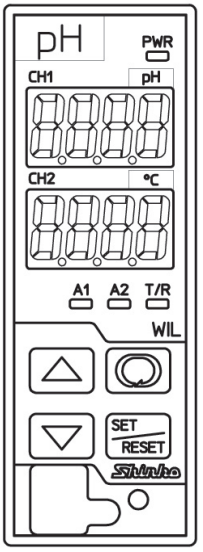
Plug-in Type
Digital Indicating pH Meter
WIL-102-PH
Instruction Manual



Shinko

Preface

Thank you for purchasing our WIL-102-PH, Plug-in Type Digital Indicating pH Meter.
This manual contains instructions for the mounting, functions, operations and notes when operating the WIL-102-PH. To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
To prevent accidents arising from the misuse of this instrument, please ensure the operator receives this manual.

Characters Used in This Manual

Indication	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication	A	b	c	d	E	F	G	H	I	J	K	L	M
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	S	T	U	V	W	X	Y	Z
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

⚠ Caution

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow all of the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed on a DIN rail within a control panel. If it is not, measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos Co., Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

Safety Precautions **(Be sure to read these precautions before using our products.)**

The safety precautions are classified into 2 categories: “Warning” and “Caution”.
Depending on the circumstances, procedures indicated by ⚠ Caution may result in serious consequences, so be sure to follow the directions for usage.

⚠ Warning Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.

⚠ Caution Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

⚠ Warning

- To prevent an electrical shock or fire, only Shinko or other qualified service personnel may handle the inner assembly.
- To prevent an electrical shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or other qualified service personnel.

⚠ SAFETY PRECAUTIONS

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for measuring equipment. Verify correct usage after purpose-of-use consultation with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Proper periodic maintenance is also required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

⚠ Caution with Respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument. In the case of resale, ensure that this instrument is not illegally exported.

PRECAUTIONS

1. Installation Precautions

⚠ Caution

This instrument is intended to be used under the following environmental conditions (IEC61010-1):

- Overvoltage category Ⅱ, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85 %RH
- No large capacity electromagnetic switches or cables through which a large current is flowing.
- No water, oil, chemicals or the vapors of these substances can come into direct contact with the unit.
- If the WIL-102-PH is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control panel – must be kept under 50℃. Otherwise the life of electronic parts (especially electrolytic capacitors) of the unit will be shortened.

Note: Do not install this instrument on or near flammable material even though the case of this instrument is made of flame-resistant resin.

2. Wiring Precautions

⚠ Caution

- Do not leave wire remnants in the instrument, as they could cause a fire or a malfunction.
- Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the WIL-102-PH.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw may be damaged.
- This instrument does not have a built-in power switch, circuit breaker and fuse.
  It is necessary to install a power switch, circuit breaker and fuse near the instrument.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
- Do not apply a commercial power source to the sensor which is connected to the input terminal nor allow the power source to come into contact with the sensor.
- Use the pH Combined Electrode Sensor in accordance with the sensor input specifications of the WIL-102-PH.
- Keep the input wires and power lines separate.

Note about the pH Combined Electrode Sensor Cable

The pH Combined Electrode Sensor cable is a highly-insulated (electrical) cable. Please handle it with utmost care as follows.

- Do not allow terminals and socket of the pH Combined Electrode Sensor cable to come in contact with moisture or oil of any kind. Likewise, ensure fingers are clean, otherwise the insulation will deteriorate, resulting in unstable indication.
  Be sure to keep the cable dry and clean at all times.
  If the cable is stained, clean it with alcohol, and dry it completely.
- For calibration or electrode checking/replacement, the pH Combined Electrode Sensor cable should be wired with sufficient length.
- Keep the pH Combined Electrode Sensor cable and junction cable away from electrical devices, such as motors or their power lines from which inductive interference emanates.

Connection

The pH Combined Electrode Sensor cable has the following terminals.

Code	Terminal
G	Glass electrode terminal
R	Reference electrode terminal
T, T	Temperature compensation electrode terminals (Cu500)
A, B	Temperature compensation electrode terminals [Pt100 (2-wire), Pt1000]
A, B, B	Temperature compensation electrode terminals [Pt100 (3-wire)]
E	Shield wire terminal

For the pH Combined Electrode Sensor with No Temperature Compensation, T, T or A, B, B cables are not available.

