the clock, press the ENTER key to update the setting.  
Pressing the CAL key at this time returns you to the Clock Display screen without changing the current setting.
4. Press the MODE key to return to the Measurement mode.

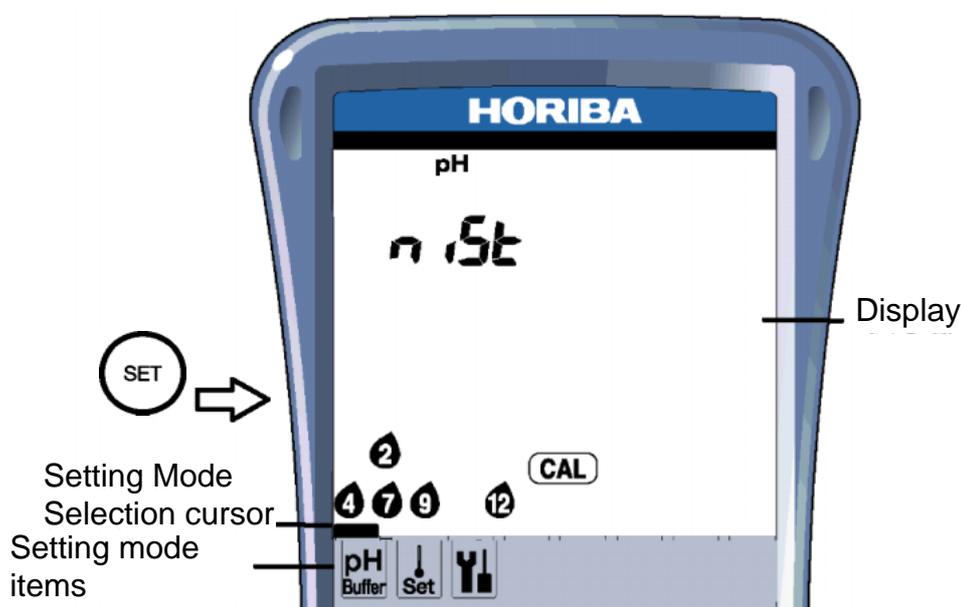
## 3.4 Setting modes

---

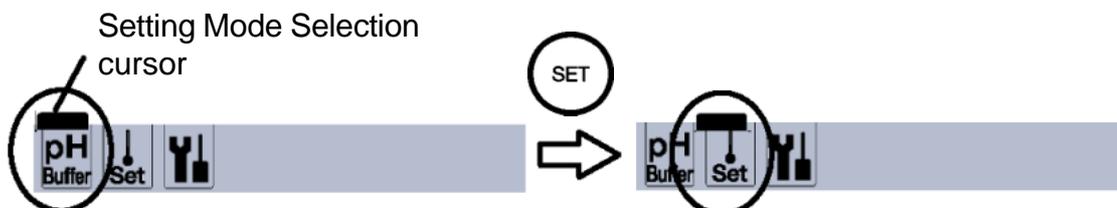
Selecting the Setting mode expands the uses of the meter.

### 3.4.1 Entering the Setting mode

1. Press the SET key in the Measurement mode. The Setting Mode Selection cursor appears at the left-bottom of the screen to indicate that the Setting mode is active.



2. Pressing the SET key moves the Setting Mode Selection cursor one by one to allow you to select the Setting mode of your choice.



3. Press the MEAS key to return to the Measurement mode from the Setting mode.

### 3.4.2 Display and description

Display	Name	Description	Page No.
	pH Buffer Setting	Sets the standard solution for pH calibration.	page 37
	Temperature Compensation Setting	Selects the Auto/Manual mode for temperature compensation.	page 41
	Maintenance	Sets various maintenance-related settings.	page 42

### 3.4.3 pH standard solution setting

The meter allows you to select the standard solution specifications used for calibration from among the NIST standard, US standard (USA), and use-defined standard (CUST).

NIST standard	When using the standard solution required by NIST standards
	Bottle mark     
US standard (USA)	When using the standard solution required by US standards
	Bottle mark     
Custom (CUST)	When using a user-defined standard solution
	Bottle mark   

**Ref.**

Refer to “Types of pH standard solution ” on “ Types of pH standard solutions” page 72.

### 3 Functions

#### 3.4 Setting modes

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**Note**

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The calibrated value for pH 7 standard solution is different between the NIST standards and US standards.

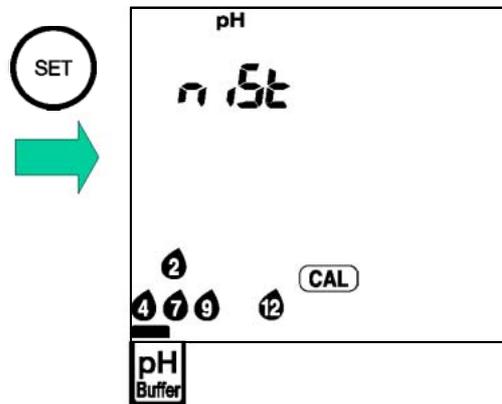
NIST standard: pH 6.86 (at 25°C)

US standard: pH 7.00 (at 25°C)

