Industrial pH meter
HP-480PL

Instruction Manual

CODE:GZ0000060563D

Preface

This manual describes the operation of the Industrial pH meter, HP-480PL.
Be sure to read this manual before using the product to ensure proper and safe operation of the instrument. Also safely store the manual so it is readily available whenever necessary.

Product specifications and appearance, as well as the contents of this manual are subject to change without notice.

Warranty and Responsibility

HORIBA Advanced Techno, Co., Ltd. warrants that the Product shall be free from defects in material and workmanship and agrees to repair or replace free of charge, at option of HORIBA Advanced Techno, Co., Ltd., any malfunctioned or damaged Product attributable to responsibility of HORIBA Advanced Techno, Co., Ltd. for a period of one (1) year from the delivery unless otherwise agreed with a written agreement. In any one of the following cases, none of the warranties set forth herein shall be extended;

- Any malfunction or damage attributable to improper operation
- Any malfunction attributable to repair or modification by any person not authorized by HORIBA Advanced Techno, Co., Ltd.
- Any malfunction or damage attributable to the use in an environment not specified in this manual
- Any malfunction or damage attributable to violation of the instructions in this manual or operations in the manner not specified in this manual
- Any malfunction or damage attributable to any cause or causes beyond the reasonable control of HORIBA Advanced Techno, Co., Ltd. such as natural disasters
- Any deterioration in appearance attributable to corrosion, rust, and so on
- Replacement of consumables

HORIBA ADVANCED TECHNO, CO., LTD. SHALL NOT BE LIABLE FOR ANY DAMAGES RESULTING FROM ANY MALFUNCTIONS OF THE PRODUCT, ANY ERASURE OF DATA, OR ANY OTHER USES OF THE PRODUCT.

Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

Regulations

FCC Rules

Any changes or modifications not expressly approved by the party responsible for compliance shall void the user's authority to operate the equipment.

■ 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.

For Your Safety

Hazard Classification and Warning Symbols

Warning messages are described in the following manner. Read the messages and follow the instructions carefully.

● **Hazard classification**

⚠ DANGER

This indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

⚠ WARNING

This indicates a potentially hazardous situation which, if not avoided, could 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 against unsafe practices.
Without safety alert indication of hazardous situation which, if not avoided, could result in property damage.

● **Warning symbols**

Description of what should be done, or what should be followed

Description of what should never be done, or what is prohibited

Safety Precautions

This section provides precautions to enable you to use the product safely and correctly and to prevent injury and damage. The terms of DANGER, WARNING, and CAUTION indicate the degree of imminency and hazardous situation. Read the precautions carefully as it contains important safety messages.

⚠ WARNING
To connect a load beyond the contact capacity or use inductive load (such as a motor, or pump), be sure to use a power relay whose rating is higher than the load.
Install lightning arresters both at the instrument and receiver device.
Electric Shock Make sure that no electric power is supplied to the instrument before starting this work.
Strong Acid If dilute hydrochloric acid gets into your eyes, your mucous membranes will be damaged, possibly to the point of blindness. When handling hydrochloric acid, be sure to wear protective glasses, protective gloves, and a protective mask. If it gets into your eyes, immediately wash your face with a large amount of water for more than 15 minutes, and see a doctor as soon as possible (When washing your eyes, open your eyelids with your fingers and wash the eyeballs and eyelids completely). Hydrochloric acid on the human body and clothes may cause burns. Take off clothes wet with the chemical and immediately wash with large amounts of water immediately.

⚠ CAUTION
When the instrument is turned OFF, the C-NC contact is shorted. Be careful when connecting a load.
Operating the instrument using a voltage out of the rated range may cause it to malfunction. Be sure to check the voltage of the power supply. Also make sure that the fluctuation of the power supply voltage is within the range of ±10% of the rated voltage.
The electrode is made of glass and broken when exposed to impact or strong force. In handling the electrode, exercise sufficient care.

Product Handling Information

Operational Precautions

Use of the equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment. And it may also reduce equipment performance.
- Do not operate the keys or push the panel surface with a sharp object, such as the fingernail.
- Do not use an organic solvent or something similar.
- Do not submerge the electrode in dilute hydrochloric acid for many seconds.

Disposal of the Product

When disposing of the product, follow the related laws and/or regulations of your country for disposal of the product.

Manual Information

Description in This Manual

___ **Note** ___

This interprets the necessary points for correct operation and notifies the important points for handling the unit.

___ Reference ___

This indicates the part of where to refer the information.

___ Tip ___

This indicates reference information.

Glossary

For explaining the operation of the converter, the following terms are being used.

Term	Explanation
Long press	To hold down the object until the lamp lights or the display changes.
Single press	To lightly press the object once.
Flash	To flicker quickly several times, and the setting is established.

Contents

Overview

● **Outline**

- IP65 (dust and water proof) panel.
- Selectable sub-display items, including current temperature.
- Concentrated control keys on the front panel for all settings.
- Compatible with 5 types of standard solution (any 2 of JIS pH 7, pH 2, pH 4, pH 9 and pH 10).
- A rich set of maintenance features.
  Automatic validation of the electrode characteristics are acceptable at the time of calibration.
- Free transmission output range.
- Free voltage power supply (100 V to 240 V AC, 50 Hz/60 Hz).
- Memory backup.

● **Features**

- Easy-to-read display (large characters).
- Improvement in operability of the keys using the embossed sheet.
- Relaxed resistance limit of the loads to the transmission output (max. 900 Ω)
  (250 Ω receiver $\times$ 3 + wiring resistance).

● **Special features**

- Improved and expanded status display with icons.
- Downsized converter and the volume is reduced by 20% compared to its predecessor. Increased types of attachable temperature-compensation electrodes.
- All of the 6 types of electrodes, with temperature compensation (350 Ω, 500 Ω, 1 kΩ, 6.8 kΩ, 10 kΩ) and without temperature compensation, can be selected.

Components

● **Front panel**

Measurement display
Displays a measured value.

Status indicator lamp
Indicates the status of output.

Sub-display
Displays a set value or error code.

Unit display

Mode indicator lamp

Operation keys
There are 6 operation keys.

pH METER   HP-480PL
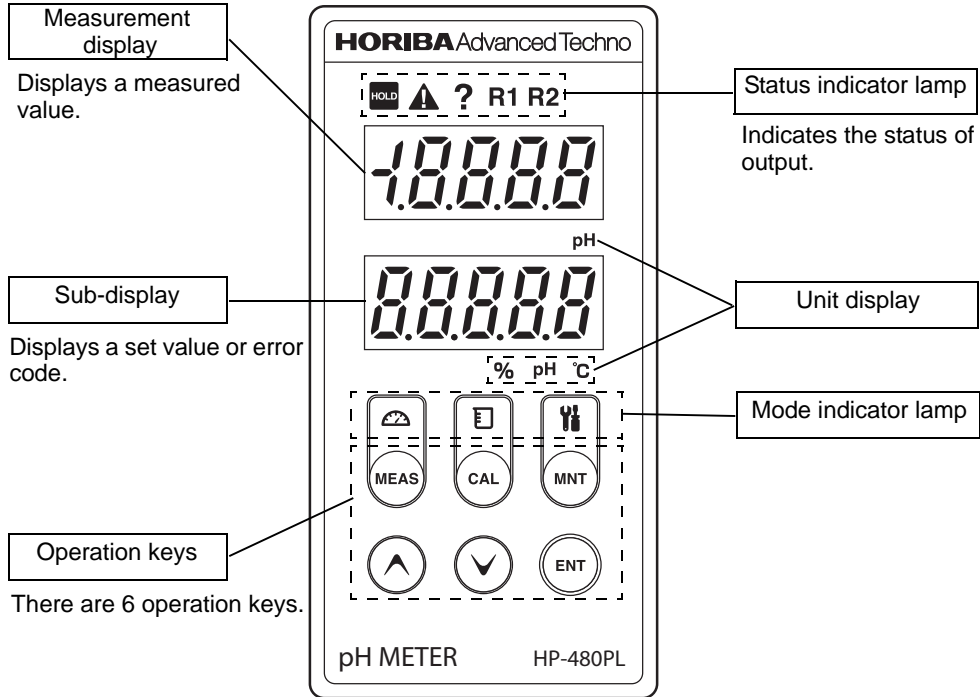
> **Note**
>
> **Do not operate the keys or push the panel surface with a sharp object, such as the fingernail.**

● **Terminal block**

Contact output R1
(See page 10.)

Contact output R2
(See page 10.)

Transmission output
(See page 14.)

Electrode
(See page 11.)

Power supply
(See page 15.)

2

■ Operation keys

Operation keys are used to switch displays, enter settings, and perform calibration, etc.
You can change the value or item while the display is blinking.
Select a value or item using the UP/DOWN keys and press the ENT key. And the display will flash, and the setting will be finished.
To disable the key operations use the security menu.

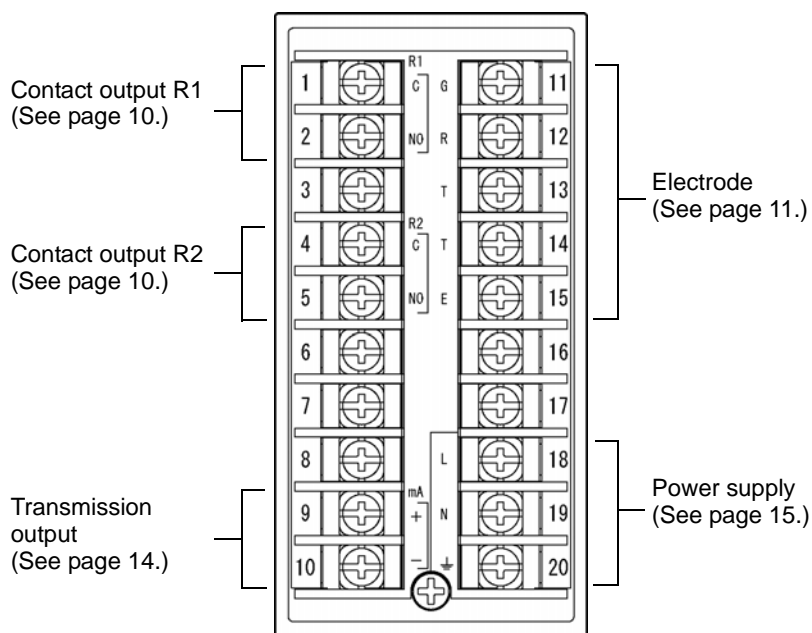| Key	Notations in the text (Meaning)	Description/Operation	
(MEAS)	MEAS key (Measurement)	Use this key to return to the measurement mode from another mode. In the setup menus of the measurement and maintenance modes, pressing once will cancel the last change and make the display return to the previous item. To return to the measurement mode, press this key repeatedly until the MEAS lamp lights up.	
(CAL)	CAL key (Calibration)	Long press	Hold down this key until the CAL lamp lights up, and the calibration mode will be enabled.
(MNT)	MNT key (Maintenance)	Single press	The control value setup menu will be enabled, and "Set" will be displayed.
		Long press	Hold down this key until the MNT lamp lights up and the MEAS lamp turns off, and the maintenance mode will be enabled.
(∧)(∨)	UP key DOWN key (Selection)	Use these keys to change the displayed value or item. For a numerical value, pressing once will increment/decrement the value by one count, and holding down the key will increase/decrease the value continuously. The UP key and the DOWN key scroll the display in the opposite directions. When you have pressed one of the buttons excessively, press the other key, to go back.	
(ENT)	ENT key (Enter)	Use this key to finish set values and calibration values. **Note** **If you use the MEAS key instead of the ENT key to return to the previous menu, the last changes are cancelled.**	

■ Indicator lamps

● Mode display

	Measurement lamp Lights up during the measurement mode. This lamp is turned OFF during the calibration and maintenance modes, during which measurement is stopped.
	Calibration lamp Lights up during the calibration mode. To enter the calibration mode, hold down the CAL key until this lamp lights up. Calibration can be performed while this lamp lights up is being lit. Measurement is stopped in this state.
	Maintenance lamp Lights up during the maintenance mode. To enter the maintenance mode, hold down the MNT key until this lamp lights up. Setups can be made while this lamp lights up. Measurement is stopped in this state.

● Status display

HOLD	Lights up when the transmission output is held constant.
⚠	Lights up when an alarm (FAIL) has been issued.
?	Lights up when an error has occurred.
R1 **R2**	Lights up when the relevant contact output is ON (C-NO is conducted).

Operation modes and menus

This instrument has 3 operation modes and 5 menus in its major category.

● Operation modes

● Measurement mode

Measurements and instrument control are performed.

● Calibration mode

Calibration is performed.

● Maintenance mode

Measurements and outputs are stopped, and performs various setups are performed.

● Menu

The following menus are provided under the measurement and maintenance mode.
For how to enter each of the modes and menus, see the respective description pages.

● Basic setup menu

This menu allows you to set up all the parameters related to measurement, such as terminal allocation of detector information.

● Calibration menu

This menu allows you to perform calibration.

● User check menu

This menu allows you to check the output state or measured values, and to reset the set values to the factory settings.

● Control value setup menu

This menu allows you to set or change control values while checking the output during measurement.

● Security menu

This menu prevents you from wrong or illegal operation.

● **Modes and menus from the measurement mode**

Measurement mode

Press the MNT
key for a while.

Maintenance mode

DOWN key → Basic setup menu — See page 20.

DOWN key → Calibration menu — See page 40.
(pH and temperature calibration)

DOWN key → User check menu — See page 49.

Press the CAL key for a while. → Calibration mode — See page 52.
(pH calibration)

Press the MNT key once. → Control value setup menu — See page 44.

Security menu

Press the MEAS key for a while. → Key lock setting — See page 46.

Press the UP/DOWN key for a while. → Password lock setting — See page 47.

Installation

Installation environment

To keep the instrument stable and reliable for use, install it in a place where the following conditions are satisfied.

● **Instrument body**

- Well-ventilated
- Ambient temperature is in the range of −5°C to 45°C.
- Where the air is not hot.
- Not exposed to direct sunlight.
- Not exposed to direct radiant heat.
- Ambient relative humidity is in the range of 20% to 85%.
- The instrument is not splashed with water or chemicals.
- Mechanical vibration is rare.
- There is enough space for maintenance and wiring.
- Dust and corrosive gases are not present.
- The influence of electromagnetic fields is rare.
- The altitude is less than 2000 m.
- The range of power supply voltage fluctuation is within 10% of the rated voltage.
- Overvoltage Category II is satisfied.
  (This regulation is applied to the electrical machinery that is powered by stationary equipment such as a switchboard.)

● **Electrode**

- Electrodes can be checked and maintained.
- No bubbles appear in the measuring solution.
- Measuring solution does not corrode the wetted part of the electrode.

Reference

For the details, refer to the instruction manual provided with the electrode.

Installation procedure

Mount the instrument on a control panel.
The panel thickness should be 1.0 mm to 9.0 mm.

Cut a square with dimensions shown in the figure below from the control panel.

$45^{+0.6}_{0}$

$92^{+0.8}_{0}$

[Unit: mm]
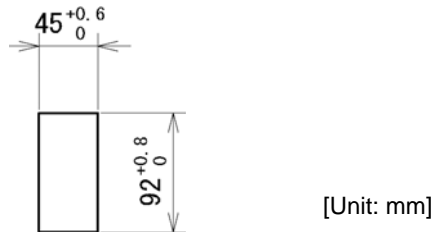
When installing the instruments in a row, leave an interval of 70 mm or more horizontally and 130 mm or more vertically between the square openings.