E cables are available depending on the sensor type.

3. Operation and Maintenance Precautions

⚠ Caution

- Do not touch live terminals. This may cause an electrical shock or problems in operation.
- Turn the power supply to the instrument OFF when retightening the terminal or cleaning.
  Working on or touching the terminal with the power switched ON may result in severe injury or death due to electrical shock.
- Use a soft, dry cloth when cleaning the instrument.
  (Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, be careful not to put pressure on, scratch or strike it with a hard object.

Contents

1. Model

1.1 Model

W I L - 1 0	2	-PH		, □□□			
Input Points	2				2 points		
Input		PH			pH Combined Electrode Sensor	Pt spec (*1)	Pt1000
							Pt100
						Cu spec (*1)	Cu500/25℃
Power Supply Voltage					100 to 240 V AC (standard)		
			1		24 V AC/DC (*2)		
Option				EVT	A□□ output (A11, A12, A21, A22)		
				TA	Transmission output 1 (*3)		
				TA2	Transmission output 1, Transmission output 2		

(*1) This input temperature specification was specified at the time of ordering.

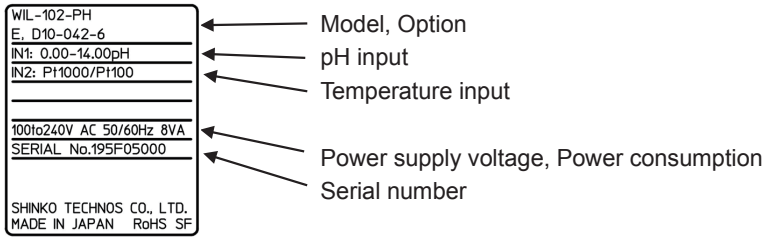
(*2) Power supply voltage 100 to 240 V AC is standard.
When ordering 24 V AC/DC, enter “1” in Power Supply Voltage after “PH”.

(*3) If the TA option is ordered, the EVT option (A1 output only) will be automatically added.

1.2 How to Read the Model Label

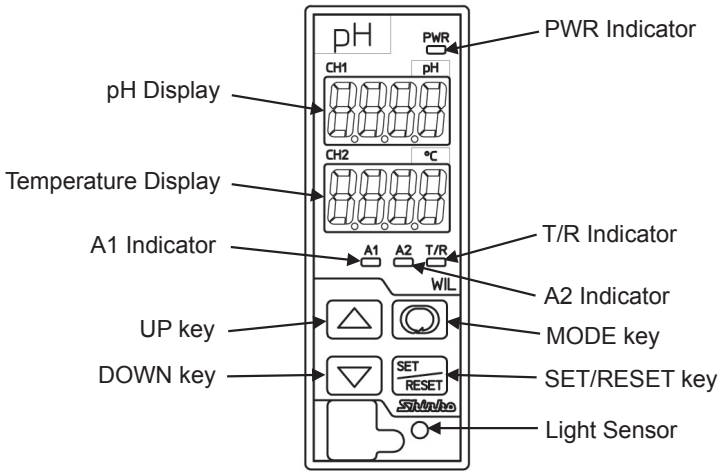
The model label is attached to the left side of the case.

• Label on the left side of the case



(Fig. 1.2-1)

2. Name and Functions of Instrument



(Fig. 2-1)

Displays

pH Display	pH or characters in setting mode are indicated in red. Indications differ depending on the selections in [Display selection (p.32)].
Temperature Display	Temperature or values in setting mode are indicated in red. Indications differ depending on the selections in [Display selection (p.32)].

Action Indicators

PWR Indicator	When power supply to the instrument is turned ON, the yellow LED is lit.
A1 Indicator	When A1 output (Contact output 1) is ON, the red LED lights. (Turns OFF if TA2 option is added.)
A2 Indicator	When A2 output (Contact output 2) is ON, the yellow LED lights. (Turns OFF if TA option or TA2 option is added.)
T/R Indicator	The yellow LED lights during Serial communication TX output (transmitting).