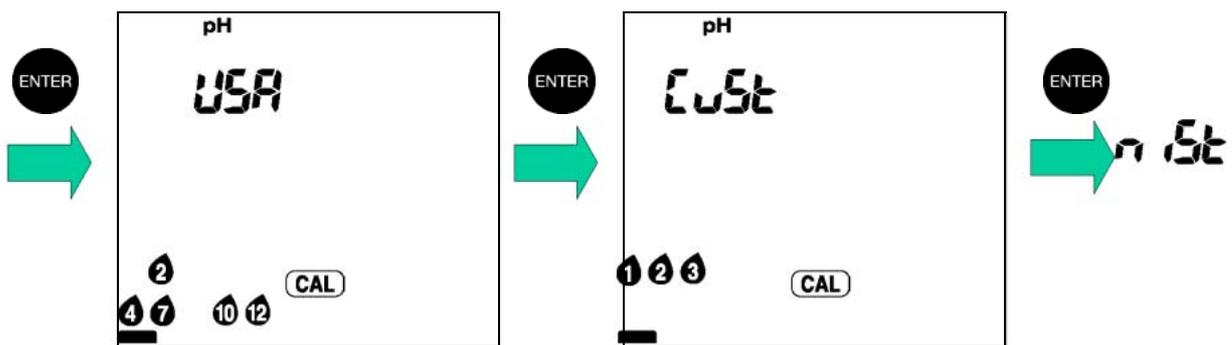
---

### Changing the standard solution setting

1. Press the SET key in the Measurement mode and select the pH Buffer Setting mode.



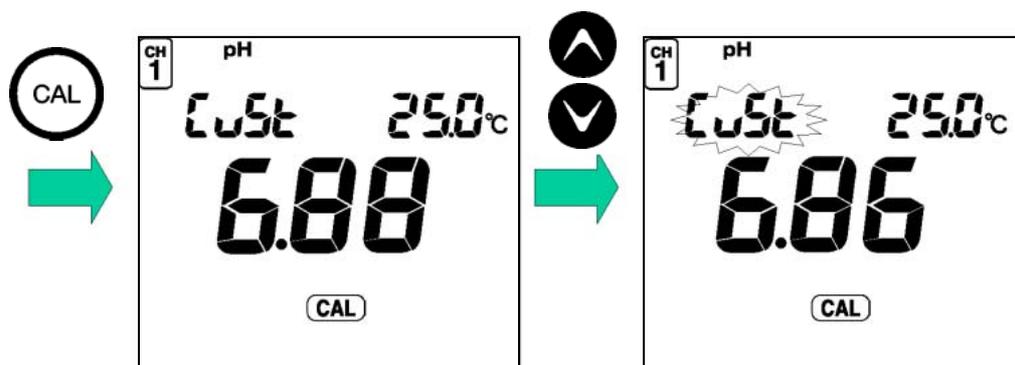
2. Press the ENTER key to toggle between NIST standard, US standard (USA) and a user-defined standard (CUST).



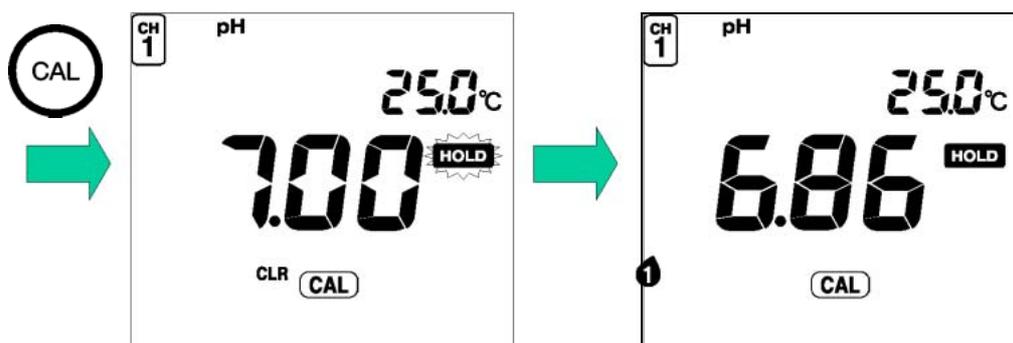
3. Press the MEAS key to return to the Measurement mode.

### Calibration using a user-defined standard (CUST)

1. Press the CAL key in the pH Measurement mode to select the Calibration mode.  
“>CAL<” will be displayed.
2. Set the pH value of the standard solution used for calibration using the  $\uparrow$  and  $\downarrow$  keys.  
While the setting is being made, “CuSt” will blink.



3. Press the CAL key to start the calibration.  
The measured value will be displayed, and “ HOLD ” will blink until the reading stabilizes.  
When the measured value stabilizes, “HOLD” will stop blinking and the calibrated value will be displayed.

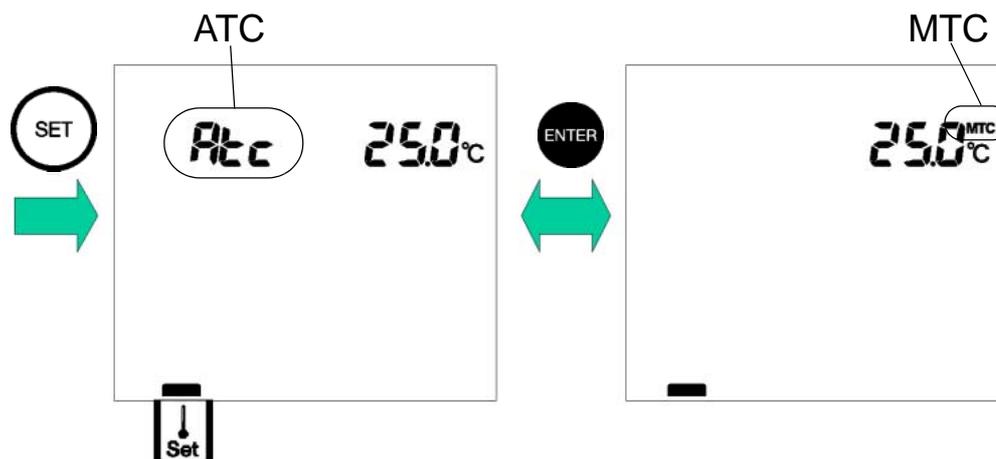


**Note**

Perform the calibration for the second and third point following the same procedure.

### 3.4.4 Temperature compensation setting

1. Press the SET key in the Measurement mode to enter the Temperature Compensation Setting mode.
2. Pressing the ENTER key toggles between MTC and ATC settings.



#### ATC

Automatic temperature compensation (when using a temperature sensor of the electrode)

ATC is displayed.

When a temperature sensor is connected, the current temperature is automatically displayed.

(When no temperature sensor is connected, the display shows 25°C.)