130 (minimum)

70 (minimum)

[Unit: mm]
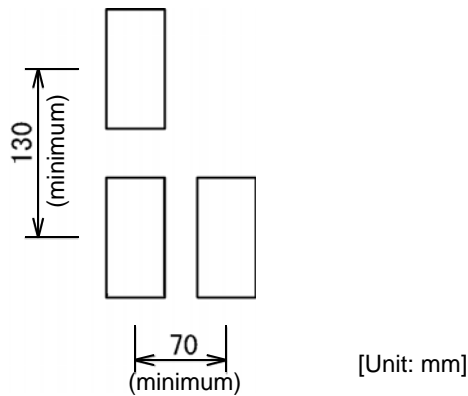
● **Mounting**

Insert the instrument into the square opening and secure it with fixtures.

1. **Insert the instrument body from into the opening the front of the control panel.**

2. **Attach one of the two fixtures on the instrument, fitting its notches into the grooves located on the top and bottom of the body case.**

3. **Attach the other fixture, in the same way.**

4. **Slide the both fixtures to the front panel to secure the instrument body.**

Gasket — Grooves
Front panel
Fixtures (after the installation) —
Fixture
Notches
Grooves
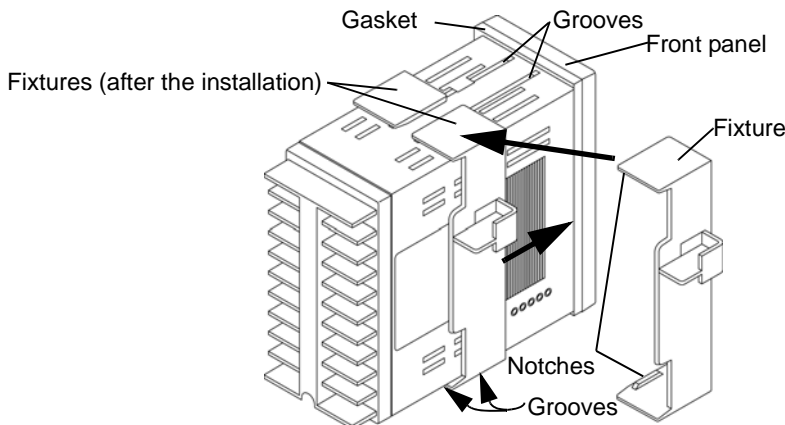
| Note |

The gasket is a consumable. Replace it with a new one when its holding power has become weak.

8

● **Dismounting**

Remove the cables from the terminal block.
Remove the fixtures one by one, then the instrument body from the panel.

1. **Insert a slotted screwdriver or the like into the gap between a fixture and the instrument body to detach a notch from the groove.**

2. **Remove the fixture.**

3. **Remove the other fixture, in the same way.**

4. **Pull out the instrument body from the control panel.**

Fixtures

Insert a slotted screwdriver or the like here.
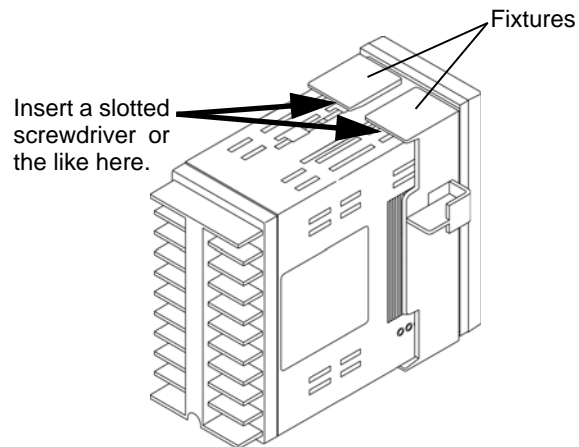
Connection

■ Connecting the contact outputs

- The contact capacity is 240 V AC 0.3 A or less, or 30 V DC 0.3 A or less.
- If load noise is observed, use a varistor or noise killer.

⚠ **WARNING**
❗ To connect a load beyond the contact capacity or use inductive load (such as a motor, or pump), be sure to use a power relay whose ratio is higher than the load.

⚠ **CAUTION**
❗ When the instrument is turned OFF, the C-NC contact is shorted. Be careful when connecting a load.

Make output connections as shown in the figure shown below.

R1 contact output: capacity
(load resistance)
240 V AC, 0.3 A or less
30 V DC, 0.3 A or less

R2 contact output: capacity
(load resistance)
240 V AC, 0.3 A or less
30 V DC, 0.3 A or less
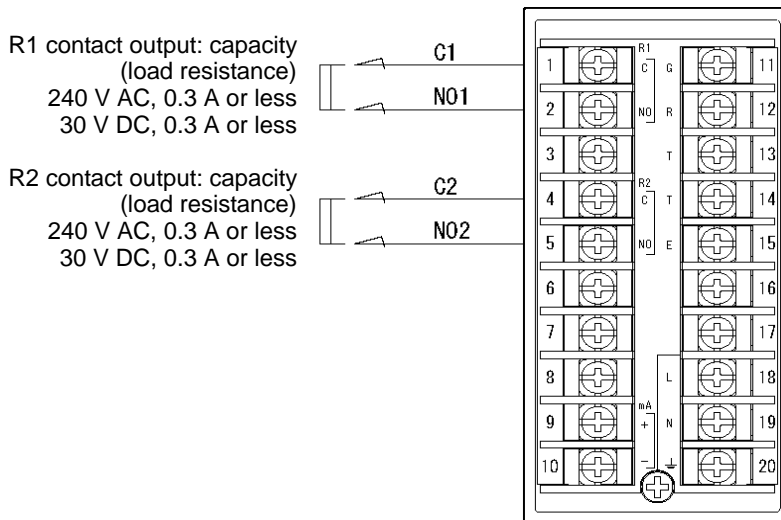
■ Connecting the electrode cable

● Precautions for handling the electrode cable

The pH electrode cable is highly insulated. Follow the instructions below when handling it.
- Do not wet the terminals of the cable or the terminal block, nor stain them with finger marks or oil. Otherwise, the insulation of the cable is weakened.
  If the insulation is weakened, the readout may become unstable. Keep the cable dry and clean all the time.
  If a terminal is stained, wipe the dirt off using alcohol or the like and dry the terminal well.
- Allow enough cable length for calibration, or inspection/replacement of the electrode.
- Wire the power cable and junction cables keeping them off any devices that may give inductive interferences such as a motor or its cables.

● Connection

The electrode cable has the following terminals.

S:	Glass electrode shielded drive terminal
G:	Glass electrode terminal
R:	Reference electrode terminal
SE:	Liquid ground electrode terminal
T, T:	Temperature compensation electrode terminal
E:	Shielded wire

Connect the cable to the terminal block as shown in the figure below. Making sure that each terminal of the cable is connected to the counterpart of the block correctly.

- For pH electrodes with S terminal and without SE terminal, such as 6108 and 6109.
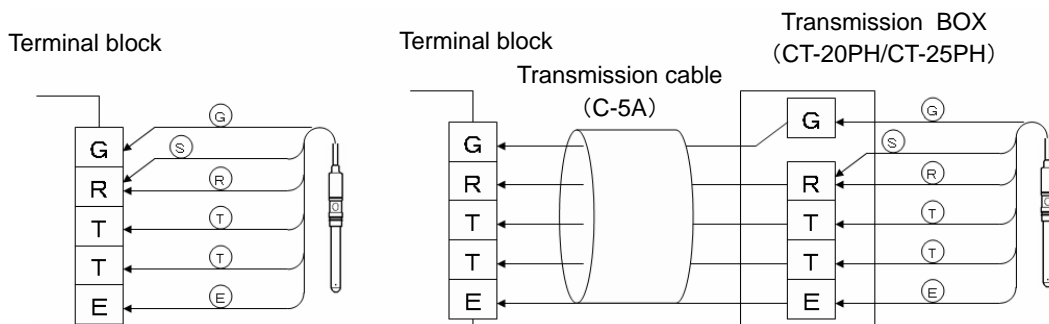
- For pH electrodes without S and SE terminals.
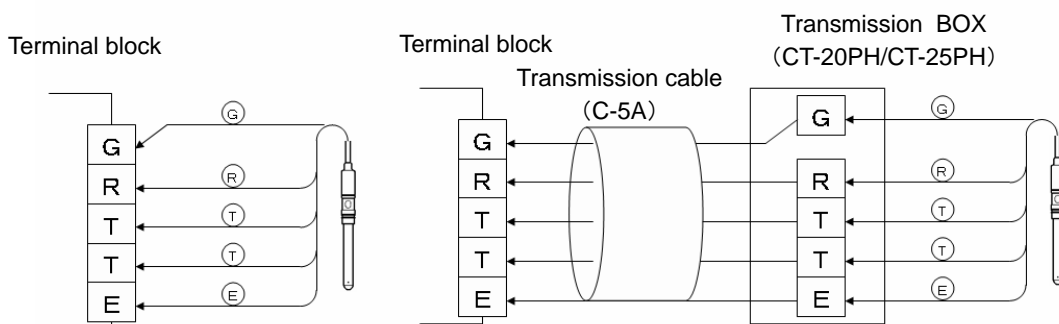
● For pH electrodes with S and SE terminals, such as 6171, 6172, 6173, and 6174.
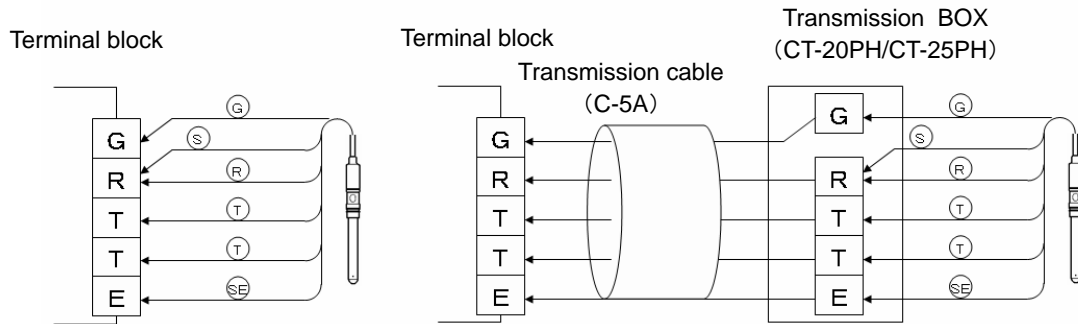
● Temperature compensation electrode

The following five types of temperature compensation electrodes, different in resistance of the resistance temperature sensors can be attached to this converter.
Resistance at 25°C: 350 Ω, 500 Ω, 6.8 kΩ and 10 kΩ
Resistance at 0°C: 1 kΩ
Confirm the type of the electrode to be used, and select an appropriate value (in the basic setup menu).

Reference

Refer to " Electrode types " (page 21).

● Extending the electrode cable

When extending the electrode cable, be sure to use.
- Special extension cable for electrode cables (C-5A) and
- Special relay box (CT-20PH/CT-25PH) manufactured by HORIBA Advanced Techno.

The maximum distance from the instrument body to the electrode is 50 m.

It is recommended to enclose the extension cable with a conduit tube to protect it from electrostatic damage, which may be caused by inductance, vibration, etc. In this case, pass wiring in the vicinity of the instrument through the flexible metal conduit.

● C-5A cable terminal crimping

Crimp the terminals in the following procedure.
1. **Remove the covering of the cable end.**

Cut in the covering using knife and remove.

Required length for connection is approx. 12 cm.
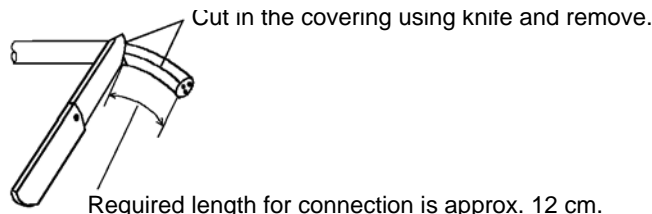
2. **Cut in the braided shield near the base, and take out the lead wires.**

Take out the lead wires.

3. **Trim the cut edge.**

Lead (black)
Braided shield
Lead (red)
Lead (white)
Lead (blue)
Waste threads
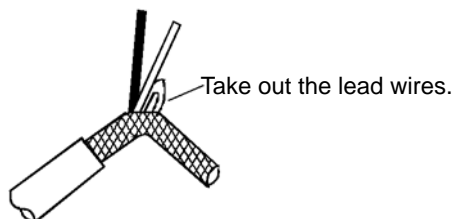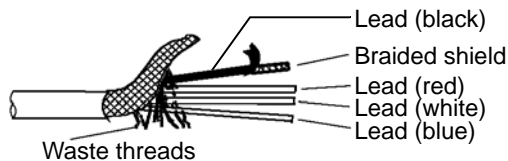
4. **Peel the covering between from the end and base of the lead wire (black) to the foot, and a braided shield will appear.**

5. **Peel the shield, and a lead wire (white stripes on black) will appear.**

Braided shield
Lead (white on black)
Lead (red)
Lead (white)
Lead (blue)
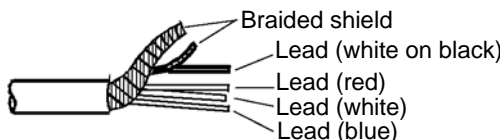
6. **Remove the covering of the lead wire (white on black), and a lead wire transparent will appear.**

Be sure to remove the covering (conducting plastic: white on black) to the base of the lead wire (transparent).

Extend it to make it thin.
Braided shield
Twist the shields together.
Lead (transparent)
Remove the black covering to t
Lead (blue)
Lead (white)
Lead (red)
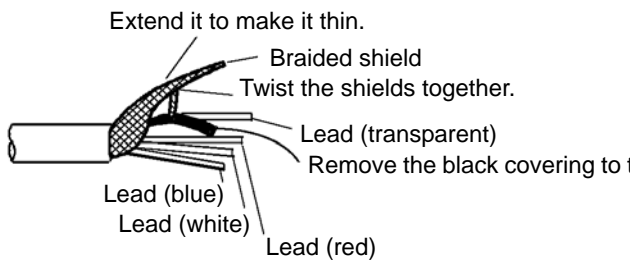
7. **Remove approximately 1 cm of covering from the end of each lead wire to strip the conductor wire.**

Be careful not to cut the conductor wire.