Keys

UP key	Increases the numeric value.
DOWN key	Decreases the numeric value.
MODE key	Selects a setting group.
SET/RESET key	Switches the setting modes, and registers the set value.

Light Sensor	Automatically measures and controls brightness of the pH Display, Temperature Display and Action indicators.

⚠ Notice

When setting the specifications and functions of this instrument, connect mains power cable to terminals 13 and 14 first, then set them referring from “6. Outline of Key Operation and Setting Groups” to “8. Setup (pp.16 to 37)” before performing “3. Mounting to the Control Panel (p.9)” and “5. Wiring (p.12)”.

3. Mounting to the Control Panel

3.1 Site Selection

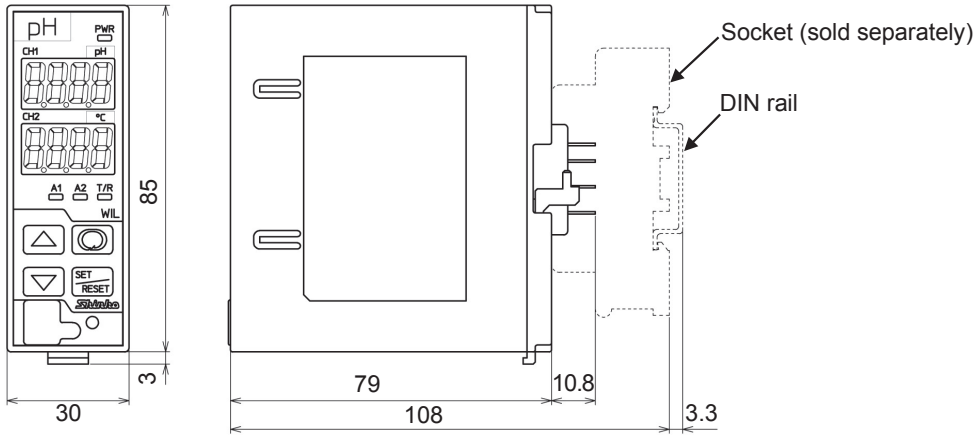
> **⚠ Caution**
>
> Use within the following temperature and humidity ranges.
> Temperature: 0 to 50℃ (32 to 122℉) (No icing), Humidity: 35 to 85 %RH (Non-condensing)
> If the WIL-102-PH is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control panel – must be kept under 50℃. Otherwise the life of electronic parts (especially electrolytic capacitors) of the unit will be shortened.

This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly
- An ambient non-condensing humidity of 35 to 85 %RH
- No large capacity electromagnetic switches or cables through which a large current is flowing
- No water, oil, chemicals or the vapors of these substances can come into direct contact with the unit

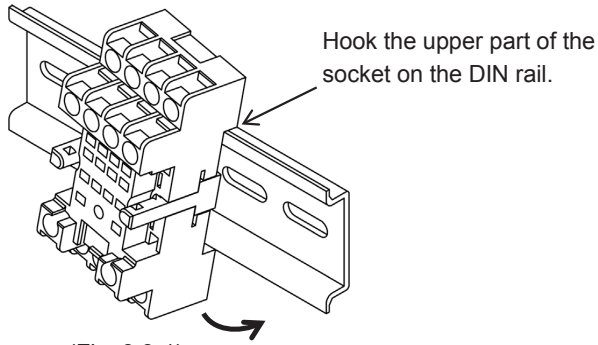
3.2 External Dimensions (Scale: mm)



(Fig. 3.2-1)

3.3 Mounting

(1) Hook the upper part of the socket on the DIN rail, and mount it (A clicking sound is heard).