#### MTC

Manual temperature compensation (when an electrode temperature sensor is not being used and the temperature of the solution is known before hand)

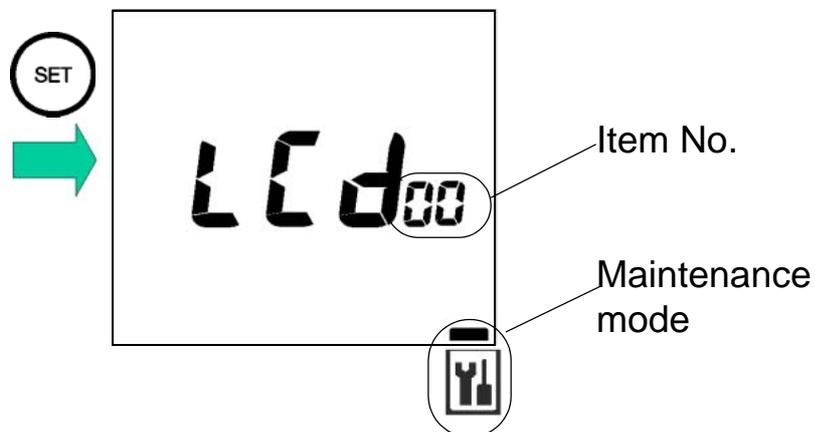
MTC is displayed.

Set the temperature using the      and      keys.

Setting range: 0.0 to 100.0°C

### 3.4.5 Maintenance mode

Press the SET key in the Measurement mode and select the Maintenance mode. The LCD CHECK screen (Item No. 00) will appear.



## Maintenance setting items

Use the MODE key to toggle between Maintenance mode items.

Item No.	Item	Description	Page No.
00	LCD check	Enables check to see if all LCD segments are displayed.	page 44
01	Battery voltage check	Enables simple battery voltage check.	page 45
02	Temperature zero adjustment	Carries out temperature calibration when the temperature sensor is immersed in a liquid of known temperature.	page 46
03	Automatic power-off setting	Turns Automatic Power-off function ON/OFF and sets time period after which the power will be turned off when no keys are touched.	page 47
05	Remaining data memory	Displays number of data items that can still be stored.	page 48
06	Data memory clear	Clears all data in the data memory.	page 48
07	Initialization of setting	Initializes all settings to default values.	page 49



## Battery voltage check [item No. 01]

The battery voltage (V) is displayed.



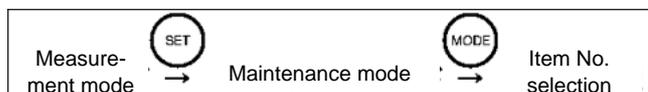
### Note

The battery voltage alarm is set at approximately 2.2 V. The measured voltage for batteries depends on the current. The voltage shown in this mode will be a little lower than the actual voltage.

1. Use the MODE key to proceed to temperature zero adjustment (item No. 02).

### HINT!

#### Entering the Maintenance mode



## Temperature zero adjustment [item No. 02]

This mode uses a known temperature to calibrate the temperature compensation value. This mode is used when calibrating the temperature of the thermometer.

1. Immerse the electrode in a liquid with a known temperature, and set the temperature using the **SET** and **MODE** keys.

Setting range: 0.0 to 100.0 °C

---

### Note

The temperature sensor attached to the electrode maintains an accuracy of  $\pm 1^\circ\text{C}$ , even without calibration. The above mode should be used when a greater precision than  $\pm 1^\circ\text{C}$  is required.

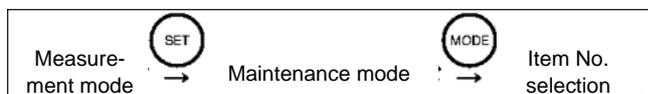
---

2. Use the **MODE** key to proceed to Automatic power-off setting (item No. 03).

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### HINT!

#### Entering the Maintenance mode



## Automatic power-off setting [item No. 03]

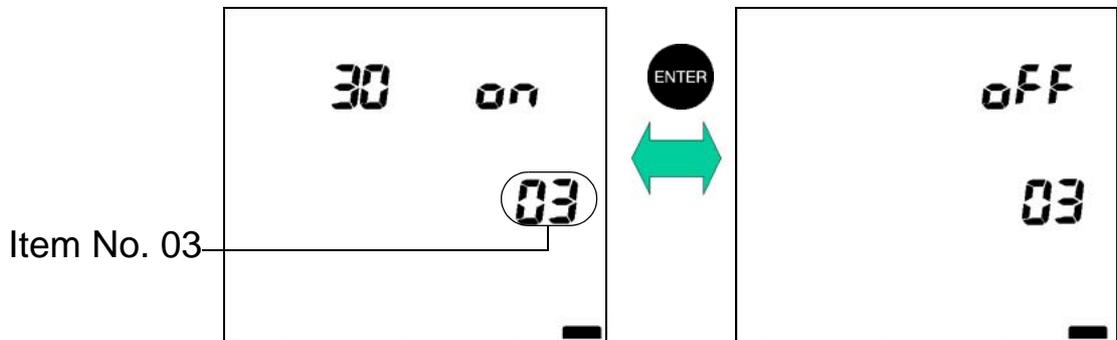
This turns the Automatic Power-off function ON/OFF and sets the time until the power is turned off.

When the Automatic Power-off function is set to ON, the power to the meter automatically turns off if the keys are not operated for the set amount of time.

1. Press the ENTER key to toggle between ON and OFF.

When set to ON, set the time for the power to be turned OFF using the and keys.

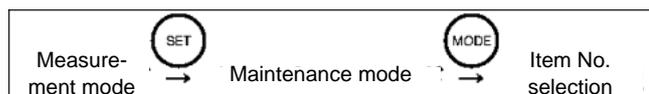
Setting range: 1 to 30 minutes



2. Press the MODE key to proceed to [Item No. 05] Remaining data memory.

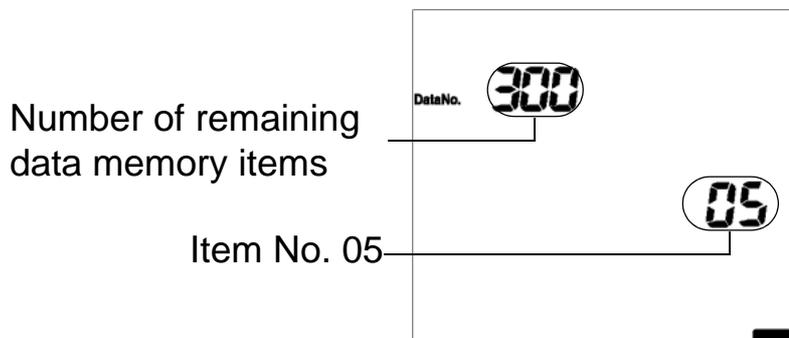
— HINT! —

### Entering the Maintenance mode



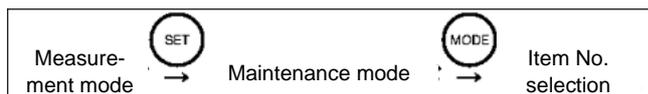
## Remaining data memory [Item No. 05]

Displays the number of data items that can still be stored.