Braided shield
Lead (transparent)
Lead (red)
Lead (white)
Lead (blue)
Approximately 1 cm stripped conductor.
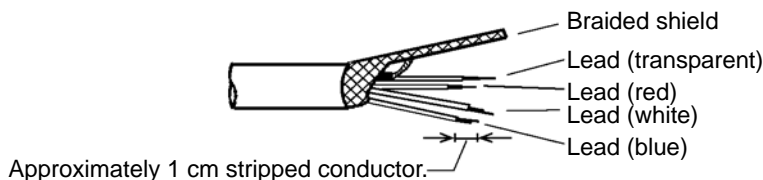
8. **Attach solderless terminal to the end of the leading wires, and crimp them securely using a crimp tool.**

Braided shield: to terminal E
Lead (transparent): to terminal G
Lead (white): to terminal R
Lead (red): to terminal T
Solderless terminal
Lead (blue): to terminal T
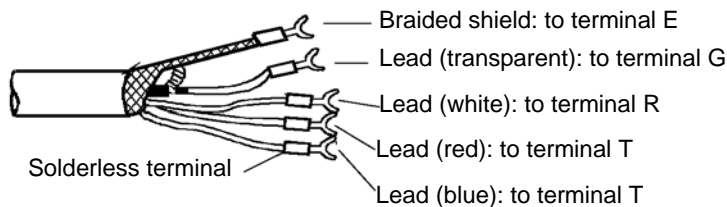
9. **Pull the solderless terminals to confirm that they are crimped firmly.**

■ **Connecting the transmission output cable**

A signal of 4 mA to 20 mA DC corresponding to the measurement range is output.
The maximum allowable input resistance of the receiver device is 900 Ω.
Select an appropriate receiver device (recorder or meter relay).

1. **Connect the cable to the terminal block referring to the figure below.**
Use a shielded wire for the transmission cable.

Transmission output
4 mA to 20 mA DC (insulation output).
The maximum load resistance: 900 Ω

(+)

(−)

Shield

Up to 900 Ω
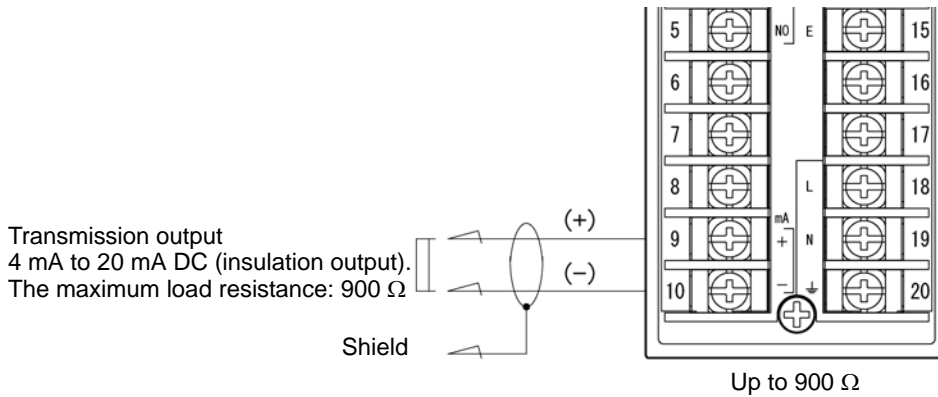
2. **Ground the shielded line via the grounding terminal of the receiver device side.**

Receiver device

(+)

OUTPUT (mA)

(−)

Receiving resistance up to 900 Ω

Shield

Grounding terminal
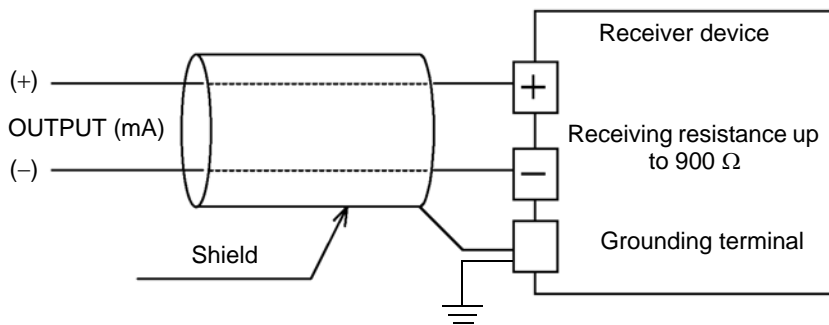
● **When two or more receiver devices are connected.**

Connect them in a series as shown in the figure below.
The allowable total resistance of the connected receiver devices is max. 900 Ω.

Receiver device 1

(+)

OUTPUT (mA)

(−)

Receiving resistance 1

Receiver device 2

Receiving resistance 2
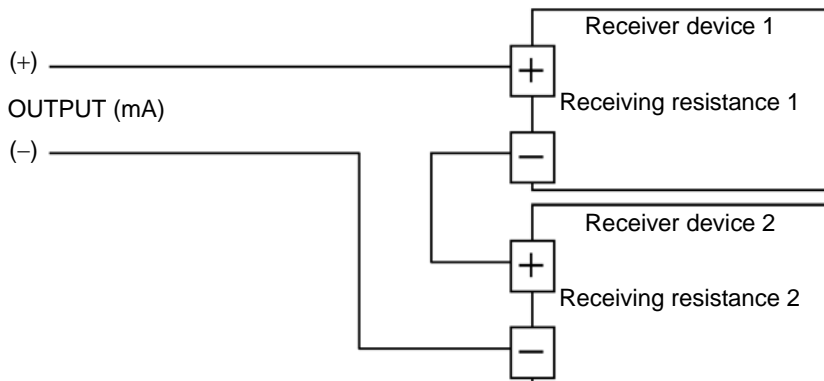
⚠	**WARNING**
❗	Install lightning arresters both at the instrument and receiver device.

14

■ Connecting the power supply

<table>
<tr><td>⚠</td><td>**WARNING**</td></tr>
</table>

Electric Shock
Make sure that no electric power is supplied to the instrument before starting this work.
Do not turn on the power until your work is completed.

About the power switch

This instrument has no power switch. Install a power switch or circuit breaker around to turn ON/OFF the instrument.

Connecting the power cable

The power supply of this instrument is a free voltage power supply (100 V to 240 V AC, 50 Hz/60 Hz).
The maximum power is 10 VA.

<table>
<tr><td>⚠</td><td>**CAUTION**</td></tr>
</table>

Operating the instrument using a voltage out of the rated range may cause it to malfunction. Be sure to check the voltage of the power supply. Also make sure that the fluctuation of the power supply voltage is within the range of 10% of the rated voltage.

Connect and ground the power cable referring to the figure below.

Supplied power
Voltage: 100 V to 240 V AC
Frequency: 50 Hz/60 Hz

The ground resistance may become 100 Ω or less
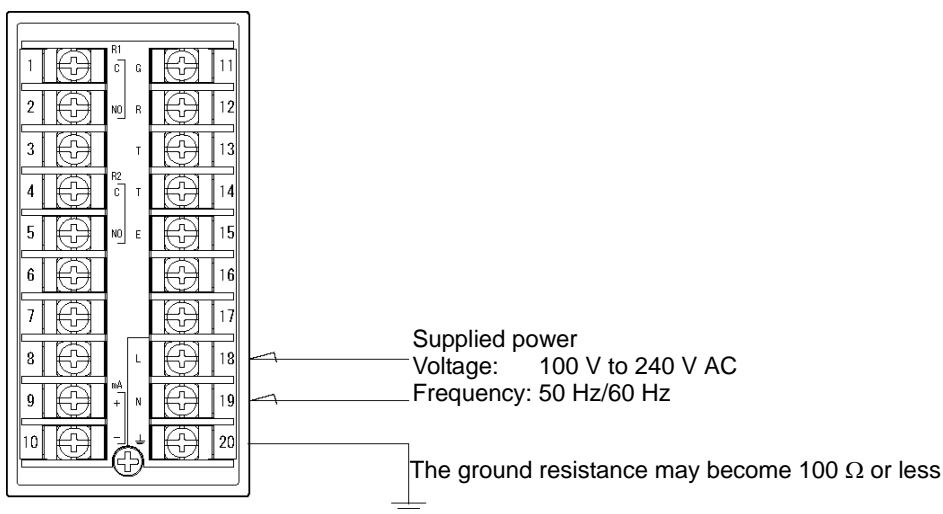
Note

Be sure to ground the converter (ground resistance of 100 Ω or less) to ensure EMC performance of immunity and emission though the insulation is class 2 (double insulation). Separate the grounding for the converter from that of electrical devices such as a motor.

□ Double insulation structure

■ Attaching the terminal covers

Be sure to attach the terminal cover after wiring to the terminal block is completed.

Preparation

When you start using the instrument for the first time after factory shipment or resetting it to factory settings, be sure to complete the following preparation procedures.

- Wiring checking
- Initial set up
- Calibration

● **Wiring checking**

Check the following.

- Are the power cable, electrode cable, and transmission cable properly wired?
- Are the terminal block screws firmly tightened?
- Is the fluctuation of the power supply voltage within ±10% of the rated voltage?

● **Initial set up**

When the instrument is powered on in the factory setting state, it starts up in the Maintenance mode.
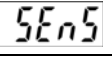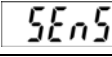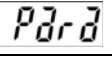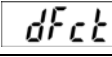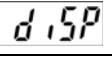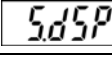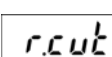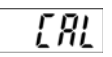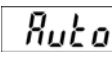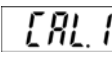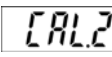
Check the current settings referring to Table 1.
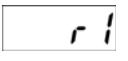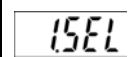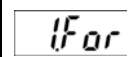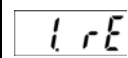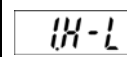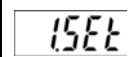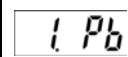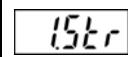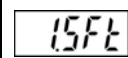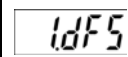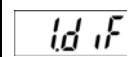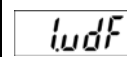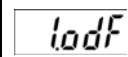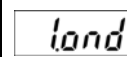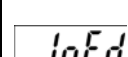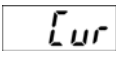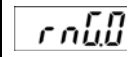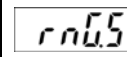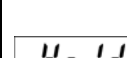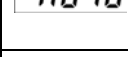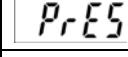
If necessary, change settings following the instructions in " Basic settings " (page 20).

To finish the initial setup, press the MEAS key repeatedly until the MEAS lamp lights up to go to the measurement mode.

Once the initial setup is finished, the instrument starts up in the measurement mode since then. This is the normal measurement mode.

Table 1   Basic setup items

Display	Description	Options	Factory setting
SEnS	Electrode (sensor) setting.		
SEnS	Select a resistance temperature sensor type.	non, 350, 500, 1 k, 6.8 k, 10 k	1 k
PArA	Measurement parameter setting.		
dFct	Select the number of data used for moving average (dumping factor).	1 to 20 (times)	1
diSP	Display setting		
S.dSP	Select the display item setting for the sub-display.	no, 1.SEt, 2.SEt, t	no
r.cut	Select the measurement range cut setting. Whether values outside the range of 0.00 pH to 14.00 pH are displayed or not.	yES, no	yES
CAL	Calibration setting		
Auto	Select the automatic calibration setting, whether the function is enabled or not.	yES, no	yES
CAL.1	Confirm the calibration solution for the first point (fixed to pH 7).	PH 7	
CAL.2	Select the calibration solution for the second point.	PH 2, PH 4, PH 9, PH 10	PH 4

Display	Description	Options	Factory setting
$r1$	Relay output 1 setting. **Note** **Settings for relay 2 are the ones that numeral part of relay 1 is replaced with 2.**		
$1SEL$	Select the target of relay 1.	non, PH, Hold, Err, FAiL	PH
$1For$	Select the control mode.	onoF, PL	onoF
$1.rE$	Select the reverse output setting of relay 1, whether the output is reversed or not.	yES, no	no
$1H-L$	Select the limit operation of relay 1, upper or lower.	H, L	R1: H R2: L
$1SEt$	Set the control value of relay 1.	0.00 to 14.00 (pH)	R1: 14.00 R2: 0.00
$1.Pb$	Set the proportional band.	0.01 to 4.00 (pH)	2.00
$1Str$	Set the maximum SPM value (the maximum number of strokes).	1 to 360 (s)	120
$1SFt$	Set the control shift amount.	0 to 50 (%)	0
$1dFS$	Set the control width type of relay 1.	d.diF, S.diF	d.diF
$1d.iF$	If the d.diF type is selected, set the control width.	0.00 to 4.00 (pH)	0.50
$1udF$	If the S.diF type is selected, set the control width below the control value.	0.00 to 2.00 (pH)	0.25
$1odF$	If the S.diF type is selected, set the control width over the control value.	0.00 to 2.00 (pH)	0.25
$1ond$	Set the alarm output duration from the start until the C-NO contact output turns ON.	0 to 600 (s)	0
$1oFd$	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF.	0 to 600 (s)	0
Cur	Transmission output setting.		
$rnG.0$	Set the pH value of the zero point (4 mA) of the transmission output range.	−1.00 to 15.00 (pH)	0.00
$rnG.S$	Set the pH value of the span point (20 mA) of the transmission output range.	−1.00 to 15.00 (pH)	14.00
$Hold$	Select the transmission output hold setting, whether the previous output value is held stable during the calibration mode (not calibration menu) or not.	yES, PrES, no	yES
$PrES$	Set the hold value to be used if preset hold is enable.	−1.00 to 15.00 (pH)	14.00
$C.cut$	Select the transmission output setting, whether values outside the range of 4 mA to 20 mA are output or not.	yES, no	yES

17

● **Calibration**

Perform the pH and temperature calibrations referring to the following pages.
- " pH calibration " (page 40)
- " Temperature calibration " (page 43)

Measurement

Measurement

Power on the pH meter with the preparation (See page 16.) is completed, and the pH meter will start up in the measurement mode.

1. **Turn the power ON.**

   The measurement target appears on the measurement display.

   The measurement range is then displayed and the instrument enters the measurement mode.

   After the measurement value is displayed, and the measurement starts.

   This is the normal measurement mode.

Basic settings

Enter the maintenance mode to set up the electrode type, measurement conditions, display settings, calibration method, contact output and transmission output.
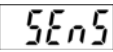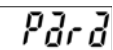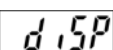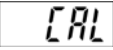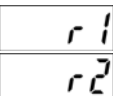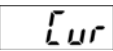
● **Precautions**

- Previous value hold is used for transmission output.
- Contact outputs are the following status.
  - OFF when the control target is set to non, PH or Err.
  - ON when the control target is set to Hold, ON.
  - FAIL when the control target is set to FAiL and a system error occurs.

● **How to open basic setup menus**

1. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
   The maintenance mode is enabled, and "SEt" is shown on the measurement display.

2. **Press the ENT key.**
   The basic setup menu is enabled, and "SEnS" is shown on the sub-display.

3. **Press the UP/DOWN key to display the item to be set up on the sub-display.**

4. **Press the ENT key.**
   The display shows the setup screen, ready for selection of setting items.
   The displays shown on the sub-display and setting items are shown in the table below.

Table 2   Displays shown on the sub-display and setting items

Display	Basic setup item	Description	Reference	Remarks
SEnS	Electrode types	Resistance temperature sensor setting.	page 21	
Pard	Measurement condition	Setting of number of data used for moving average (Dumping factor).	page 21	
d iSP	Display method	Sub-display setting.	page 22	During measurement
		Measurement range cut ON/OFF.	page 22	
CAL	Calibration method	Automatic calibration ON/OFF.	page 23	
		Second calibration point setting.	page 23	Valid only during the automatic calibration.
r 1 r2	Contact output: R1/R2	Control target selection	page 27	
		Control mode selection	page 27	
		Reverse output setting	page 29	
		Control method setting	page 29	Valid only when the control target is measured value.
		Control value setting	page 30	
		Proportional band	page 31	
		Maximum SPM value	page 32	
		Control shift amount	page 34	
		Control width type selection	page 34	
		Control width setting	page 35	
		Delay time (setting for relay ON.)	page 36	
		Delay time (setting for relay OFF.)	page 36	
Cur	Transmission output	Transmission output setting	page 37	

Press the MEAS key to return to the menu one tier up.
To return to the basic setup menu from the setup screen, press the MEAS key repeatedly until "SEt" is shown on the measurement display and nothing is shown on the sub-display, then press the ENT key.