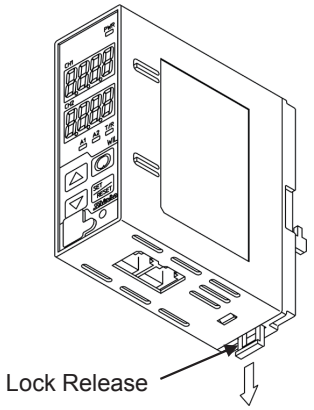


(Fig. 3.3-1)

⚠ Caution

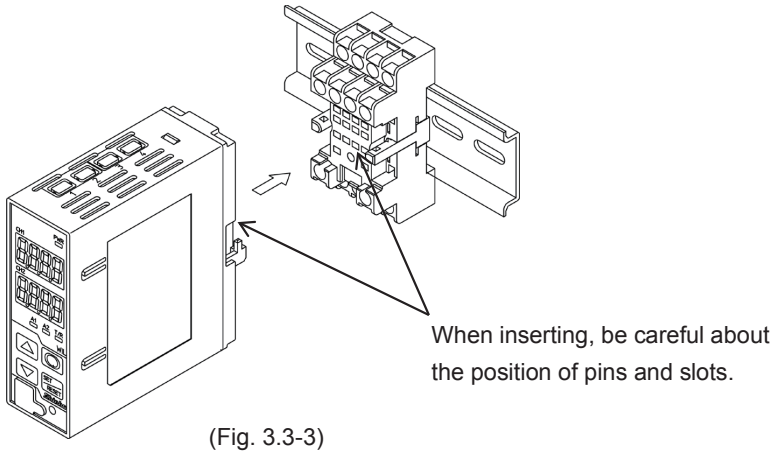
Before inserting the WIL-102-PH into the socket, wire the unit while referring to Section “5. Wiring” (p.12).

(2) Check that the Lock Release has been lowered.



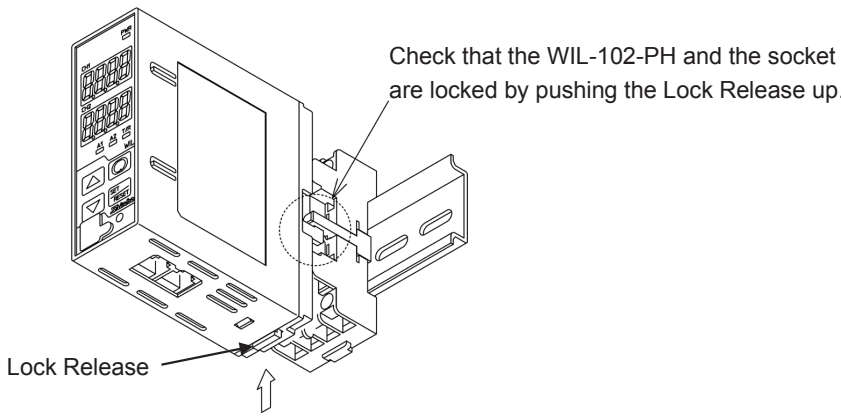
(Fig. 3.3-2)

(3) Insert the WIL-102-PH into the socket.



(Fig. 3.3-3)

(4) Fix the WIL-102-PH and the socket by pushing the Lock Release up.

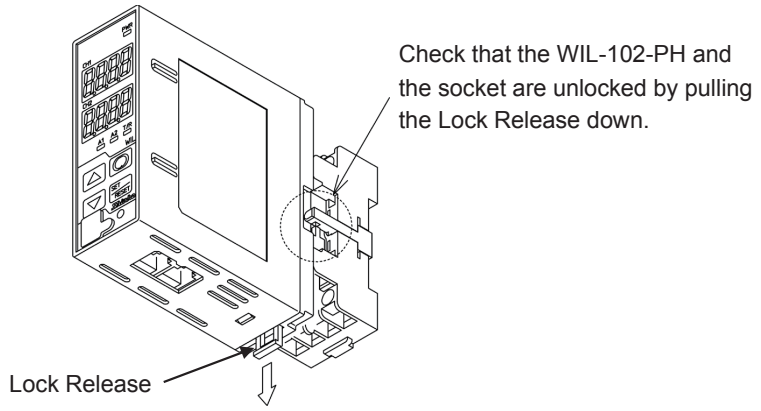


(Fig. 3.3-4)