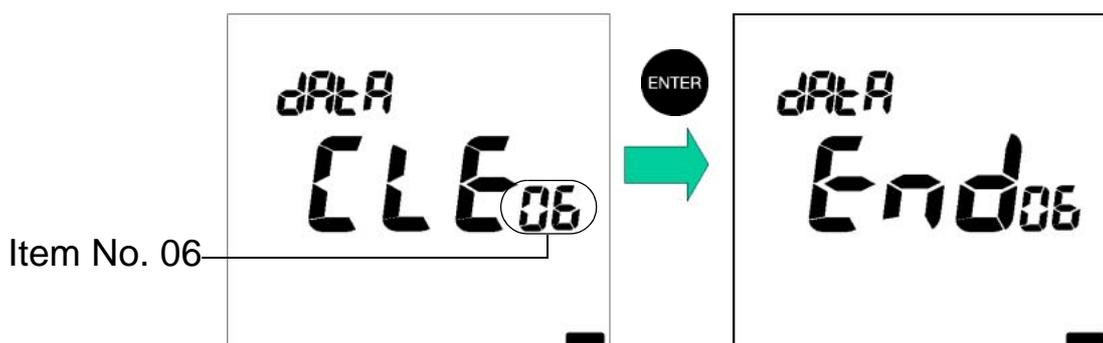
1. Press the MODE key to proceed to Data memory clear (item No. 06).

— **HINT!** —  
**Entering the Maintenance mode**



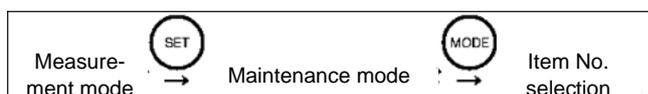
## Data memory clear [Item No. 06]

1. Pressing the ENTER key clears all the data stored in the memory.



2. Press the MODE key to proceed to Initialization of setting (item No. 07).

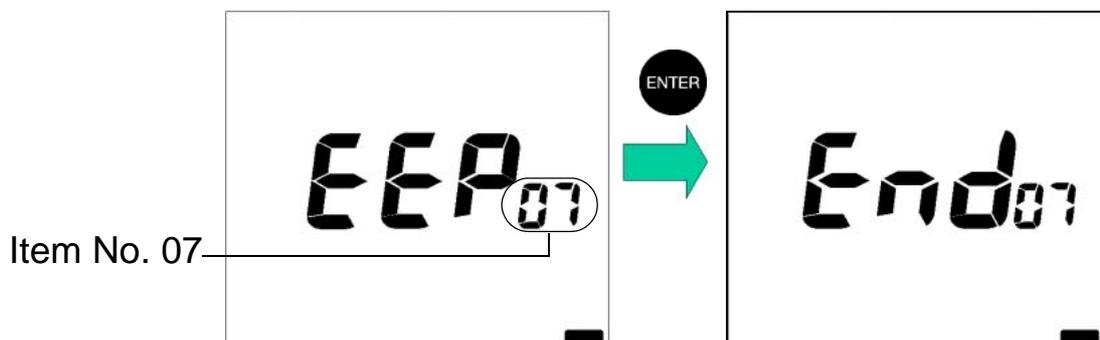
— **HINT!** —  
**Entering the Maintenance mode**



## Initialization of setting [item No. 07]

This mode returns all settings to the default settings. Use this mode to return the pH meter to the original settings when the meter was purchased.

1. Press the ENTER key to initialize the settings.

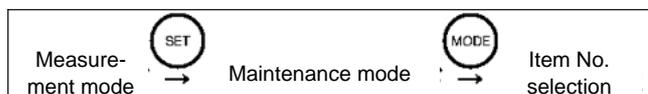


Ref.

The setting values to be initialized are shown on page 77.

**HINT!**

### Entering the Maintenance mode



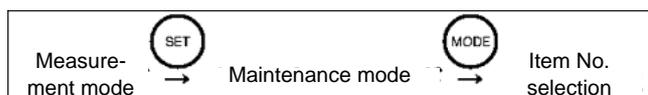
2. Press the MODE key to return to the first item in the maintenance modes, LCD check.

### Test print format

```
!"#$%&'()*+,-./0123
456789:;<=>?@ABCDEFGH
IJKLMNOPQRSTUVWXYZ[
¥]^_`abcdefghijklmnop
qrstuvwxyz{|}
```

**HINT!**

### Entering the Maintenance mode



**3 Functions**  
**3.4 Setting modes**

# 4 Maintenance and Troubleshooting

This chapter explains how to perform daily meter maintenance and how to deal with error messages. Daily maintenance is vital in assuring accurate measurement and preventing breakdowns before they occur. Maintenance of the electrodes is especially important; if ignored, various problems and erroneous measurements may result. This meter is equipped with a convenient error message function. If an error message is displayed, be sure to take appropriate action.

## 4.1 pH electrode maintenance

---

Maintain your electrodes by referring to the following information or to the operation manuals for the electrodes.



### Injury warning

Glass fragments can cause injury. The outer tube of the electrode and the tip of the electrode are made of glass. Use care not to break them.

---

### Maintenance after daily use

After taking measurements, wash the electrode using pure water (de-ionized water), wipe off the water from the electrode with filter paper or tissue paper, and store it with its cap on.

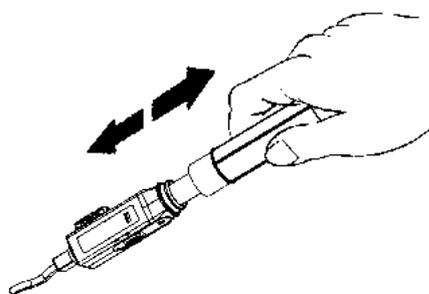
#### Note

The liquid junction may become clogged if the electrode is left in distilled water.