■ Electrode types

● Select the resistance temperature sensor type of the electrode.

Select the resistance temperature sensor type of the electrode to be used for measurement.

1. **Open the basic setup menu referring to " How to open basic setup menus " (page 20).**
The current electrode type setting is shown on the panel as below.
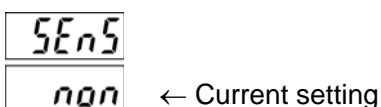
```
┌──────┐
│ 5En5 │
└──────┘
┌──────┐
│  non │  ← Current setting
└──────┘
```

2. **Press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**
Choices are: "non", "350", "500", "1 k", "6.8 k" and "10 k"
When connecting an electrode without temperature compensation, select "non".

4. **Press the ENT key to finish the setting.**

── Tip ──────────────────────────────────
To select another setting item, press the MEAS key.

■ Measurement condition

● Number of moving averages (dumping factor)

Set the number of data used for moving average, which is performed to display the measured values.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current measurement condition setting on the panel, referring to " How to open basic setup menus " (page 20).**
The number of moving averages setting "dFct" is displayed on the measurement display.
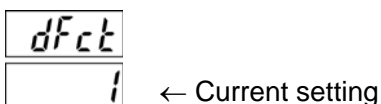
```
┌──────┐
│ dFct │
└──────┘
┌──────┐
│    1 │  ← Current setting
└──────┘
```

2. **Press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the number of data used for moving average.**

UP key: Increments the value by 1 time.
DOWN key: Decrements the value by 1 time.
The setting range is 1 time to 20 times.

4. **Press the ENT key to finish the setting.**

── Tip ──────────────────────────────────
To select another setting item, press the MEAS key.

■ Display method

● Sub-display setting

Select the item to be displayed on the sub-display during measurement.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current sub-display setting (as below) on the panel, referring to " How to open basic setup menus " (page 20).**

The display item selection screen for the sub-display appear on the screen.

```
5.dSP
```
```
      no    ← Current setting
```

2. **Press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

no: Nothing is displayed.
1.Set: Control value of relay 1
2.Set: Control value of relay 2
t: Temperature.

4. **Press the ENT key to finish the setting.**

――― Tip ―――
- **To change measurement range cut ON/OFF setting press the DOWN key.**
- **To select another setting item, press the MEAS key.**

● Measurement range cut ON/OFF

Specify whether values outside the measurement range, are displayed or not.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current sub-display setting on the panel, referring to " How to open basic setup menus " (page 20).**

The display item selection screen for the sub-display appear on the screen.

2. **Press the DOWN key to display "r.cut" on the measurement display, then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

UP key (YES):   Values outside the measurement range are not displayed.
DOWN key (no):   Values outside the measurement range are displayed.

4. **Press the ENT key to finish the setting.**

――― Tip ―――
- **To change sub-display setting, press the UP key.**
- **To select another setting item, press the MEAS key.**

■ Calibration method

You can choose automatic or manual calibration.
If choosing automatic calibration, select the second calibration point from pH 2, pH 4, pH 9 and pH 10 (JIS).

— Tip —

In automatic calibration, the first calibration point is fixed to pH 7.
In manual calibration, you can freely set calibration points. However, the difference between two points must be 2 pH or more.

● Automatic calibration ON/OFF

1. **Open the basic setup menu and press the UP/DOWN keys to display the automatic calibration setting (as below) on the panel, referring to " How to open basic setup menus " (page 20).**

```
 Auto 
      no 
```
← Current setting

2. **Press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**
YES: Automatic calibration
no: Manual calibration

4. **Press the ENT key.**
The setting is finished and the screen returns to the Calibration setup screen in view mode.
When you have selected the automatic calibration, set the value for the second calibration point.

— Tip —

● **If you set the value of the second calibration point next, start the procedure described next from step 2.**
● **To select another setting item, press the MEAS key.**

● Second calibration point setting (only for automatic calibration)

1. **Open the basic setup menu and press the UP/DOWN keys to display the automatic calibration setting on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key.**
The first calibration point setting is displayed.

— Tip —

The first calibration point is fixed to pH 7.

3. **Press the DOWN key again.**
The current second calibration point setting is displayed.

4. **Press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

5. **Press the UP/DOWN key to select the a setting from pH 2, pH 4, pH 9 and pH 10.**

6. **Press the ENT key to finish the setting.**

——— Tip ———————————————————————————————

- **To display the first calibration value or change the automatic calibration ON/OFF setting, press the UP key.**
- **To select another setting item, press the MEAS key.**
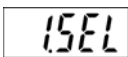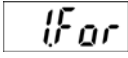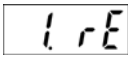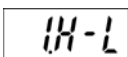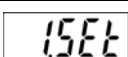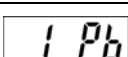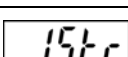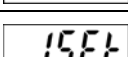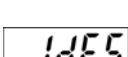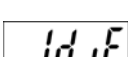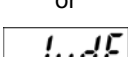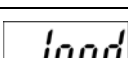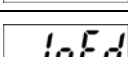
■ Contact output

Set the control actions for R1 and R2 respectively.
This section explains the setup procedures using R1 as an example. Set up the R2 actions in the same way.
The following control items can be set.

Table 3   Contact output: the setting items for R1

Display	Item	Description	Reference	Remarks
1.SEL	Control target	Select the control target from: non: Relay OFF PH: PH H/L setting Hold: During maintenance Err: For error alarm FAiL: For failure alarm	page 27	
1.For	Control mode	Options: ON/OFF control and pulse control	page 27	
1.rE	Reverse output	Select the reverse output setting, whether the output is reversed or not.	page 29	
1.H-L	Control method	Select the limit operation, upper or lower.	page 29	
1.SEt	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 30	
1.Pb	Proportional band	Proportional band used for pulse control.	page 31	
1.Str	Maximum SPM value	Maximum number of strokes to output per minute.	page 32	
1.SFt	Control shift amount	Shift amount of control output in pulse control.	page 33	

1.dFS	Control width type	● d.diF:
		  Sets the same width is set both over and under the control value at the center.
		● S.diF:
		  Different widths are set over and under the control value.
			page 34	*

1.diF
or
1.udF
	Set control width	Set the control widths:
		● When the control width type is "d.diF".
		  Set the width (1.diF) from the control value at the center.
		● When the control width type is "S.diF".
		  The width under the control value (1.udF) and the width over the control value (1.odF).
			page 35	

1.ond	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON (unit: seconds).	page 36	
1.oFd	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF (unit: seconds).	page 36	

*: Refer to " Control targets and available options " (page 26) for the options available for the selected control target.

● **Control targets and available options**

Make the settings referring to the table below.
Displayed options differ depending on the setting shown in gray. Items marked with a circle are displayed as options.

Table 4 Control targets and available options

Displays	Items	Options					
		non	PH		Hold	Err	FAiL
`1.SEL`	Control target selection	non	PH		Hold	Err	FAiL
`1.For`	Control mode selection		onoF	PL			
`1.rE`	Reversal of the control output		✓		✓	✓	✓
`1.H-L`	Control method		✓	✓			
`1.SEt`	Control value		✓	✓			
`1.Pb`	Proportional band			✓			
`1.Str`	Maximum SPM value			✓			
`1.SFt`	Control shift amount			✓			
`1.dFS`	Types of control width		d.diF	S.diF			
`1.diF`			✓				
`1.udF`	Control width			✓			
`1.odF`				✓			
`1.ond`	Delay time (Relay ON)		✓	✓	✓	✓	✓
`1.oFd`	Delay time (Relay OFF)		✓	✓	✓	✓	✓

● **Control target selection**

Select the control target of the contact output.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 (as below) on the panel, referring to " How to open basic setup menus " (page 20).**

```
 1.SEL
   PH    ← Current setting
```
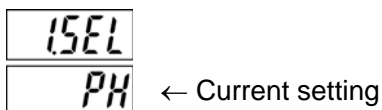
2. **Press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

   non: Relay OFF
   PH: PH H/L setting
   Hold: During maintenance
   Err: For error alarm
   FAiL: For failure alarm

4. **Press the ENT key to finish the setting.**

   ── Tip ──────────────────────────────────
   ● **To set another item of relay output 1 setting next, press the DOWN key to display it.**
   ● **To select another setting item, press the MEAS key.**

● **Control mode selection**

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 (as below) on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.For" on the measurement display, then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a control mode.**

   onoF: ON/OFF control (When the proportional band is zero).
   PL: Pulse proportional control (When the proportional band is other than zero, the number of strokes (pulse number) for controlling the instrument becomes variable).

4. **Press the ENT key to finish the setting.**

   Reference ──────────────────────────────
   Refer to " ON/OFF control " (page 28) and " Pulse proportional control " (page 28).

   ── Tip ──────────────────────────────────
   ● **To set another item of contact output R1 setting next, press the UP/DOWN key to display it.**
   ● **Press the MEAS key to return to the basic setup menu.**

● ON/OFF control

The ON/OFF control turns ON the output when the measured value is higher than the control value. It activates the metering pump to inject chemicals. It turns OFF the output when the measured value is lower than the control value, deactivating the pump to stop injecting chemicals (The above is the action when the upper limit is reached. When the lower limit is reached, the opposite action is triggered).

The method for keeping pH constant by turning ON/OFF the output is called "ON/OFF control". It is also called "two-step control (action)", since the output is selected between two values, 0% and 100%, taking the control value as the threshold.
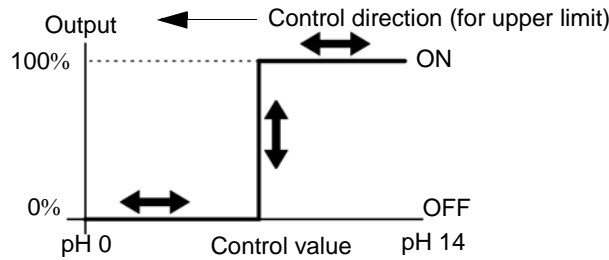
_____ Tip _____

This ON/OFF control mode is applicable also to the alarm contact output.

● Pulse proportional control

This control mode allows variable outputs by changing the number of ON/OFF times per minute (number of pulses).

Number of pulses (number of strokes) to output is expressed in units of SPM (stroke per minute). A value expressed in SPM represents the number of pulses (strokes) produced per minute.

This instrument allows you to.

- Output any number of pulses (SPM value) between no pulse output (0%) and the maximum SPM value (100%).
- The number of strokes (SPM value) is determined in proportion to the deviation (difference between measured and control values) to perform pulse proportional control.
- Since the chemical injection volume can be controlled in proportion to the deviation from the control value, fine adjustment near the control value is made possible, making instances exceeding the control value infrequent.

_____ Tip _____

Proportional control is a method of control in which the output is controlled in proportion to the deviation from the control value (difference between the control value and the measured value) and the control for it is activated when it falls into the proportional band that has been specified for the control value.
Once the measured value falls into the proportional band, the output will be reduced in proportion to the deviation. When the measured value matches the control value (the deviation is zero), no output is made.
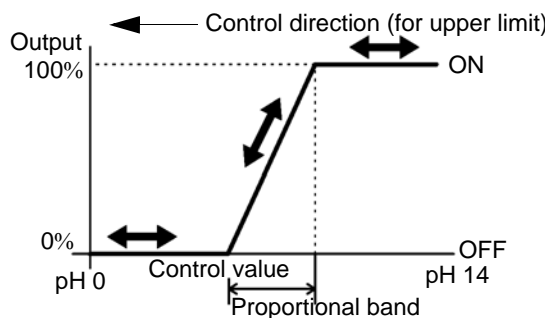
● **Reverse output setting**

Select whether or not to invert the control output of the control target.
   1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**
   2. **Press the DOWN key to display "1.rE" on the measurement display, then press the ENT key.**
      The sub-display starts blinking. Now you can change the setting.
   3. **Press the UP/DOWN key to select a setting.**

      UP key (yES):   The control output is reversed.
      DOWN key (no): The control output is not reversed.

   4. **Press the ENT key to finish the setting.**

      ─── Tip ───
      ● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
      ● **To select another setting item, press the MEAS key.**

● **FAIL output when the instrument power is shut down**

Since the instrument has no NC terminal, FAIL cannot be output when the instrument power is shut down.

   Note

   When this function is used, the target of the delay time setting is also reversed. Make the settings properly in the delay time setting for turning OFF the relay.

● **Control method setting**

Select the limit operation, upper or lower.
   1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**
   2. **Press the DOWN key to display "1.H-L" on the measurement display, then press the ENT key.**
      The sub-display starts blinking. Now you can change the setting.
   3. **Press the UP/DOWN key to select a setting.**

      UP key (H):   Upper limit operation.
      DOWN key (L): Lower limit operation.

   4. **Press the ENT key to finish the setting.**

      ─── Tip ───
      ● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
      ● **To select another setting item, press the MEAS key.**

● **Control value setting**

Set the control value, used as the criterion for switching the relay output ON/OFF.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.SEt" on the measurement display, then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set a setting.**

UP key: Increments in units of 0.01 pH.

DOWN key: Decrements in units of 0.01 pH.

The setting range is 0.00 pH to 14.00 pH.

4. **Press the ENT key to finish the setting.**

──── Tip ────

● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

● **Proportional band**

The larger the proportional band (Pb), the smaller the number of stroke per unit deviation: the smaller the proportional band (Pb), the larger the number of stroke per unit deviation.
Make the setting in accordance with the flow rate of stock solution injected into the processing tank and pH value.

Proportional band is narrow (the number of strokes per unit deviation is large).

Proportional band is wide (the number of strokes per unit deviation is small).
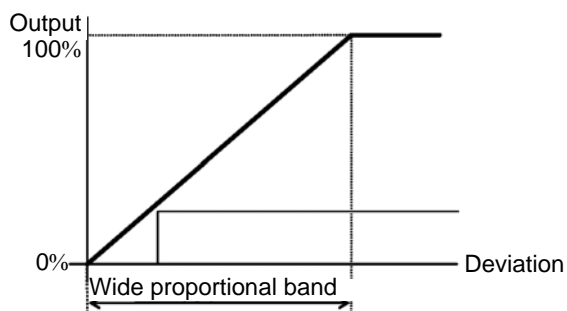
1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.Pb" on the measurement display, then press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select your desired setting.**

UP key: Increments the value by 0.01 pH.

DOWN key: Decrements the value by 0.01 pH.

The setting range is 0.01 pH to 4.00 pH.

4. **Press the ENT key to finish the setting.**

── Tip ──────────────────────────────────

● **To set another item of contact output R1 setting next, press the UP/DOWN key to display it.**
● **Press the MEAS key to return to the basic setup menu.**

● **Maximum SPM value**

Set the maximum number of strokes to output per minute for performing pulse proportional control.