4. Removal

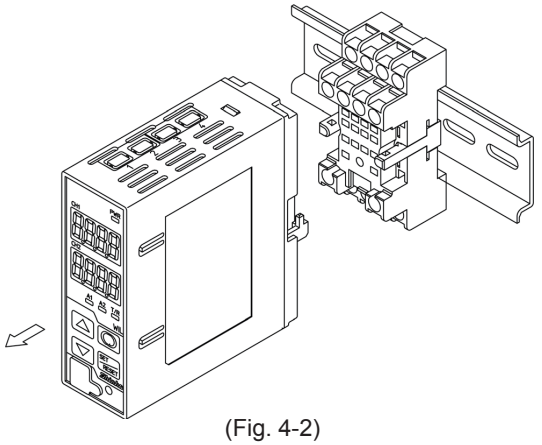
(1) Turn the power supply to the unit OFF.

(2) Pull the Lock Release down, and release the WIL-102-PH from the socket.



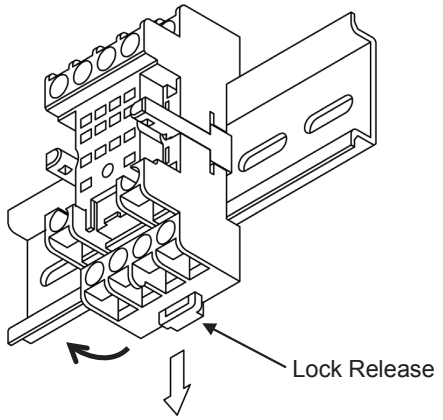
(Fig. 4-1)

(3) Separate the WIL-102-PH from the socket.



(Fig. 4-2)

(4) Remove the socket from the DIN rail by pulling the socket Lock Release (at the bottom of the socket) down.



(Fig. 4-3)

5. Wiring

⚠ Warning

Turn the power supply to the instrument off before wiring or checking.
Working on or touching the terminal with the power switched on may result in severe injury or death due to electrical shock.

⚠ Caution

- Do not leave wire remnants in the instrument, as they could cause a fire or a malfunction.
- Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the unit.
- Tighten the terminal screw using the specified torque. If excessive force is applied to the screw when tightening, the terminal screw may be damaged.
- This instrument does not have a built-in power switch, circuit breaker and fuse.
  It is necessary to install a power switch, circuit breaker and fuse near the instrument.
  (Recommended fuse: Time-lag fuse, rated voltage 250 V AC, rated current 2 A)
- For a 24 V AC/DC power source, do not confuse polarity when using direct current (DC).
- Do not apply a commercial power source to the sensor which is connected to the input terminal nor allow the power source to come into contact with the sensor.
- Use the pH Combined Electrode Sensor in accordance with the sensor input specifications of this unit.
- Keep the input wires and power lines separate.

Note about the pH Combined Electrode Sensor Cable

The pH Combined Electrode Sensor cable is a highly-insulated (electrical) cable. Please handle it with utmost care as follows.

- Do not allow terminals and socket of the pH Combined Electrode Sensor cable to come in contact with moisture or oil of any kind. Likewise, ensure fingers are clean, otherwise the insulation will deteriorate, resulting in unstable indication. Be sure to keep the cable dry and clean at all times. If the cable is stained, clean it with alcohol, and dry it completely.
- For calibration or electrode checking/replacement, the pH Combined Electrode Sensor cable should be wired with sufficient length.
  Keep the pH Combined Electrode Sensor cable and junction cable away from electrical devices, such as motors or their power lines from which inductive interference emanates.

Connection

The pH Combined Electrode Sensor cable has the following terminals.

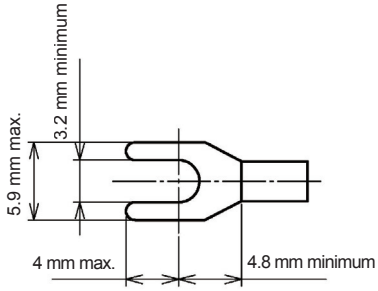
Code	Terminal
G	Glass electrode terminal
R	Reference electrode terminal
T, T	Temperature compensation electrode terminals (Cu500)
A, B	Temperature compensation electrode terminals [Pt100 (2-wire), Pt1000]
A, B, B	Temperature compensation electrode terminals [Pt100 (3-wire)]
E	Shield wire terminal

For the pH Combined Electrode Sensor with No Temperature Compensation, T, T or A, B, B cables are not available.
E cables are available depending on the sensor type.