## Extended storage

When an electrode is not to be used for a long period of time, store the electrode after performing the following steps. Also, replace the reference solution every three to six months, using the method explained below.

1. Remove the electrode from the pH meter.
2. Remove the protective cap from the electrode.



#### Chemical warning

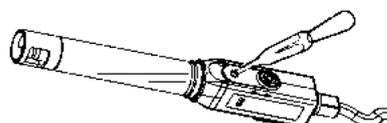
The liquid inside the electrode is highly concentrated potassium chloride (3.33 mol/L KCl).



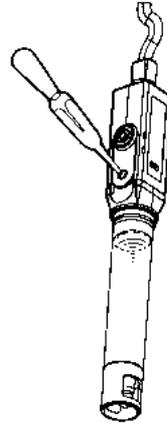
Caution

If the internal solution in the electrode comes in contact with your hands or skin, wash immediately with water. If the internal solution comes in contact with your eyes, flush immediately with large amounts of water and seek treatment by a physician.

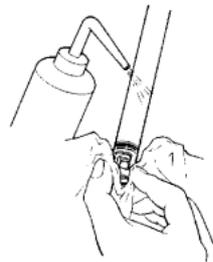
3. Open the internal solution filler port and use a syringe to remove the internal solution.



4. Fill the electrode with new internal solution (#300), until it nears the opening.



5. Wash the tip of the electrode well with pure (de-ionized) water and wipe it with filter paper or tissue paper.



6. If the liquid on the inside of the electrode cap has dried, wash the inside of the electrode cap with pure (de-ionized) water, and then, after shaking out the water, fill the cap with enough pure water to soak the sponge.

---

**Note**

If the solution inside the protective cap for the electrode has dried up and the electrode has not been used for an extended period of time, the response speed of the electrode may be slower (and its sensitivity lower) than before.

---

#### Washing the electrodes

If the tip of the pH electrode is extremely dirty, the speed of its response may slow and it may cause errors in measurement. If the electrode is so dirty that it cannot be cleaned by rinsing with pure (de-ionized) water, wash the electrode using the most appropriate method below.

##### General dirt & oily grime

Wipe the dirt/grime off using cotton gauze that contains a neutral detergent.



##### Inorganic grime

Rinse using a hydrochloric acid solution or cleaning liquid (#220) of approximately 1 mol/L. Be sure not to soak the electrode in strong acid for a long period of time.



## 4.2 Troubleshooting

---

The meter is equipped with a simply error-message function to notify the operator that an operation error or problem with the equipment has occurred. Errors or other problems that occur while in the Measurement mode are announced by an error No. appearing in the lower left-hand corner of the display.

### 4.2.1 Error message chart

ERR No.	Message	Explanation
01	Memory error	Data cannot be read from or written to the internal memory.
02	Battery voltage low	The battery voltage is low.
03	Electrode stability error	The electric potential did not stabilize within three minutes.
04	Asymmetric potential error	pH: The asymmetric potential of the electrode is 45 mV or more.
05	Electrode sensitivity error	pH: The electrode sensitivity is either 105% or more or 85% or less than the theoretical sensitivity. DO: The electrode sensitivity is out of the standard.
06	Max. calibration points exceeded	pH: No more than three points can be calibrated.
07	Cannot identify standard solution	pH: The pH meter cannot identify the standard buffer.
10	Data memory over	The number of data items has exceeded the limit of the memory.

**ERR No. 01 Memory error****Explanation**

Data cannot be read from or written to the internal memory.

Cause	How to solve problem
The pH meter does not start operating correctly even after the power is turned ON.	Take the battery from the pH meter, and disconnect the AC adapter. Then press the ON/OFF key for about 10 seconds.
The internal IC is defective.	Seek repairs at your nearest retail outlet or HORIBA service station.

**ERR No. 02 Battery voltage low****Explanation**

The battery has insufficient voltage.

Cause	How to solve problem
The battery voltage is low. (Battery voltage: 2.2V or less)	Replace the dry-cell battery.

**Note**

The measured value cannot be guaranteed when ERR No. 02 is displayed.

## ERR No.03 Electrode stability error

### Explanation

The electric potential did not stabilize within three minutes.

Cause	How to solve problem
This is caused by the sample solution (when the sample solution is pure water or another solution with low conductivity or the pH concentration or temperature change).	Press the MEAS key again while "HOLD" is either blinking or steadily lit in the display, to measure the sample using instantaneous value measurement.
The electrode is dirty.	Wash the electrode.
The electrode is cracked.	Replace the electrode.
The responsive glass membrane of the electrode has been dry for a long time.	Soak the membrane (on the electrode) in pure (de-ionized) water for 24 hours.
The temperature of the sample solution is fluctuating.	Measure after the sample solution temperature stabilizes.

**ERR No.04 Asymmetric potential error****Explanation**

The asymmetric potential of the electrode is 45 mV or more.

Cause	How to solve problem
The electrode is dirty.	Wash the electrode.
The electrode is cracked.	Replace the electrode.
The reference solution concentration is fluctuating.	Replace the internal solution in the reference electrode.
The electrode is not connected correctly.	Connect the electrode correctly.
The electrode is not submerged deeply enough to cover the liquid junction (tip).	Immerse the electrode in the sample at least three centimeters deep.
There is problem with the standard solution.	Prepare new standard solution.

## ERR No.05 Electrode sensitivity error (pH)

### Explanation

The electrode sensitivity is either 105% or more or 85% or less than the theoretical sensitivity.

Cause	How to solve problem
The electrode is dirty.	Wash the electrode.
The electrode is cracked.	Replace the electrode.
Calibration was not performed correctly.	Redo the calibration correctly.
There is a problem with the standard solution.	Use fresh standard solution.
The electrode is not connected correctly.	Connect the electrode correctly.
Electrode is not submerged deeply enough to cover reference junction.	Immerse the electrode in the sample at least three centimeters deep.

## ERR No.06 Max. calibration points exceeded

### Explanation

Calibration was performed on a fourth calibration point.

Cause	How to solve problem
Calibration was performed on a fourth calibration point.	Limit the number of calibration points to three. This error message is cleared by setting the pH meter to Measurement mode.

---

#### Note

This error does not affect calibration data obtained from previous three calibration points.

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#### Ref.

Refer to “ Standard solution calibration” page 21.