Note

Be sure to set a maximum SPM value below the rated value of the pulse pump to connect.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.Str" on the measurement display, then press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select your desired setting.**

UP key: Increments the value by 1 time.

DOWN key: Decrements the value by 1 time.

The setting range is 1 time to 360 times.

*4.* **Press the ENT key to finish the setting.**

—— Tip ——

● **To set another item of contact output R1 setting next, press the UP/DOWN key to display it.**
● **Press the MEAS key to return to the basic setup menu.**

● **Control shift amount**

This is the shift amount to be used for increasing the pump output in accordance with the deviation (difference between measured and control values). Even when the deviation is zero, the pump output is performed based on the control shift amount.
The shift function is disabled if the control shift amount is set to 0%.
The settable range is 0% to 50% of the value set as the maximum SPM value.
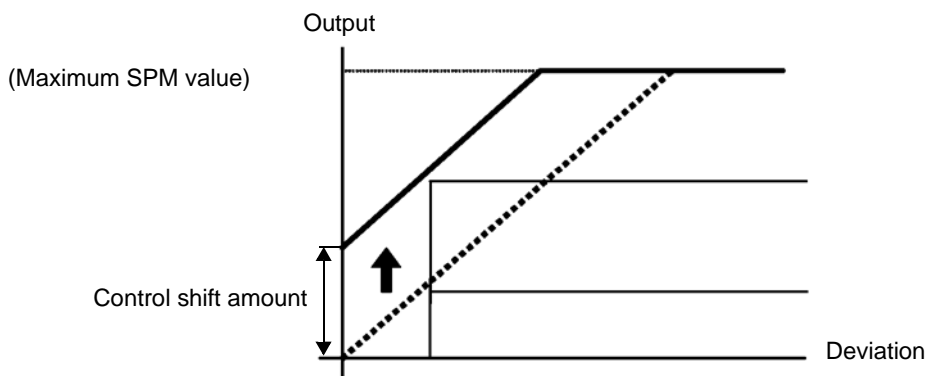
The above figure illustrates how the shift increases the number of strokes even if the deviation is unchanged. For example, when the maximum SPM value is set to 50 and the control shift amount is set to 50%, the maximum number of strokes is reached when 25 strokes is added to the number of strokes for the control shift amount at 0%. When the maximum SPM value is exceeded, the number of strokes performed will be the maximum SPM value.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.SFt" on the measurement display, then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select your desired setting.**

UP key: Increments the value by 1%.

DOWN key: Decrements the value by 1%.

The setting range is 0% to 50%.

4. **Press the ENT key to finish the setting.**

— Tip —
● **To set another item of contact output R1 setting next, press the UP/DOWN key to display it.**
● **Press the MEAS key to return to the basic setup menu.**

● **Control width type setting**

Select the control width type.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.dFS", then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

   UP key (d.diF):   Sets the same width is set both over and under the control value at the center.

   DOWN key (S.diF): Different widths are set over and under the control value.

4. **Press the ENT key to finish the setting.**

   —— Tip —————————————————————————————

   ● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
   ● **To select another setting item, press the MEAS key.**

● **Example of d.diF setting**
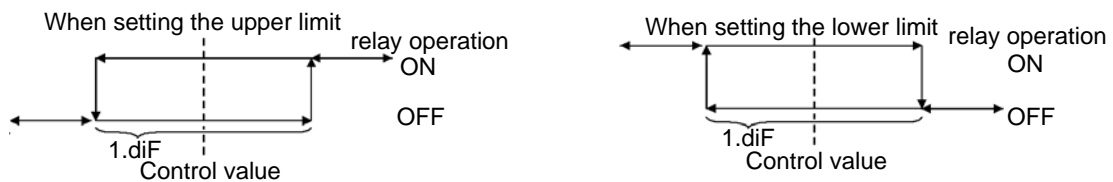
When setting the upper limit

If the settings are control value: 7.0 pH and 1.dif: 0.5 pH, the relay turns ON at 7.25 pH and turns OFF at 6.75 pH.

When setting the lower limit

If the settings are control value: 7.0 pH and 1.dif: 0.5 pH, the relay turns ON at 6.75 pH and turns OFF at 7.25 pH.

● **Example of S.diF setting**
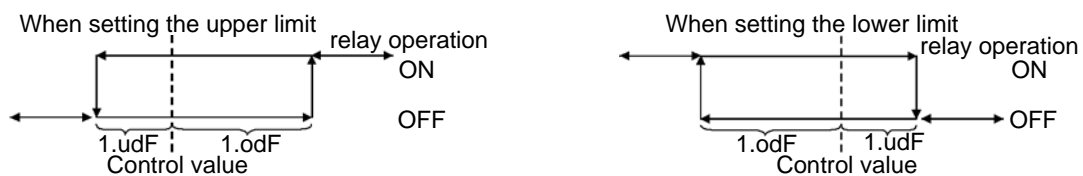
When setting the upper limit

If the settings are control value: 7.0 pH, 1.udf: 0.5 pH, and 1.odf: 1.0 pH, the relay turns ON at 8.0 pH and turns OFF at 6.5 pH.

When setting the lower limit

If the settings are control value: 7.0 pH, 1.udf: 0.5 pH, and 1.odf: 1.0 pH, the relay turns ON at 6.0 pH and turns OFF at 7.5 pH.

34

● **Control width setting**

Set the control widths. The procedures are different depending on the selected control width type.

● **When the control width type is "d.diF"**

Sets the same width is set both over (1.odF) and under (1.udF) the control value at the center.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.diF", then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select the control width.**

   UP key: Increments the value by 0.01 pH.
   DOWN key: Decrements the value by 0.01 pH.

   The setting range is 0.00 pH to 4.00 pH.

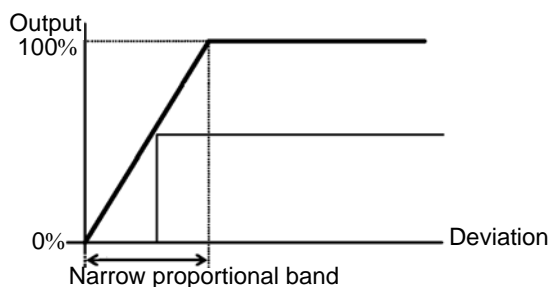4. **Press the ENT key to finish the setting.**

   ___ Tip ___
   ● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
   ● **To select another setting item, press the MEAS key.**

● **When the control width type is "S.diF"**

Different widths are set over (1.odF) and under (1.udF) the control value.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.udF", then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the control width for under the control value.**

   UP key: Increments the value by 0.01 pH.
   DOWN key: Decrements the value by 0.01 pH.

   The setting range is 0.00 pH to 2.00 pH.

4. **Press the ENT key to finish the setting.**
   The display returns to the contact output setting menu.

5. **Press the DOWN key to display "1.odF", then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.

6. **Press the UP/DOWN key to select the control width over the control value.**

   UP key: Increments the value by 0.01 pH.
   DOWN key: Decrements the value by 0.01 pH.

   The setting range is 0.00 pH to 2.00 pH.

7. **Press the ENT key to finish the setting.**

   ___ Tip ___
   ● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
   ● **To select another setting item, press the MEAS key.**

● **Delay time setting for relay ON**

Set the alarm output duration from the start until the C-NO contact output turns ON.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.ond" on the measurement display, then press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the delay time (seconds).**

UP key: Increments the value by 1 second.

DOWN key: Decrements the value by 1 second.

The setting range is 0 seconds to 600 seconds.

*4.* **Press the ENT key to finish the setting.**

—— Tip ——

● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

● **Delay time setting for relay OFF**

Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to " How to open basic setup menus " (page 20).**

2. **Press the DOWN key to display "1.oFd" on the measurement display, then press the ENT key.**
The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the delay time (seconds).**

UP key: Value increases in the unit for 1 second.

DOWN key: Value decreases in the unit for 1 second.

The setting range is 0 seconds to 600 seconds.

4. **Press the ENT key to finish the setting.**

—— Tip ——
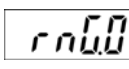
● **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

■ Transmission output

Set up the items related to transmission output.

Table 5   Settings for transmission output
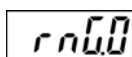
Display	Item	Description	Reference	Remarks
rnG.0	Zero point of the transmission output range	Set the measured value corresponding to 4 mA is parallelized.	page 37	
rnG.S	Span point of the transmission output range	Set the measured value corresponding to 20 mA is parallelized.	page 38	
Hold	Hold output	Select the hold method.	page 38	
PrES	Hold value	Value of the optional hold.	page 39	Valid only when the hold output is set to "PrES".
C.cut	Transmission output limit	Select the transmission output setting, whether values outside the range of 4 mA to 20 mA are output or not.	page 39	
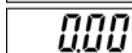
● Zero point of the transmission output range

Set the pH value corresponding to the output zero point.

***1.* Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output (as below) on the panel, referring to " How to open basic setup menus " (page 20).**

The setup item selection screen is displayed on the measurement display, showing the zero point of the transmission output range, "rnG.0".

rnG.0

0.00   ← Current setting

***2.* Press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

***3.* Press the UP/DOWN key to specify a pH value corresponding to the zero point output.**

UP key: Increments the value by 0.01 pH.

DOWN key: Decrements the value by 0.01 pH.

The setting range is −1.00 pH to 15.00 pH.

***4.* Press the ENT key to finish the setting.**

— Tip

● **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

37

● **Span point of the transmission output range**

Set the pH value corresponding to the output span point.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to " How to open basic setup menus " (page 20).**

The setup item selection screen is displayed on the measurement display, showing the zero point of the transmission output range, "rnG.0".

2. **Press the DOWN key to display "rnG.S", then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the pH value corresponding to the span point output.**

UP key: Increments the value by 0.01 pH.

DOWN key: Decrements the value by 0.01 pH.

The setting range is −1.00 pH to 15.00 pH.

4. **Press the ENT key to finish the setting.**

Note

If the zero point and span point are set to the same value, the actual output is fixed to 20 mA.

Tip
- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● **Hold output**

Select the hold method when the mode is switched from measurement to calibration.

Tip

When the mode is switched to maintenance, the previous value hold is used as the hold value.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to " How to open basic setup menus " (page 20).**

The setup item selection screen is displayed on the measurement display, showing the zero point of the transmission output range, "rnG.0".

2. **Press the DOWN key to display "Hold", then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

yES: The previous value is used as the hold value (Previous value hold).

PrES: A preset value is used as the hold value (Preset hold).

no: Hold output is not used (Actual data is output continuously).

4. **Press the ENT key to finish the setting.**

Tip
- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● **Hold value**

Set the hold value to be used if preset hold is enable.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to " How to open basic setup menus " (page 20).**

The setup item selection screen is displayed on the measurement display, showing the zero point of the transmission output range, "rnG.0".

2. **Press the DOWN key to display "PrES" on the measurement display, then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to specify a pH value to output as the hold value.**

UP key: Increments the value by 0.01 pH.

DOWN key: Decrements the value by 0.01 pH.

The allowable value is −1.00 pH to 15.00 pH.

4. **Press the ENT key to finish the setting.**

—— Tip ——————————————————————————
● **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

● **Transmission output limit**

Select the transmission output setting, whether values outside the range of 4 mA to 20 mA are output or not.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to " How to open basic setup menus " (page 20).**

The setup item selection screen is displayed on the measurement display, showing the zero point of the transmission output range, "rnG.0".

2. **Press the DOWN key to display "C.cut" on the measurement display, then press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to set the transmission output limit ON/OFF.**

UP key (yES):   Values under the zero point or over the span point are not output.

DOWN key (no): Values below the zero point or over the span point are output.

4. **Press the ENT key to finish the setting.**
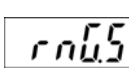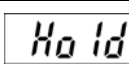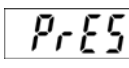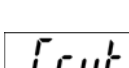
—— Tip ——————————————————————————
● **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
● **To select another setting item, press the MEAS key.**

39

Calibration

There are two types of calibration: pH calibration and temperature calibration.

Note

Be sure to perform the calibration using the standard solution at the first power ON.

■ pH calibration

There are two types of pH calibration: automatic calibration and manual calibration.

Reference
- **Refer to " Automatic calibration ON/OFF " (page 23) for how to change the calibration method.**
- **You can enter the pH calibration mode from the measurement mode directly. Refer to " Daily calibration (calibration mode) " (page 52) for the procedures.**
- **This instrument is equipped with the automatic potential stability judgment function, which automatically judges whether the electrode potential is stable or not at the time of calibration. If the pH value fluctuation is within 0.05 pH for ten seconds, you can finish the value by pressing the ENT key.**

● Precautions

- Do not reuse standard solution.
- Previous value hold is used for transmission output during the maintenance mode.
- Contact outputs are in the following states during the maintenance, depending on the selected control target.
  - OFF when the control target is set to non, PH or Err.
  - ON when the control target is set to Hold.
  - FAIL when the control target is set to FAiL and a system error occurs.

● Operation

Open the calibration menu from the measurement mode.

1. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
   The instrument enters the maintenance mode, and "SEt" is shown on the measurement display.
   Measurement stops, and the instrument enter a state of hold.

2. **Press the DOWN key to display "CAL" on the measurement display, then press the ENT key.**
   The instrument enters the calibration menu and "PH" is displayed on the sub-display.

3. **Press the ENT key.**
   Now you can start automatic or manual pH calibration (depending on the current setting of automatic calibration ON/OFF).
   Perform calibration following the instructions on automatic or manual calibration described in next pages.

   Tip
   - **To abort the calibration, press the MEAS key. The instrument will returns to the calibration menu without changing calibration data.**
   - **If any error occurs (because a wrong solution was used for calibration, etc.), take necessary measures referring to " Remedies for error codes " (page 59).**

● **Automatic calibration**

Calibration is performed, using the first (pH 7) and second (set in basic setup) calibration values in this order.

Requirements

- Standard solution of pH 7.
- Standard solution for the second point specified in the basic setup menu.

● **Operation**

Perform the calibration for the first point.

—— Tip ——
- **To abort the calibration, press the MEAS key.**
- **If any error occurs, follow the instructions for the displayed error code.**

1. **Perform the operations described in " pH calibration " (page 40) to open the calibration menu.**

| | ←Nothing is shown.
| *PH_7* |
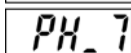
2. **Immerse the electrode in the standard solution of pH 7, then press the ENT key.**
Calibration starts and the measured value blinks on the measurement display.
After passing the automatic potential stability judgement, the measurement value stops blinking, and calibration for the first point is completed.

Perform the calibration for the second point next.

3. **Press the ENT key.**
The pH value specified for the second point in the basic setup menu is shown on the sub-display.

4. **Immerse the electrode in the standard solution for the second point, then press the ENT key.**
Calibration starts and the measured value blinks on the measurement display.
After passing the automatic potential stability judgement, the measurement value stops blinking, and calibration for the second point is completed.

5. **Press the ENT key.**
The calibration values are updated, and "CAL" is displayed on the measurement display and "good" on the sub-display with flashing.

Now the new calibration values are applied, and automatic pH calibration is completed.

—— Tip ——
- **To check the measured value recalculated using the new calibration result, press the MNT key. And the new value will be displayed on the measurement display.**
- **To perform temperature calibration, press the MEAS key to display "CAL" on the measurement display and "PH" on the sub-display (pH calibration entrance state), then press the DOWN key.**

● **Manual calibration**

You can preform calibration manually, for example, when you want to use calibration solution combination other than pH 7 and pH 2, pH 4, pH 9, or pH 10, or use another solutions. You can fine adjust the calibration values to the known pH value of the calibration solution being used.