5.1 Lead Wire Solderless Terminal

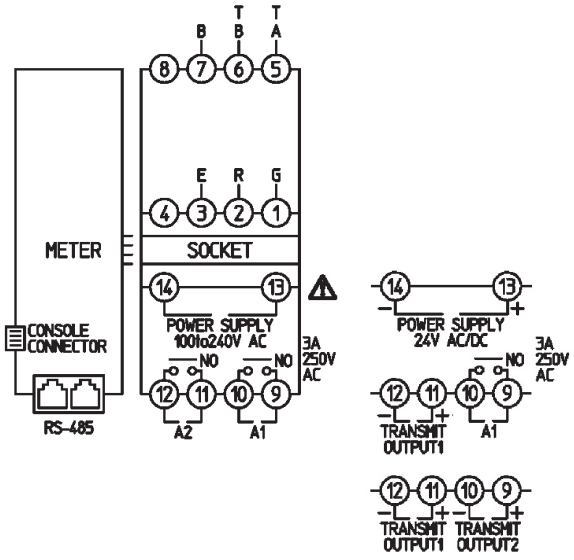
Use a solderless terminal with an insulation sleeve in which an M3 screw fits as follows.
The tightening torque should be 0.63 N•m.

Solderless Terminal	Manufacturer	Model
Y-type	Nichifu Terminal Industries CO., LTD.	TMEV1.25Y-3S

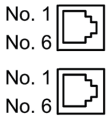


(Fig. 5.1-1)

5.2 Terminal Arrangement



Modular Jack Pin (WIL-102-PH side arrangement)



No. 1	COM
No. 2	NC
No. 3	YB(+)
No. 4	YA(−)
No. 5	NC
No. 6	COM

(Fig. 5.2-1)

G, R: Electrode sensor terminals (①-②)
pH Combined Electrode Sensor

E: Shield wire terminal (③)
pH Combined Electrode Sensor

T, T: Temperature compensation sensor terminals (⑤-⑥)
Temperature element: Cu500 (2-wire)

A, B: Temperature compensation sensor terminals (⑤-⑥)
Temperature element: Pt100 (2-wire), Pt1000

A, B, B: Temperature compensation sensor terminals (⑤-⑥-⑦)
Temperature element: Pt100 (3-wire)

When the EVT option is ordered
A1: A1 output terminals (⑨-⑩)
A2: A2 output terminals (⑪-⑫)

When the TA option is ordered
A1: A1 output terminals (⑨-⑩)
TRANSMISSION OUTPUT1:
Transmission output 1 terminals (⑪-⑫)

When the TA2 option is ordered
TRANSMISSION OUTPUT2:
Transmission output 2 terminals (⑨-⑩)
TRANSMISSION OUTPUT1:
Transmission output 1 terminals (⑪-⑫)

POWER SUPPLY: Power terminals (⑬-⑭)
24 V AC/DC (Enter “1” after the input code.)

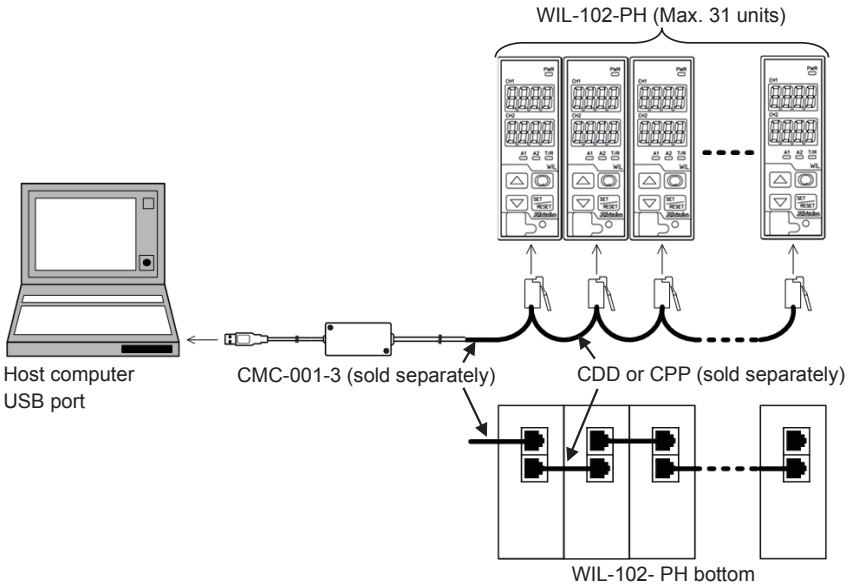
RS-485: Serial Communication modular jack