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## ERR No.07 Cannot identify standard solution

### Explanation

If the automatic standard-solution identification function of the meter does not work, recalibrate the meter after performing the appropriate measures below.

Cause	How to solve problem
There is a problem with the standard solution.	Prepare new standard solution.
There is a problem with the standard solution setting.	Check the NIST or US standards settings and the kind of standard solution used for calibration, and make sure they match.
The responsive membrane is dry or dirty.	Measure after washing the responsive membrane and soaking it in pure (de-ionized) water for 24 hours.
The reference solution is contaminated.	Replace the reference solution with new solution.
The responsive membrane is damaged or worn out.	Replace the electrode.

## ERR No.10 Data memory over

### Explanation

The number of data items has exceeded the limit of the memory.

Cause	How to solve problem
Memory over	Delete data stored in the memory after confirming their contents.

### 4.2.2 More troubleshooting

This section explains how to respond to various symptoms of trouble that are not indicated by an error number.

#### **Nothing shows up on the display when the power is turned ON**

Cause	How to solve problem
No batteries	Place batteries in the meter.
The batteries are loaded with the poles reversed.	Re-insert the batteries with the poles correctly oriented.
The battery voltage is low.	Remove the old batteries and correctly insert new dry-cell batteries. Or connect the unit to the optional AC adapter.

## The indicated value fluctuates

### When there is a problem with the electrode...

Cause	How to solve problem
The responsive membrane is dry or dirty.	Wash the responsive membrane.
The responsive membrane is damaged or worn out.	Replace the electrode.
There are air bubbles on the electrode.	Shake the electrode to remove the air bubbles.
There is no reference solution remaining.	Fill the electrode with new reference solution, as noted in the electrode operation manual.
The wrong reference solution is being used.	Use the correct reference solution.

### When there is a problem with the main unit of the pH meter...

Cause	How to solve problem
There is a motor or other device causing electrical interference.	Move the meter to a place where it is not subject to dielectric effects. Be sure to ground devices that are using commercial electricity.
The electrode is not connected correctly.	Connect the electrode correctly.

**When there is a problem with the sample solution...**

Cause	How to solve problem
The liquid junction is not immersed in the sample solution.	Immerse the electrode in the sample solution up until the liquid junction or deeper.
Some effects of the sample	Determine if this is the cause by measuring with a stable standard solution.

### The response is slow

Cause	How to solve problem
Some effects of the sample	Response time may slow down, depending on the properties of the sample solution.
The electrode is dry or dirty.	Wash the responsive membrane.
The electrode is cracked or worn out.	Replace the electrode.
There is a problem with the reference solution.	Fill the electrode with new reference solution, as noted in the electrode instruction manual.

### The indicated value does not change, or there is absolutely no response

Cause	How to solve problem
The system is locked.	Turn the power OFF, and then turn it back ON again.
The electrode connector is not attached correctly.	Attach the electrode connector correctly.
pH meter is defective.	Contact your local HORIBA distributor.

### The measured value is blinking

The pH value exceeds the measurement range (when pH value is displayed).

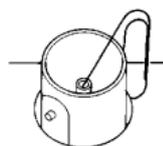
Measurement range: pH 0.00 – pH 14.00

Cause	How to solve problem
The sample solution is inappropriate.	Change to a sample solution with properties within the measurement range.
The liquid junction is not immersed in the sample solution.	Immerse the electrode in the sample solution all the way until the liquid junction or deeper.
The electrode cable has been severed.	Replace the electrode.
The main body of the pH meter is defective.	Check the point described below.
The meter has not been calibrated or it has been calibrated incorrectly.	Calibrate the meter correctly.

#### Check this point

As shown in the diagram, use a jumper wire or bent paper clip to short the meter by touching both the center pin and some metal part in the electrode connector.

If the flashing measured value disappears when this done, the meter is normal.



**The temperature display is blinking.**

**The temperature display does not change from 25°C.**

The temperature measurement exceeds the measurement range.

Measurement range: -10 – 100.0°C

Cause	How to solve problem
The temperature of the sample solution exceeds the measurement range.	Check the temperature of the sample solution and change to a sample solution that has a temperature within the measurement range.
The thermistor connection within the electrode is severed or shorted.	Measure the resistance of the temperature sensor connector. If it is 50 kΩ or more at room temperature, replace the electrode.
The electrode connector is not attached properly.	Attach the electrode connector properly, so that the O-ring on the temperature connector disappears from sight.
The main unit of the meter may be defective.	In Temperature Display Calibration mode (See “ Temperature zero adjustment [item No. 02]” page 46), check whether or not the “Minus” display appears, regardless of whether or not there is a temperature connector.
There is a problem with the setting for the temperature display calibration mode (see page 46).	Initialize the settings (see page 49).

### Measurements are not repeatable

Cause	How to solve problem
Some effects of the sample solution	The pH or other properties of the sample solution may have changed over time, making repeatability poor.
The responsive membrane is dry or dirty.	Wash the responsive membrane.
There is not enough reference solution or it is dirty.	Replace the reference solution with new solution.
The responsive membrane is cracked or worn out.	Replace the electrode.

# 5 Reference

This chapter provides a simple compilation of information for those who would like to know about the functions of the main unit of the meter and other measurement principles in greater detail.

It also serves as a reference for spare and optional parts.

## 5.1 pH measurement

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### pH measurement and temperature

The temperature of the solution being inspected is an important parameter in the accurate measurement of pH. There are many possible sources of errors during measurement, such as the state of the solution junction potential, asymmetric potential, and reference solution pH concentration, but all of these items contain factors that change with temperature. The best way to minimize these potential causes of errors is to keep the temperature of the pH standard solution uniform at the time of calibration.

### Liquid junction potential

“Liquid junction potential” is the electric potential that occurs to a greater or lesser degree at the liquid junction. The size of the electric potential differs depending on the type of solution, the temperature of the solution, and the structure of the liquid junction.

When solutions of different compositions come in contact, ION diffusion occurs on the contact surface between the two solutions. The ions are of various sizes, so a difference occurs in the diffusion transfer speed.