Requirements

Two calibration solutions, which must differ 2 pH or more.

● **Operation**

Perform the calibration for the first point.

─── Tip ───────────────────────────────────
● **To abort the calibration, press the MEAS key.**
● **If any error occurs, follow the instructions for the displayed error code.**
───

1. **Perform the operations described in " pH calibration " (page 40) to open the pH calibration menu.**

| | ←Nothing is shown.
| - *1* - |
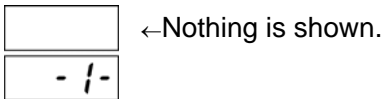
2. **Immerse the electrode in the standard solution for the first point, then press the ENT key.**
Calibration starts and the measured value blinks on the measurement display.
After passing the automatic potential stability judgement, the measurement value stops blinking, and calibration for the first point is completed.
The same value as displayed on the measurement display is displayed and blinks on the sub-display.

3. **Press the UP/DOWN key to adjust the pH value.**

UP key: Increments the value by 0.01 pH.
DOWN key: Decrements the value by 0.01 pH.
The allowable value is 0.00 pH to 14.00 pH.

4. **Press the ENT key.**
The sub-display flashes, and calibration for the first point is completed.
Then the sub-display will display "-2-".

Perform the calibration for the second point next.

5. **Immerse the electrode in the calibration solution for the second point, then press the ENT key.**
Calibration starts and the measured value blinks on the measurement display.
After passing the automatic potential stability judgement, the measurement value stops blinking, and calibration for the first point is completed.
The same value as displayed on the measurement display is displayed and blinks on the sub-display.

6. **Press the UP/DOWN key to change the numerical value shown on the sub-display to the pH value of the calibration solution being used.**

UP key: Increments the value by 0.01 pH.
DOWN key: Decrements the value by 0.01 pH.
The allowable value is 0.00 pH to 14.00 pH.

7. **Press the ENT key.**

The sub-display flashes, and calibration of the second point is completed.

Then, "CAL" is displayed on the measurement display and "good" on the sub-display with flashing. Now the new calibration values are applied and manual pH calibration is completed.

—— Tip ——————————————

● **To check the measured value recalculated using the new calibration result, press the MNT key. And the new value will be displayed on the measurement display.**

● **To perform temperature calibration, press the MEAS key to display "CAL" on the measurement display and "PH" on the sub-display (pH calibration entrance state), then press the DOWN key.**

■ **Temperature calibration**

Adjust the temperature compensation value.

● **Operation**

1. **Dip the electrode into a solution of known temperature, and allow time for the temperature sensor to stabilize.**

2. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**

The instrument enters the maintenance mode, and "SEt" is shown on the measurement display.

Measurement stops, and the instrument enter a state of hold.

3. **Press the DOWN key to display "CAL" on the measurement display, and then press the ENT key.**

The pH meter enters the calibration menu and "PH" is displayed on the sub-display.

4. **Press the DOWN key to display "t" on the sub-display, then press the ENT key.**

Now you can start temperature calibration. The sub-display starts blinking.

5. **Press the UP/DOWN key to set the value on the measurement display to the solution temperature.**

UP key: Increments the value by 1°C.

DOWN key: Decrements the value by 1°C.

The setting range is −10°C to 10°C.

6. **Press the ENT key.**

The temperature calibration factor is updated.

The above completes the temperature calibration.

—— Tip ——————————————

● **To abort the calibration, press the MEAS key. The instrument will returns to the calibration menu without changing calibration data.**

● **To set another item of transmission output setting next, press the UP key to display it.**

Control value setup menu

This menu allows you to change the following control-related settings while performing measurements in the measurement mode.

Table 6   Contact output: setting items

Display	Item	Description	Reference	Remarks
$dFct$	Number of data used for moving average	Select the number of data used for moving average, which is performed to display measured values.	page 21	
$1.5Et$	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 30	These options are available only when "PH" is selected as the control target.
$1.Pb$	Proportional band	Proportional band used for pulse control.	page 31	
$1.5tr$	Maximum SPM value	Maximum number of strokes to output per minute.	page 32	
$1.5Ft$	Control shift amount	Shift amount for control output used in pulse control.	page 33	
$1.d\,iF$ or $1.udF$ $1.odF$	Control width	Set the control widths: ● When the control width type is "d.diF". Set the width (1.diF) from the control value at the center. ● When the control width type is "S.diF". The width under the control value (1.udF) and the width over the control value (1.odF).	page 35	
$1.ond$	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON.	page 36	
$1.oFd$	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF.	page 36	
$2.5Et$	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 30	These options are available only when "PH" is selected as the control target.
$2.Pb$	Proportional band	Proportional band used for pulse control.	page 31	
$2.5tr$	Maximum SPM value	Maximum number of strokes to output per minute.	page 32	
$2.5Ft$	Control shift amount	Shift amount for control output used in pulse control.	page 33	
$2.d\,iF$ or $2.udF$ $2.odF$	Control width	Set the control widths: ● When the control width type is "d.diF". Set the width (2.diF) from the control value at the center. ● When the control width type is "S.diF". The width under the control value (2.udF) and the width over the control value (2.odF).	page 35	
$2.ond$	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON.	page 36	
$2.oFd$	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF.	page 36	

● **Operation**

1. **Press the MNT key in the measurement mode.**
   The sub-display shows "dFct" (The measurement display keep showing a measured value.).

2. **Press the UP/DOWN key to display on the sub-display, then press the ENT key.**
   The setting items are displayed in the order shown in Table 6. Then the change the setting.

3. **Change the setting referring to the instruction page of the selected item.**

—— Tip ————————————————————————————————

If you do not operate any keys for 10 seconds during item selection (step 2. mentioned above), this function is closed automatically (the display, returns to the normal measurement status).
During setting change (step 2. or later), this function is always open.

Security menu

This menu allows you two functions:
Key lock, to prevent accidental operation; and password lock, to prevent illegal operation.

■ Key lock

This function prevents accidental key operation, which may cause unintended setting change or hold output.

● Set up

1. **Hold down the MEAS key in the measurement mode displayed until "Lock" on the measurement display and "on" on the sub-display respectively.**

The key lock displayed function starts working. Releasing the key lets the instrument return to the measurement mode, and the setup for the key locking is completed.

No key operation is accepted hereafter and when any key is pressed, "Lock" is displayed on the measurement display and "on" on the sub-display respectively.

● Release

1. **Press the MEAS key when a measured value is displayed.**

The instrument will display "Lock" on the measurement display and "on" on the sub-display.

> **Note**
>
> **You cannot release the key lock immediately after key lock setup, with the displays showing "Lock" and "on". Make sure to start the release operation with a measured value displayed.**

2. **Hold down the key in the measurement mode continuously until the display of the sub-display turns into "oFF" from "on".**

When you release the MEAS key with "oFF" displayed on the sub-display, key lock release is completed.

The instrument returns to the measurement mode, and now all keys are enabled.

■ Password locking

This function prevents illegal operation by unauthorized persons using passwords. This function uses the first and second passwords, which are 4-digit numbers respectively and totals eight digits. When the password lock is active, the instrument performs measurement and accepts no key operations except for entries for a password.
You can enable/disable the lock only by following the procedure described below.

> **Note**
>
> ● Note that if the password locking is enabled, the maintenance functions such as calibration and settings are disabled. Set it up carefully.
> ● The password before factory shipment has been set to 0000-0000.

● Password Locking Operation

1. **Hold down the UP key and DOWN keys at the same time in the measurement mode until "PASS" is shown on the main display.**
When you release the buttons, the measurement display shows "PAS1", and the sub-display shows "0000" with the left most digit blinking. You can change the value of the blinking digit.

— Tip —
To cancel the whole password setting and return to the measurement mode, press the MEAS key with a digit blinking.

2. **Press the UP/DOWN key to select a value for the blinking digit.**

3. **Press the ENT key.**
The setting is finished and the digit stops blinking.
The numerical value on the next digit starts blinking instead to signal that it is now ready to be changed.

4. **Repeat steps 2. to 3. to the right most digit.**
When the right most digit is finished, all the four digits flashes and the first password is read into the instrument.
Now you can enter the second password.

5. **Input the second password in the same way.**
When the two passwords are correct, the measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.

> **Note**
>
> If either of the passwords is wrong, the measurement display shows "PASS" and the sub-display shows "bad", and the instrument returns to the measurement mode.
> The instrument does not tell you which password was wrong.

6. **If necessary, to change the setting press the ENT key.**
The instrument enters the setup state and the sub-display starts blinking.

7. **Press the UP/DOWN key to set the password locking.**

UP key (on):   Enables the password lock.
DOWN key (oFF): Disables the password lock.

8. **Press the ENT key.**
The sub-display flashes, and the setting is finished. The measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.

9. **Press the MEAS key to return to the measurement mode.**

■ Password setting

The password used for this instrument is consisted of the first and second passwords, which are 4-digit numbers respectively and totals eight digits.
You must input the current passwords before setting up new passwords.

> **Note**
> - **It is recommended to use numbers which is easy to remember and hard to forget.**
> - **If you cannot remember the password you set, you cannot change the password.**
>   **If you forget the passwords you set, send the instrument back to HORIBA Advanced Techno.**
>   **We will send it back to you after resetting the passwords to the default setting (0000-0000) (Charged).**

1. **Perform the steps 1. to 2. of " Password Locking Operation " (page 47).**
Measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.

2. **Press the UP/DOWN key to select the password to be set.**

3. **Press the ENT key.**
The instrument enters the setup state and the sub-display starts blinking.

> Tip
> **To cancel the whole password setting and return to the measurement mode, press the MEAS key with a digit blinking.**

4. **Press the UP/DOWN key to set a new password.**

5. **Press the ENT key.**
The setting is finished and the digit stops blinking.
The numerical value on the next digit starts blinking instead to signal that it is now ready to be changed.

6. **Repeat steps 4. to 5. to the right most digit.**
When the right most digit is finished, all the four digits flashes and the password is read into the instrument.
To change the other password next, press the UP/DOWN key to select the other password, and change it in the same way.

User check menu

The user check menu allow you to check the instrument status, and to reset it to the default. Operate it from the user check menu.

● **How to open the user check menu**

Start the operation it from the measurement mode.

1. **Hold down the MNT key until the MNT lamp lights up.**
   The instrument enters the maintenance mode, and "SEt" is shown on the measurement display.

2. **Press the DOWN key to display "USr" on the measurement display, and then press the ENT key.**
   The instrument opens the user check menu, and "LEd" is shown on the sub-display.
   Refer to the below instructions for perform each of the available operations in accordance with the following description.

■ **Status check**

You can check the four items shown below.
   ● LEDs
   ● Transmission output
   ● Relay operation
   ● Measured value and temperature

● **Operations**

Perform the following operations after opening the user check menu.

● **LEDs**

1. **Press the UP/DOWN key, if necessary, to display "LEd" on the sub-display, then press the ENT key.**
   All the LED will light up normally.

2. **Check that LEDs light up without problems.**

3. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

● **Transmission output**

You can output an electric current of 4 mA, 12 mA and 20 mA from the transmission output.

1. **Press the UP/DOWN key to display "Cur" on the sub-display.**

2. **Press the ENT key.**
   "4-20" is shown on the measurement display and "4" on the sub-display outputting a 4 mA transmission output.

3. **To switch the current output, press the UP/DOWN key to select the value corresponding to the current (mA) to be output from 4, 12, or 20.**

4. **Check that the electric current is being output properly.**

5. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

● **Relay operation**

Check the operations of contact outputs R1 and R2.

Checking the contact output R1

1. **Press the UP/DOWN key to display "rLy" on the sub-display.**

2. **Press the ENT key.**
"rLy1" is shown on the measurement display and "rLy" on the sub-display.

3. **Press the ENT key.**
The relay lamp R1 lights up and the relay is turned on, normally.
Press the ENT key to switch the relay ON/OFF to check the operation.

4. **Press the MEAS key.**
The instrument returns to the user check menu entrance.

Checking the contact output R2

You can check R2 in the same way as R1. But, press the UP/DOWN key to display "rLy2" on the sub-display after the step 2.

● **Checking the pulse pump operation**

Check the operation of pulse pumps connected to output contacts R1 and R2.

Checking the operation of the pulse pump connected to contact output R1.

1. **Press the UP/DOWN key in the user check menu to display "PStr" on the sub-display.**

2. **Press the ENT key.**
The instrument shows "PStr" on the measurement display and "rLy1" on the sub-display.

3. **Press the ENT key.**
The sub-display starts blinking. The pump is driven at the number of strokes displayed.

4. **Press the UP/DOWN keys to change the number of strokes.**
The range of settable number of stokes is 0 to the maximum SPM value that has been specified.

5. **After checking the operation, press the MEAS key.**
The instrument shows "PStr" on the measurement display and "rLy1" on the sub-display, stopping the operation of the pump.

6. **Press the MEAS key.**
The instrument returns to the user check menu.

Checking the operations of the pulse pump connected to contact output R2

After finishing step 2 of the checking procedure for the pulse pump connected to R1, press the UP/DOWN key to display "rLy2" on the sub-display.
Other operations are the same as the ones for R1.

● **Measured value and temperature**

   1. **Press the UP/DOWN key in the user check menu to display "diSP" on the sub-display.**

   2. **Press the ENT key.**
      The current measured value is shown on the measurement display and the current temperature on the sub-display.

   3. **Press the MEAS key.**
      The instrument returns to the user check menu entrance.

■ **Instrument reset**

This operation allows you to initialize all the settings and restart the instrument.
Then preform the steps in " Initial set up " (page 16) in the automatically opened basic setup menu.
Calibration values are also reset. Be sure to perform the steps in " Calibration " (page 40) before use.

● **Operation**

   1. **Enter the user check menu referring to " How to open the user check menu " (page 49).**
      "USr" is shown on the measurement display and "LEd" on the sub-display.

   2. **Press the DOWN key to display "init" on the sub-display, then press the ENT key.**
      The sub-display shows "no" and starts blinking.

   3. **Press the UP key to select "yES", then press the ENT key.**
      The instrument is reset to the state before factory shipment.
      The sub-display shows "good" with flashing, and the instrument restarts.

—— Tip ——
● **The initial settings are shown in " Basic setup items " (page 16).**
● **To return to the user check menu entrance without resetting, select "no" in step 3. and press the ENT key.**

For More Accurate Measurements

This is the maintenance information to keep the precision of this instrument and to use it better.

This chapter explains the maintenance to keep the precision of the instrument such as daily calibration.

Daily calibration (calibration mode)

Here we explain how to perform daily calibration.

● Precautions for calibration

- Do not reuse standard solution.
- The transmission output is put to the state set in the " Hold output " (page 38) setting of the basic setup.
- Contact outputs are put to the following conditions:
  - Turned OFF when set to non, PH or Err.
  - Turned ON when set to Hold, ON.
  - FAIL is output if a system error is raised when set to FAiL.

● Calibration operation

Operate it from the measurement mode.

1. **Hold down the CAL key until the CAL lamp lights up.**

   The pH calibration menu appears and the calibration type selected in the basic setup (automatic calibration or manual calibration) starts.