When no option is ordered, A1, A2, TRANSMIT OUTPUT1 and TRANSMIT OUTPUT2 terminals are not equipped.

5.3 Wire the Communication Line

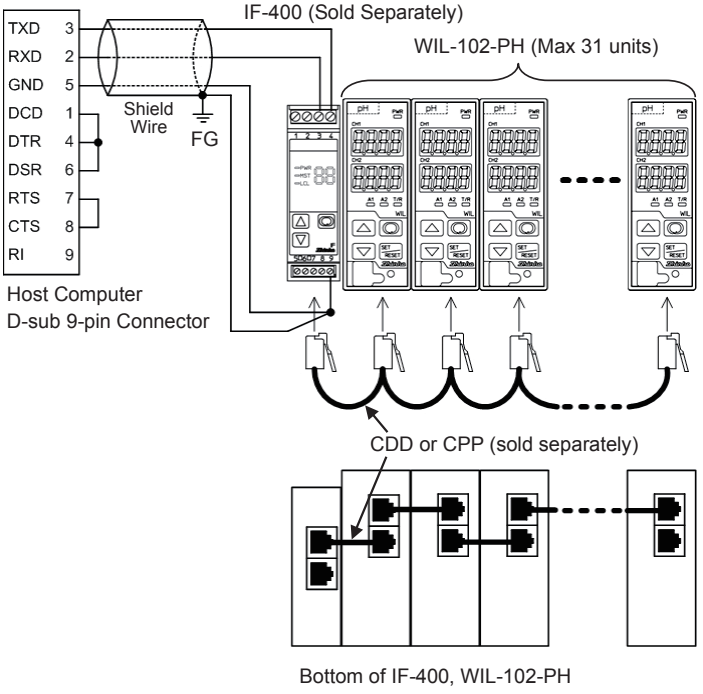
Connect to the modular jack at the bottom of the instrument, using CDD or CPP (sold separately).

• Wiring Example Using USB communication cable CMC-001-3 (sold separately)



(Fig. 5.3-1)

• Wiring Example Using a Communication Converter IF-400



(Fig. 5.3-2)

Shield Wire

Be sure to ground only one end of the shield wire so that current cannot flow to the shield wire.
If both ends of the shield wire are grounded, the circuit will be closed, resulting in a ground loop. This may cause noise.
Be sure to ground the FG.
Recommended cable: OTSC-VB 2PX0.5SQ (made by Onamba Co., Ltd.) or equivalent
(Use a twisted pair cable.)

Terminator (Terminal Resistor)