As diffusion proceeds, a difference in charges occurs on the contact surface of the two solutions, giving rise to a difference in potential. This potential works to reduce the transfer speed of fast ions and increase the speed of slow ions, ultimately achieving a state of equilibrium when the transfer speed of the positive and negative ions on the contact surface of the two solutions is equal. In this state of equilibrium, the potential at the contact surface between the two solutions is called the “liquid junction potential.” A large liquid junction potential means measurements will be very inaccurate.

## **Asymmetric potential**

The glass electrode is immersed in a pH 7 reference solution. When the electrode is immersed in the pH 7 solution, both the internal and external sides of the electrode membrane are supposed to take on a pH of 7, making the potential 0. In actuality, however, a potential does occur. This potential is called “asymmetric potential.” The size of the asymmetric potential differs depending on any stress that may have occurred during the processing of the glass and the shape and compositions of the glass. Asymmetric potential also changes depending on the degree of contamination of the reference solution and the state of the glass membrane. Also, if the electrode membrane dries out, a large asymmetric potential will occur, giving rise to measurement errors.

## Temperature compensation

The electromotive force generated by the glass electrode changes depending on the temperature of the solution. “Temperature compensation” is used to compensate for the change in electromotive forces caused by temperature. There is absolutely no relation between the change in pH caused by the temperature of the solution and temperature compensation. This is often misunderstood. When pH is to be measured, the temperature of the solution when the pH is measured must be recorded along with that pH value, even if a meter that has automatic temperature compensation is used. If the solution temperature is not recorded, the results of the pH measurement are relatively meaningless.

## Types of pH standard solutions

When measuring pH, the pH meter must be calibrated using a standard solution. There are several kinds of standard solutions. For normal measurement, three standard solutions—with a pH of 4, 7, and 9—are sufficient to accurately calibrate the meter.

- pH 1.68 standard solution: Oxalate  
0.05 mol/L tetra-potassium oxalate aqueous solution
- pH 4.00 standard solution: Phthalate  
0.05 mol/L potassium hydrogen phthalate aqueous solution
- pH 6.86 standard solution: Neutral phosphate  
0.025 mol/L potassium dihydrogen phosphate, 0.025 mol/L sodium dihydrogenphosphate aqueous solution
- pH 9.18 standard solution: Borate  
0.01 mol/L tetra-sodium boric acid (boric sand) aqueous solution
- pH 12.45 standard solution: Saturated calcium hydroxide solution

**pH values of pH standard solutions at various temperatures (NIST (former NBS) settings)**

Temp. (°C)	pH 1.68 standard solution Oxalate	pH 4.00 standard solution Phthalate	pH 6.86 standard solution Neutral phosphate	pH 9.18 standard solution Borate	pH 12.45 standard solution Saturated calcium hydroxide solution
0	1.666	4.003	6.984	9.464	13.423
5	1.668	3.999	6.951	9.395	13.207
10	1.670	3.998	6.923	9.332	13.003
15	1.672	3.999	6.900	9.276	12.810
20	1.675	4.002	6.881	9.225	12.627
25	1.679	4.008	6.865	9.180	12.454
30	1.683	4.015	6.853	9.139	12.289
35	1.688	4.024	6.844	9.102	12.133
38	1.691	4.030	6.840	9.081	12.043
40	1.694	4.035	6.838	9.068	11.984
45	1.700	4.047	6.834	9.038	11.841

**Note**

When the standard solutions use US settings, the pH 7 values shown in the following table are different and pH 9 becomes pH 10 (see next page).

**pH values of pH 7 and pH 10 standard solutions  
at various temperatures (US-standard settings)**

Temp. (°C)	pH 7 standard solution  Neutral phosphate	pH 10 standard solution  Carbonate
0	7.119	10.318
5	7.086	10.245
10	7.058	10.178
15	7.035	10.117
20	7.015	10.061
25	7.000	10.011
30	6.988	9.965
35	6.979	9.925
40	6.973	9.888
45	6.969	9.856

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**Note**

Calibration is performed using Nernst's equation with the above values.

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## Using standard solutions

Standard solutions are used to calibrate the scale of the pH meter employed to measure the unknown pH of a solution. Standard solutions of pH 4, 7, and 9 are used in combination according to the particular conditions of the solution that is to be inspected.

### **When the approximate pH value is desired (1-point calibration)**

Use the pH 7 standard solution or a standard solution that approximates the pH value of the solution that is to be inspected.

### **When it is known beforehand whether the test solution is acidic or alkaline (2-point calibration)**

Acidic: Use the pH 4 and 7 standard solutions.

Alkaline: Use the pH 7 and 9 standard solutions.

### **When an unknown solution is to be inspected (3-point calibration)**

Use the pH 4, 7, and 9 standard solutions.

### **Other**

When finding the pH of other solutions, perform 2-point or 3-point calibration using pH 2, 4, 7, 9, or 12 standard solutions randomly, then measure the test solution.

## 5.2 Specifications

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### Measurement target

Target	Item	Description
pH	Measurement principle	Glass electrode
	Display range	pH -2.00 – 16.00
	Measurement range	pH 0.00 – 14.00
	Resolution	0.01 pH
	Repeatability	±0.01 pH ±1digit
Temp.	Measurement principle	Thermistor
	Measurement range	0.0 – 100.0 °C
	Resolution	0.1 °C
	Repeatability	±0.1 °C ±1digit

### Items in common among meter models

Data memory capacity	Max. 300 pieces of data
Power	Dry cell batteries type:AA alkaline with automatic power OFF function
Ambient temperature	0 – 45 °C
Dimensions	170(H) × 80(W) × 40(D) mm
Mass of main unit (including batteries)	300 g