2. **Or, perform calibration in accordance with the method described in " Automatic calibration " (page 41) or " Manual calibration " (page 42).**

   ——— Tip ———

   - **If you want to abort the calibration, press the MEAS key. The display returns to the measurement mode without updating the calibration data.**
   - **If any error occurs (because a wrong solution was used for calibration, etc.), take necessary measures referring to " Remedies for error codes " (page 59).**
   - **To perform the temperature calibration, call up the calibration screen from the maintenance mode.**

Maintenance procedure for HP-480PL

■ Checks of HP-480PL

The decreased insulation of the electrode connector makes it difficult to make accurate measurements.
Check the electrode plate periodically (about once every year) to see whether it is free from rust and any other cause for the decreased insulation.
Use soft cloth to wipe off dirt on the case for the HP-480PL.

> **Note**
>
> **Do not use any organic solvent.**

Maintenance of electrode

This section describes the maintenance method of a general pH electrode.
For further details, refer to the instruction manual for each electrode.

■ Cleaning the electrode

Dirt on the electrode can delay the response speed, reading drift, and instability. Periodically check the tip (glass membrane) and the liquid junction of the electrode and maintain them clean by rinsing off any dirt and coating.
It is recommended that the electrode be cleaned when calibration is performed using a standard solution. In this case, clean the electrode before the calibration.

> **Note**
>
> **When a cleaner is installed, stop its operation and then perform the maintenance of the electrode.**
> **Turn OFF the HP-480PL or hold down the HOLD key to enter the hold mode and then start the maintenance.**

● View of pH electrode alone

KCl filling inlet   Liquid junction

Glass response membrane
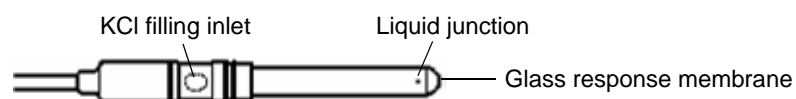
● Cleaning the pH electrode

[1], [2], and [3] indicate the cleaning steps for different dirt levels.
If the characteristics cannot be restored by performing step [1], go on to step [2] or even step [3]. If the characteristics are still not restorable, replace the electrode as its service life has expired.

⚠️ **WARNING**

Strong Acid

If dilute hydrochloric acid gets into your eyes, your mucous membranes will be damaged, possibly to the point of blindness.

When handling hydrochloric acid, be sure to wear protective glasses, protective gloves, and a protective mask.

If it gets into your eyes, immediately wash your face with a large amount of water for more than 15 minutes, and see a doctor as soon as possible (When washing your eyes, open your eyelids with your fingers and wash the eyeballs and eyelids completely).

Hydrochloric acid on the human body and clothes may cause burns. Take off clothes wet with the chemical and immediately wash with large amounts of water immediately.

Note

Do not immerse the electrode in dilute hydrochloric acid for long hours.

	General dirt	Removal of soft foreign matter Organic matter Fiber, Algae	Removal of adhesive foreign matter Oil Organic matter	Removal of hard foreign matter Calcium salt Inorganic salt
⊙Common work Rinse with deionized water and wipe off dirt with gauze	[1]	[1]	[1]	[1]
Wipe off with gauze soaked with organic solvent and then rinse with deionized water	[2]	[2]	[2]	-
Wipe off with gauze soaked with detergent and then rinse with deionized water	-	[3]	[3]	-
Immerse in dilute hydrochloric acid (1 mol/L) for 15 seconds and then rinse with deionized water (repeat this process)	[3]	-	-	[2]

■ Adding KCl internal solution

For accurate measurements, the level of the internal solution (3.33 mol/L KCl solution) in the electrode must be higher by 10 cm minimum than the level of the solution under measurement. Periodically add the internal solution so that this level can be maintained.
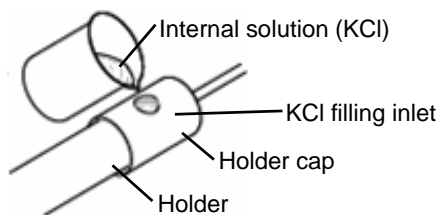
■ Storage

Ensure that the tip (glass membrane) and the liquid junction of the electrode are not dried. Fill the provided protective cap with tap water and then put the cap on the electrode tip for storage. In addition, tightly close the internal solution filling inlet to prevent internal drying.

Replacing the electrode

⚠	**CAUTION**
❗	The electrode is made of glass and broken when exposed to impact or strong force. In handling the electrode, exercise sufficient care.
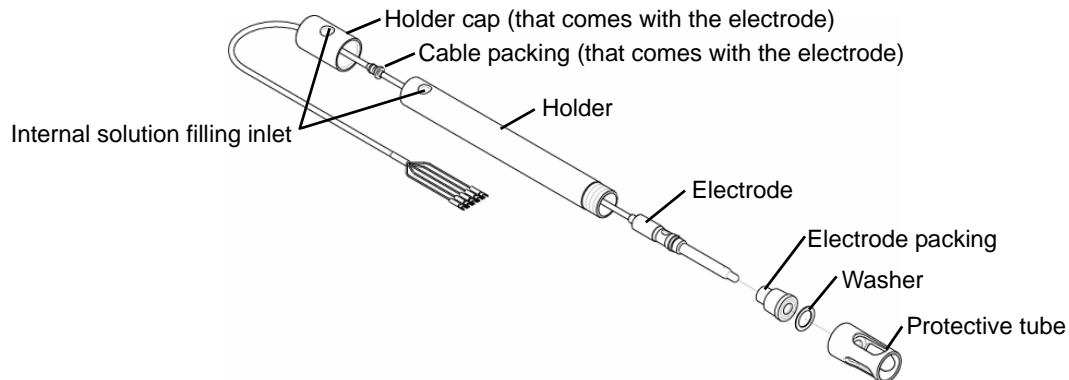
1. **Remove the holder cap and drain all the internal solution in the holder.**
2. **Remove the protective tube and the washer at the holder tip and then remove the electrode packing from the holder.**
3. **Remove the electrode packing while holding the electrode.**
4. **Remove the electrode from the top of the holder.**

Note

Dispose of the pH electrode as industrial waste.

5. **Clean the holder, electrode packing, washer, and protective tube with alcohol or the like and then well dry them.**
6. **Extend the holder cap and the cable packing approximately to the holder length.**
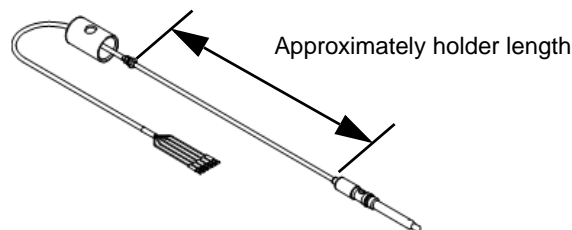
7. **Insert a new electrode from the top of the holder and then pass it through the bottom of the holder.**
8. **Fully fit the electrode packing to the electrode.**
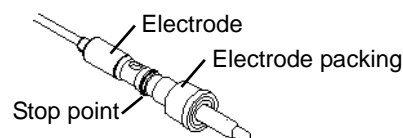
9. **Remove the protective cap for the electrode and the tape for the KCl filling inlet on the electrode.**

55
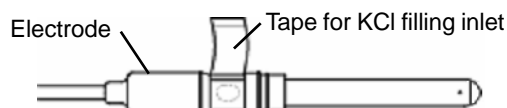
Note

- **Unless the tape for the filling inlet on the electrode is removed, no measurements can be made successfully.**
- **Since the internal solution in the electrode may leak, remove the tape while orienting the KCl filling inlet upward.**
- **Do not discard the protective cap as it is used for storage.**

10. **Push the electrode packing into the holder and then tighten the protective tube through the washer.**

11. **Adjust the cable packing so that the distance between the holder cap and the holder top becomes 5 cm to 10 cm.**

5 cm to 10 cm
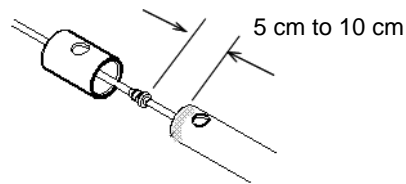
12. **Apply silicone grease to the entire circumference of the holder top.**

13. **Supply a new internal solution through the filling inlet up to the specified level.**

Tip

Approximately 500 mL of internal solution is required for the holder of 1 meter.

Internal solution (KCl)

KCl filling inlet
Holder cap
Holder
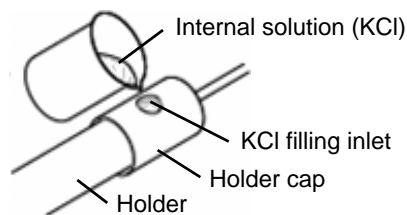
14. **Fit the holder cap into the holder.**

15. **Slightly draw the cable packing out of the holder packing.**

Holder cap

Cable packing

Holder

Holder cap

Cable packing

Holder
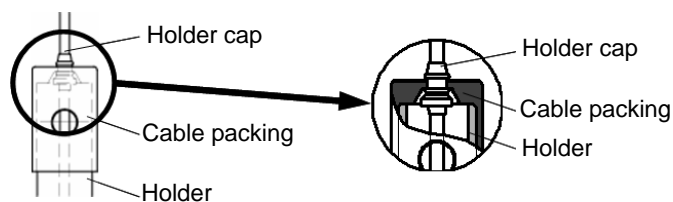
16. **Open the internal solution filling inlet by about one third. Now the electrode is ready for use.**

Open the internal solution filling inlet by about one third.
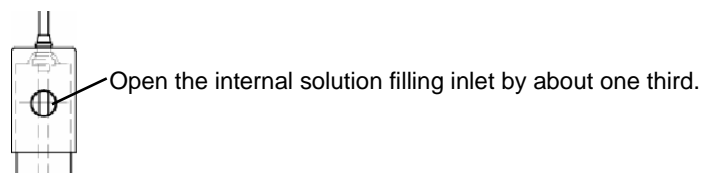
Note

Check the following points:
- **Did you remove the protective cap for the electrode?**
- **Did you remove the tape for the KCl filling inlet on the electrode?**
- **Is the filling inlet on the holder opened by about one third?**

Troubleshooting

When measurements fail

Problems	Causes or possibilities	Remedies
The measurement readout is unstable.	Bubbles stick to the electrode.	Do not allow bubbles to appear in the measurement liquid.
	Bubbles appear because the flow rate is too fast.	Control the flow rate.
	The level of the measuring solution has changed, and thus the area of the electrode that contact with liquid has changed.	Install the instrument in a way that the level of the measuring solution does not change.
	Rapid changes in liquid temperature.	Install the instrument in a place where liquid temperature does not change drastically.
	Screws of the terminal block are loose.	Tighten them securely.
	Insulation of the terminal block has been weakened.	● Drain the moisture of the terminal block. ● Clean the terminal block.
Abnormal value is displayed.	The electrode is stained.	Wash the electrode.
	The electrode is not soaked in the sample liquid.	Install the instrument in a way that the level of the measuring solution does not change.
	Disconnection or short circuit of the electrode cable.	Check the electrode cable.
	Loose connection with the terminal block.	Check the terminal block.
Response is slow.	The flow rates is slow.	Increase the flow rate.
	The uneven concentration of the measuring solution (when a tank has been installed).	● Stir the sample well. ● Install it in a place where the concentration is even.
The instrument cannot be turned ON.	The power supply voltage is out of the rated voltage range.	Check the power supply voltage.
	Wiring mistake.	Check the wiring.
	Internal error of the instrument.	Contact HORIBA Advanced Techno.

Out of the measurement range

When the pH measurement value is out of the measurement range (less than 0.00 or more than 14.0), "oF" is displayed on the sub-display with blinking.
If that happens, follow the instructions given below.

Code	Causes or possibilities	Remedies
oF (out of the measurement range)	The electrode is not soaked into the sample liquid.	Set the electrode in a way that it may be soaked in the sample liquid even if the level of the sample liquid changes.
	The protective cap of the electrode is placed on.	Remove the protective cap.
	● Wrong wiring for the electrode cable Especially, suspect disconnection of the G and R lines. ● Wrong wiring for the junction cable.	Check if screws are loose or the wiring is wrong with the terminal block on the back of the instrument or the one of the relay box.

Error code

The instrument is equipped with the function to display various error codes.
Error codes are shown on the sub-display in a blinking state.

■ Description of error codes

Error code		Error	Description	Occurrence	Contact output
E-11	Error	Response speed error	Response of the pH electrode is slow at the time of standard solution calibration.	At the time of calibration [*1]	None [*2]
E-12	Error	Electrode sensitivity error	Sensitivity of the pH electrode is low at the time of the standard solution calibration.		
E-13	Error	Asymmetry potential error	The electromotive force (asymmetry potential) of pH 7 is large at the time of standard solution calibration.		
E-14	Error	Standard solution error	The standard solution is not the specified one.		
E-15	Error	Calibration solution temperature error	The temperature is 55°C or more in pH 10 solution.		
E-21	FAIL	Temperature sensor disconnected	The lead of the temperature sensor is broken.	At the time of measurement and calibration [*1]	Yes [*3]
E-22	FAIL	Temperature sensor short-circuited	The lead of the temperature sensor has been short-circuited.		
E-23	Error	Out of the temperature compensation range	The measured temperature is 110°C or more.		
E-24	Error	Out of the temperature compensation range	The measured temperature is 0°C or less.		
E-90	FAIL	System error	Initialization error	System error	Yes
E-91	FAIL	System error	The content of the memory such as set values and calibration values has been lost.		
E-92	FAIL	System error	Malfunction of the A/D converter.		

*1: You can restart calibration in the cases of E-11 to E-15, but not in the cases of E-21 to E-24.
   Take necessary measures in accordance with " Remedies for error codes " (page 59).

*2: The contact output is not activated even if the target of the contact output has been set to Err.

*3: Although E-21 and E-22 can happen during calibration, the contact output will not be activated.

— Tip —
● **Errors and FAILs can be output as an anomaly by setting the basic setup items.**
● **If any error code is displayed, the transmission output is preset to the value just before the error happens.**

■ Remedies for error codes

When an error code is displayed, take necessary actions in accordance with the table below.