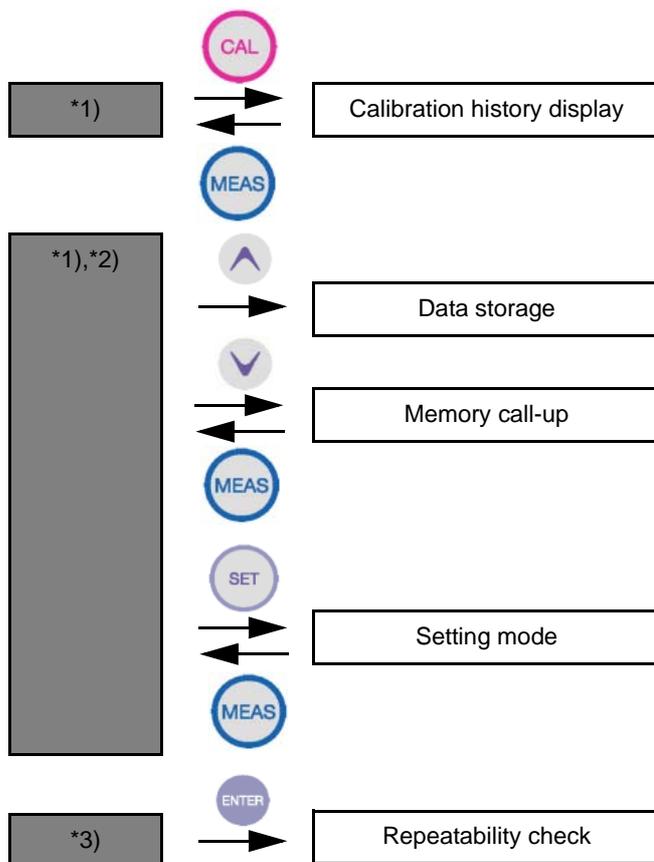
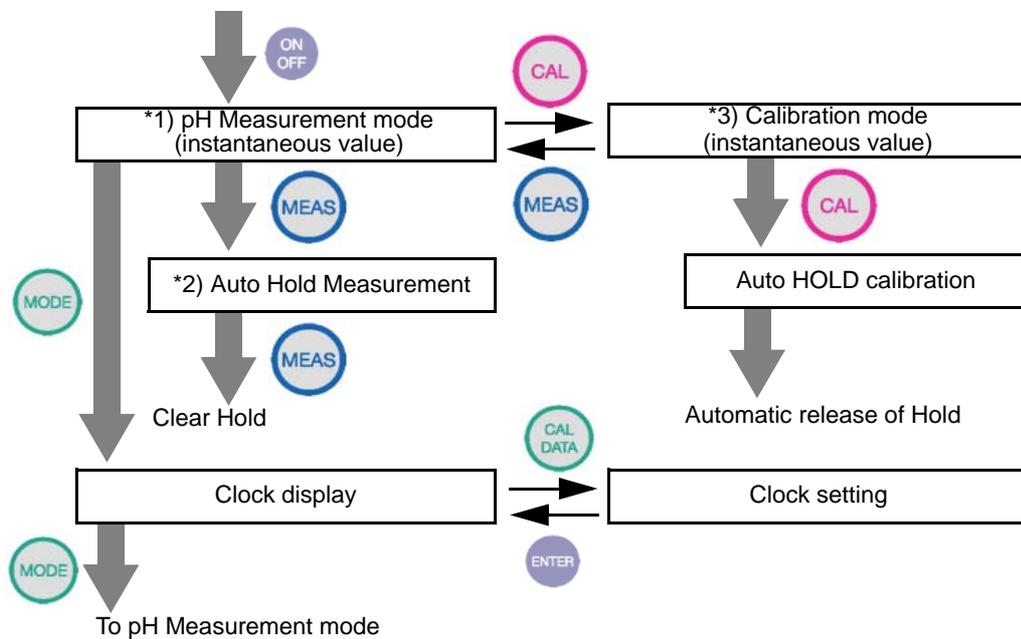
## 5.3 Default settings

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Category	Item	Default values
Common setting	Temperature compensation	Automatic temperature compensation
	Manual temperature compensation	25 °C
	Automatic power OFF	Approx. 30 min (ON)
pH	Standard calibration solution	NIST
	Calibration setting	Asymmetric potential: 0mV Sensitivity: 100%

## 5.4 Operation flowcharts

The following flowcharts summarize pH meter operations



## 5.5 Spare and optional parts

This section lists spare and optional parts for the pH meter.

These parts are available through HORIBA distributors. Place an order specifying their name, model, and part number.

### 5.5.1 Spare parts list

#### pH electrode (with built-in temperature sensor)

Part name	Model	Part number	Remarks
D-50 series standard electrode	9621-10D	9096001700	Plastic-body electrode (for immersion measurement)
F-50 series standard electrode	9611-10D	9096001800	Glass-body electrode (reinforced responsive glass)
Laboratory-use electrode for slurry samples	9677-10D	9096002000	Built-in washable reference electrode (reinforced responsive glass)
Laboratory-use electrode for micro samples	9669-10D	9096001900	Electrode incorporating temperature sensor compatible with micro sample measurement Tip: $\phi 3$ , 55 mm

#### pH electrode (without built-in temperature sensor)

Part name	Model	Part number	Remarks
Low-end electrode	6066-10C	9003013400	Glass-body electrode
Electrode for NMR tubes	6069-10C	9003013500	Tip: $\phi 3$ , 180 mm

## 5 Reference

### 5.5 Spare and optional parts

#### pH standard solution

Part name	Model	Part number	Remarks
pH2 standard solution	100-2	9003001500	500 mL Accuracy: $\pm 0.02$ pH
pH4 standard solution	100-4	9003001600	
pH7 standard solution	100-7	9003001700	
pH9 standard solution	100-9	9003001800	

Part name	Model	Part number	Remarks
pH2 standard solution powder	150-2	9003002600	Makes 500mL (10 packets) Accuracy: $\pm 0.05$ pH
pH4 standard solution powder	150-4	9003002700	
pH7 standard solution powder	150-7	9003002800	
pH9 standard solution powder	150-9	9003002900	

#### Internal reference solution

Part name	Model	Part number	Remarks
Internal reference solution	#300	9003003200	250 mL

#### Cleaning liquid

Part name	Model	Part number	Remarks
Cleaning liquid for electrodes	#220	9096002500	For pH, ORP, and ION electrodes

### 5.5.2 Options

Part name		Part number	Remarks	
AC adapter for the pH meter	AC adapter	9096003100	Be sure to purchase the cable when purchasing the AC adapter.	
	Cable	For Japan		9096003200
		For US		9096003300
		For Europe		9096003400
Soft case		9096005100		
Strap		9096005200	For the meter	
Stand for electrode		9096002700		
Stand arm		9096002800		

For any question regarding this product,  
please contact your local agency, or  
inquire from the Customer Registration  
website ([www.horiba.co.jp/register](http://www.horiba.co.jp/register))

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