Error code	Causes or possibilities	Remedies
E-11 (Response speed error)	● The electrode is stained. ● The electrode has been dry for a long time.	Wash the electrode. Response becomes slow when the glass membrane is dry. Soak the electrode in water all day and night, and perform the standard solution calibration once again.
	Temperature difference between the sample liquid and standard solution is large.	Perform the standard solution calibration after the temperature of the temperature compensation element of the electrode has been stabilized.
E-12 (Electrode sensitivity error)	The electrode is stained.	Wash the electrode.
	The glass electrode has been cracked.	Replace it if it is damaged.
	● Electrode internal solution error. ● Shortage of the internal solution.	For the internal solution refill type, replenish the internal solution if there is shortage in the quantity of the solution.
E-13 (Asymmetry potential error)	● Discoloration of the internal solution. ● Contamination of the internal solution.	● For the internal solution no-refill type, replace the electrode if no white powder is seen in the solution. ● Replace the internal solution entirely with a new one if the internal solution has been discolored or deteriorated.
	Anomaly in or deterioration of the pH standard solution.	● Perform calibration with a fresh standard solution if you are using an old one.
E-14 (Standard solution error)	Lack of pH difference (less than pH 2).	● Use a proper standard solution.
	Defect of the electrode.	
E-15 (Calibration solution temperature error)	Temperature is 55°C or more in pH 10 standard solution.	Lower the solution temperature.
E-21 (Temperature sensor disconnected)	Resistance error between T and T of the electrode. 350 Ω: 320 Ω to 392 Ω 500 Ω: 450 Ω to 590 Ω 6.8 kΩ: 6.2 kΩ to 7.7 kΩ 1 kΩ: 1 kΩ to 1.3 kΩ 10 kΩ: 9.1 kΩ to 11.2 kΩ	The electrode is defective if the resistance value is out of the ranges shown on the left. Replace it with a new one.
	Wrong wiring of the electrode cable or junction cable.	Check if the wiring is open between T and T.
E-22 (Temperature sensor short-circuit)	Resistance error between T and T of the electrode.	Refer to the section on E-21.
	Wrong wiring of the electrode cable or junction cable.	Check if the wiring is short-circuited between T and T.
E-23 (Out of temperature compensation range error)	Measured liquid temperature error (110°C or more).	Lower the temperature of the measured liquid to within the working temperature range of the electrode.
	Resistance error between T and T of the electrode.	Refer to the section on E-21.
E-24 (Out of temperature compensation range error)	Measured liquid temperature error. (0°C or less)	Lower the temperature of the measured liquid to within the working temperature range of the electrode.
	Resistance error between T and T of the electrode.	Refer to the section on E-21.

Error code	Causes or possibilities	Remedies
E-90 E-91 E-92(System error)	System error in the instrument.	Turn the power OFF and turn it ON again. If the system error persists even after restarting the instrument, contact HORIBA Advanced Techno.

Troubleshooting for pH electrode problems

If any problem is found in the HORIBA Advanced Techno pH electrode, check your electrode taking actions described in the table below. If the problem persists even after checking the electrode using the instructions below, consult with HORIBA Advanced Techno.

Possible causes \ Problems	Cannot perform calibration.	The readout is unstable.	Response is slow.	The readout does not change.	The internal solution runs out soon.	Foreign substance is found inside the reference electrode.	The duration of electrode life is short.	Actions to take
Crack in the glass membrane/reference electrode.	✓	✓	-	✓	✓	✓	-	Replace the electrode. It is unusable.
The glass membrane is stained.	✓	✓	✓	✓	-	-	-	Wash it with tap water or the like.
The glass membrane is dry.	✓	✓	✓	-	-	-	-	Use it after soaking it in water for about one hour.
The liquid junction is dirty or clogged.	✓	✓	-	✓	-	-	-	Wash it with tap water or the like.
Shortage of the reference electrode internal solution.	✓	✓	✓	-	-	✓	-	Replenish the reference electrode internal solution.
Conductivity of the sample is less than 100 µS/cm.	-	✓	✓	-	-	-	-	Cannot measure. Consult with HORIBA Advanced Techno.
The cap has not been removed.	✓	✓	✓	✓	-	-	-	Remove the cap before use.
The internal solution filling port has not been opened.	✓	✓	-	-	-	✓	-	Open the internal solution filling port.
The glass membrane was damaged at the time of washing.	✓	-	-	-	-	-	✓	Wash the glass membrane with sponge or the like so that it may not get damaged.
Any terminal has not been connected securely.	✓	✓	-	-	-	-	-	Connect a cable specified by HORIBA Advanced Techno referring to the instruction manual.
The liquid junction (ceramics) has been worn out.	-	-	-	-	✓	✓	-	Replace it with the sleeve type, or replace the electrode earlier.
An old calibration solution is being used.	✓	-	-	-	-	-	-	Use a new calibration solution.
The sample has been contaminated with hydrofluoric acid.	✓	-	✓	✓	-	-	✓	Glasses dissolve with hydrofluoric acid. It is recommended to replace it earlier.
Backflow of the sample.	✓	✓	-	-	-	✓	✓	Replace the reference electrode internal solution or the electrode.

Data

Specifications

Product name	Pulse proportional control pH meter for industrial use
Model	HP-480PL
Measuring range	0 pH to 14 pH: 0.01 pH resolution Temperature 0°C to 100°C: 1°C resolution (selectable display)
Transmission output	4 mA to 20 mA DC, input/output isolated type Maximum load resistance 900 Ω
Transmission output range	Free
Repeatability and linearity	±0.05 pH, ±0.08 mA (for transmission output range of 0 pH to 14 pH)

Contact output	Outputs: 2 points
	Alarm contact output (R1 and R2)
	    Contact type: relay contact, SPDT (1c)
	    Contact rating: 240 V AC, 0.3 A and 30 V DC, 0.3 A (resistance load)
	    Contact function: selectable from upper/lower limit operation (ON/OFF control), alarm, and maintenance.

Control actions	ON/OFF control	• Upper/lower limit setting range: 0.00 pH to 14.00 pH • Control width: 0.00 to 4.00 pH (±0.00 pH to ±2.00 pH)
	Pulse proportional control	• Upper/lower limit setting range: 0.00 pH to 14.00 pH • Maximum number of pulse output: Freely selectable in the range of 1 SPM to 360 SPM. • Proportional band: 0.01 pH to 4.00 pH • Control output shift function: 0% to 50%

Calibration function	Two-point automatic calibration or manual calibration
	Two-point automatic calibration: with automatic validation of the electrode characteristics.
	    Types of standard solution: pH 2, pH 4, pH 7, pH 9 and pH 10 (JIS)
	    Combination of standard solutions: pH 7 and one of the others
	    Manual calibration: Freely selectable, but the difference should be over 2 pH.
	Temperature calibration (one point)

Transmission output hold feature	• Previous value hold • Optional value hold • Continuous Selectable from the above (However, only the previous value hold is available in the maintenance mode).

Self-diagnosis function	• Calibration function
	  Asymmetry potential error, sensitivity error, response speed error and standard solution error.
	• Electrode self-diagnosis
	  Temperature sensor short-circuit and temperature sensor disconnection.
	• Outside of the measuring range
	• Converter error

Temperature compensation element	Selectable from compensation ON (350 Ω (25°C), 500 Ω (25°C), 1 kΩ (0°C), 6.8 kΩ (25°C) and 10 kΩ (25°C)) and compensation OFF
Temperature-compensated range	0°C to 100°C

Ambient temperature	−5°C to 45°C	
Relative humidity	20% to 85% (without dew condensation)	
Storage temperature	−25°C to 65°C	
Power supply	Rated voltage 100 V to 240 V AC, 50 Hz/60 Hz, 10 VA (max.)	
Structure	Indoor-use panel installation type Panel case: ABS, Terminal: PBT Panel: water proof structure	
Protective structure	Panel: IP65 (IEC60529, JIS C0920) Rear case: IP20, Terminal: IP00 Class II device (IEC61010-1) Pollution level 2 (IEC61010-1)	
Conforming standards	FCC Rule	FCC Part15
External dimensions	48(W) x 96 (H) x 115 (D) mm Case depth: approx. 105 mm	
Mass	Approx. 400 g	

Parts list

■ **Options**

	Application	Product name	Main materials	Measurement solution conditions※			Interface
				Temperature (°C)	Pressure	Flow rate	
Immersion type	General use type	CH-101	PP	−5 to 80	Atmospheric pressure	2 m/s or less (flow velocity)	-
	Tip replaceable type	HIBP	PP	−10 to 80			
Flow type	General use type	CF-251	PP	−5 to 80	Atmospheric pressure	0.3 L/min to 10 L/min	JIS 10K 25A（inlet/outlet）
	General use internal solution tank mounted type	CF-251-T	PP				
	General use pressurized type	CF-301	PP		0.3 MPa		
	Tip replaceable type	CF-501	PP		Atmospheric pressure		

*: Usage conditions vary according to the combination of electrodes. Refer to the specifications document of each product for details.

■ Consumables

Part names	Models	Specifications
Calibration set	S-1	pH 4 or 7 standard solution (500 mL): 1, KCl Internal solution (250 mL): 2
	T-1	pH 7 or 9 standard solution (500 mL): 1, KCl Internal solution (250 mL): 2
	L-1	pH 4 or 7 standard solution (500 mL): 1, KCl Internal solution (250 mL): 2, Beaker (500 mL) with a cap: 3
	M-1	pH 7 or 9 standard solution (500 mL): 1, KCl Internal solution (250 mL): 2, Beaker (500 mL) with a cap: 3
	N-1	pH 4 or 7 standard solution (500 mL): 1, Beaker (500 mL) with a cap: 3
	P-1	pH 4 or 7 phthalic acid salt standard powder: 10 bags, KCl Internal solution (250 mL): 2, Beaker (500 mL) with a cap 3
pH standard solution	#100-4	pH 4 standard solution (500 mL, Accuracy ±0.02 pH)
	#100-7	pH 7 standard solution (500 mL, Accuracy ±0.02 pH)
	#100-9	pH 9 standard solution (500 mL, Accuracy ±0.02 pH)
pH standard powder	#150-4	Standard powder for pH 4 (Accuracy ±0.05 pH): 10 bags
	#150-7	Standard powder for pH 7 (Accuracy ±0.05 pH): 10 bags
	#150-9	Standard powder for pH 9 (Accuracy ±0.05 pH): 10 bags
Reference electrode internal solution	#300	Reference electrode internal solution 250 mL, *3.3 mol/L KCl solution
Powder for the reference electrode internal solution	#350	KCl Powder 500 g

Type		Product name	Usable temperature range (°C)	Useable pressure range (MPa)	Combined holder
Standard	Dome type pH electrode	6108-50B	−10 to 100	0 to 0.6	CH-101, CF-251, CF-301
	Sleeve type pH electrode	6109-50B	−10 to 80	0 to 0.03	CH-101, CF-251
	Plastic composite pH electrode (for Hydrofluoric acid containing sample)	6151-50B	−10 to 60	0 to 0.2	CH-101, CF-251, CF-301
	Plastic composite pH electrode (for Highly alkalic sample)	6152-50B			
	Dome type pH electrode (gel)	6108G-50B	−10 to 100	0 to 0.6	Specialized pressurized holder
Tip replaceable	pH electrode (Tip replaceable)	6174-50B	−10 to 100	0 to 0.03	HIBP, HIBS, CF-501
	pH electrode HF (Tip replaceable)	6171-50B	−10 to 60		
	pH electrode Alkalic (Tip replaceable)	6172-50B			
	pH electrode Oil (Tip replaceable)	6173-50B			

Consumables that come with the product.

Fixture	−	The part attached at the time of the product purchase.
Terminal cover	−	
Gasket	−	

Disposing of the instrument

When disposing of this instrument, be sure to follow the laws and regulations stipulated by your national and local governments.

The parts of this instrument are made of the following materials.
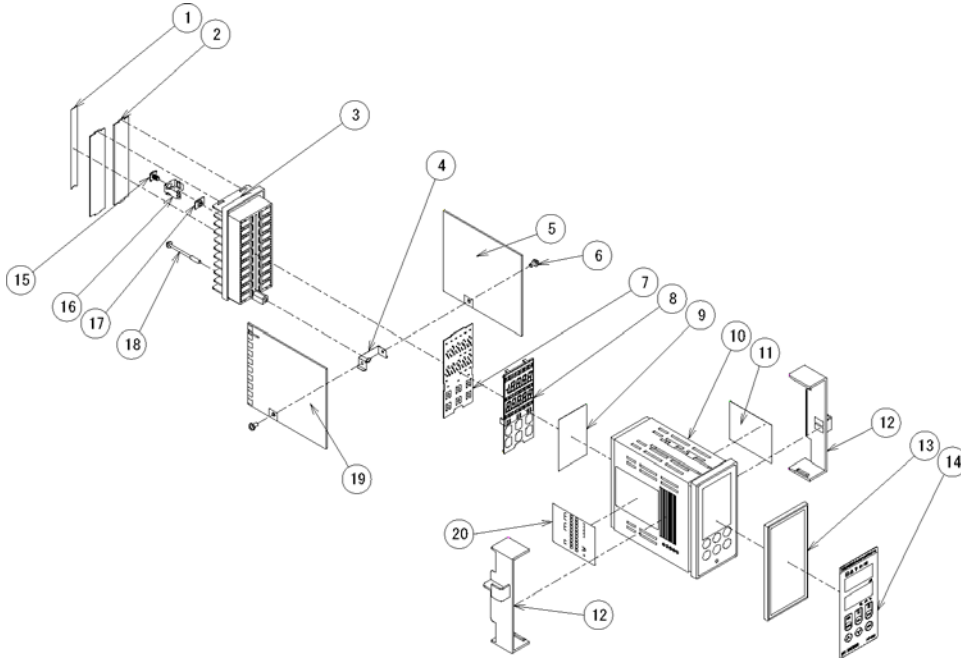
No.	Names	Materials	No.	Names	Materials
1	Terminal label	PET	11	Rating nameplate	PP
2	Terminal cover	PC	12	Case stopper	POM-N
3	Terminal block	PBT	13	Gasket	EPDM
4	F.G. bracket	C5210	14	Panel sheet	PET
5	PIO board	Printed board	15	Terminal label	PET
6	Pan-head tapping screw	S-ZN3	16	Terminal spring	C5210
7	MTH board	Printed board	17	Terminal retainer	C2680
8	LED panel	PPE	18	Case screw	Carbon steel
9	Diffuser sheet	PET	19	ANL board	Printed board
10	Case	ABS	20	Terminal nameplate	PET

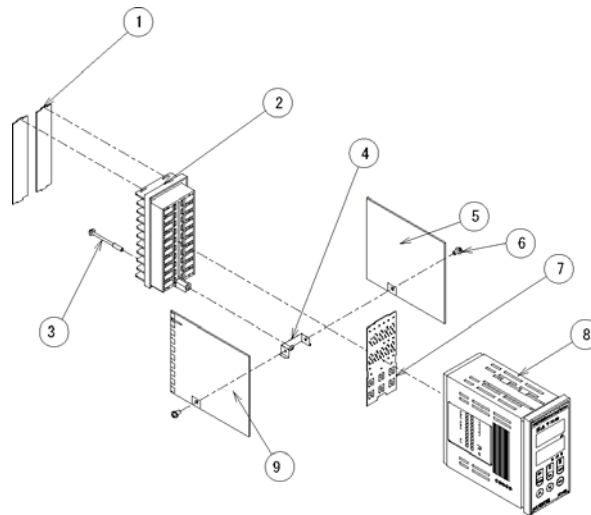● **Disposing of the printed boards after classifying their parts**

When it is required to classify the parts of the printed boards before disposing of them, disassemble them referring to the figure shown below.

● **Tool**

Phillips screwdriver

● **How to disassemble**

⚠ WARNING
Electric Shock   Make sure that no electric power is supplied to the instrument before starting this work.

1. **Make sure that no electric power is supplied to the instrument, and then remove terminal cover (1).**
2. **Disconnect all the wires to terminal block (2).**
3. **Unscrew the case screw located at the center of the bottom of terminal block (2).**
4. **Pull out terminal block (2) from the case.**
   The terminal block will come out with the printed boards attached.
5. **Pull out printed boards (5), (7), and (9) from terminal block (2).**
6. **Unscrew two pan-head tapping screws (6) to detach the F.G. bracket connecting printed boards (5) and (9).**

HORIBA Advanced Techno

http://www.horiba-adt.jp