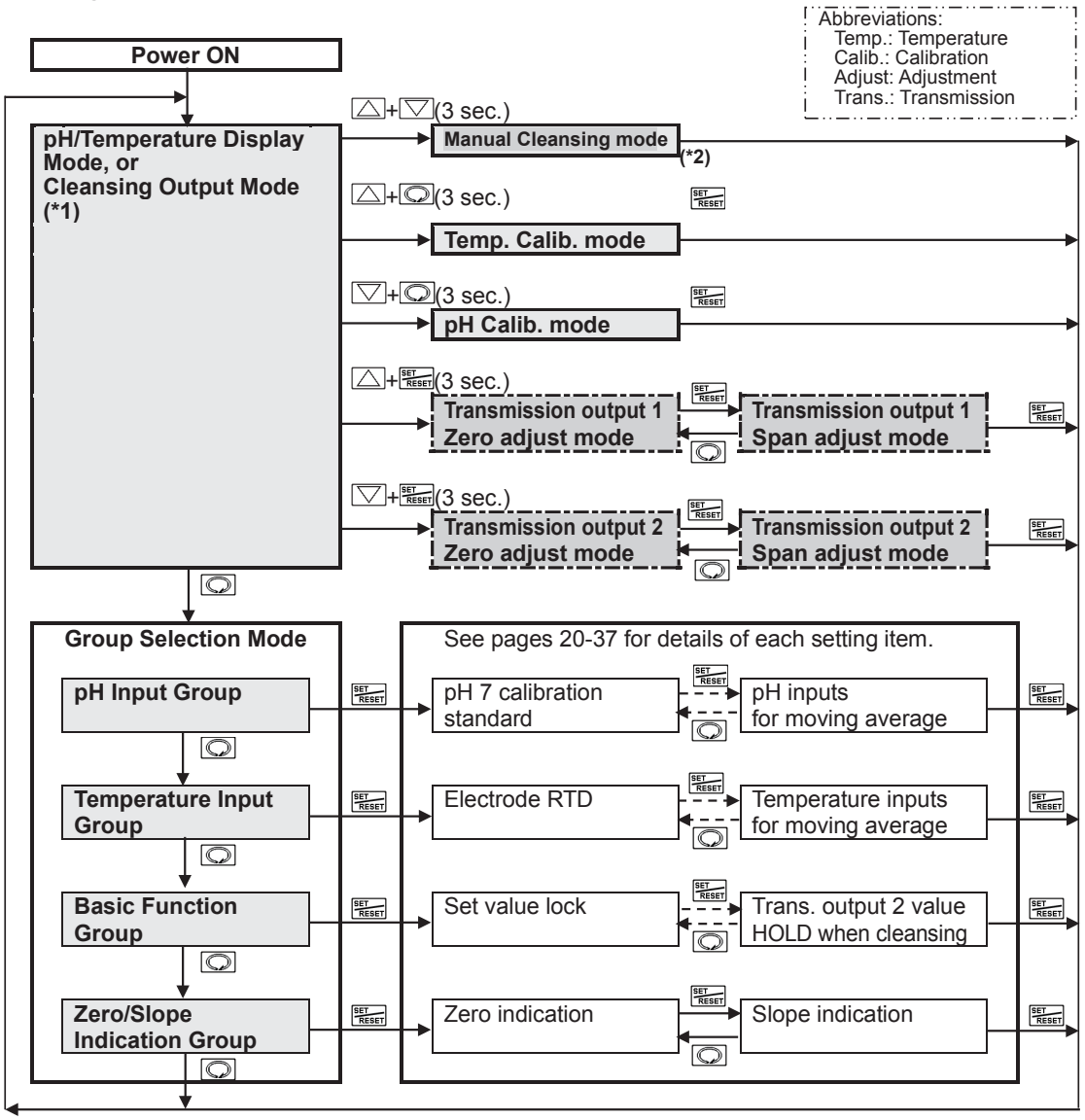
The terminator is mounted at the end of the wire when connecting multiple peripheral devices to a personal computer. The terminator prevents signal reflection and disturbance.
Do not connect a terminator with the communication line because each WIL-102-PH has built-in pull-up and pull-down resistors.
Communication converter IF-400 (sold separately) has a built-in terminal resistor.

6. Outline of Key Operation and Setting Groups

6.1 Outline of Key Operation

Setting items are divided into groups, and group selection has to be made with keypads.
Press the ◎ key in pH/Temperature Display Mode, or Cleansing Output Mode. The unit enters Group Selection mode.
Select a group with the ◎, and press the SET/RESET. The unit enters each setting item.
To set each setting item, use the △ or ▽ key, and register the set value with the SET/RESET key.

6.2 Setting Groups



(*1) During pH/Temperature Display Mode, or Cleansing Output Mode, indicates the item selected in [Display selection (p.32)]. If power is turned ON again, the last mode (pH/Temperature Display Mode, or Cleansing Output Mode) at power OFF will resume.

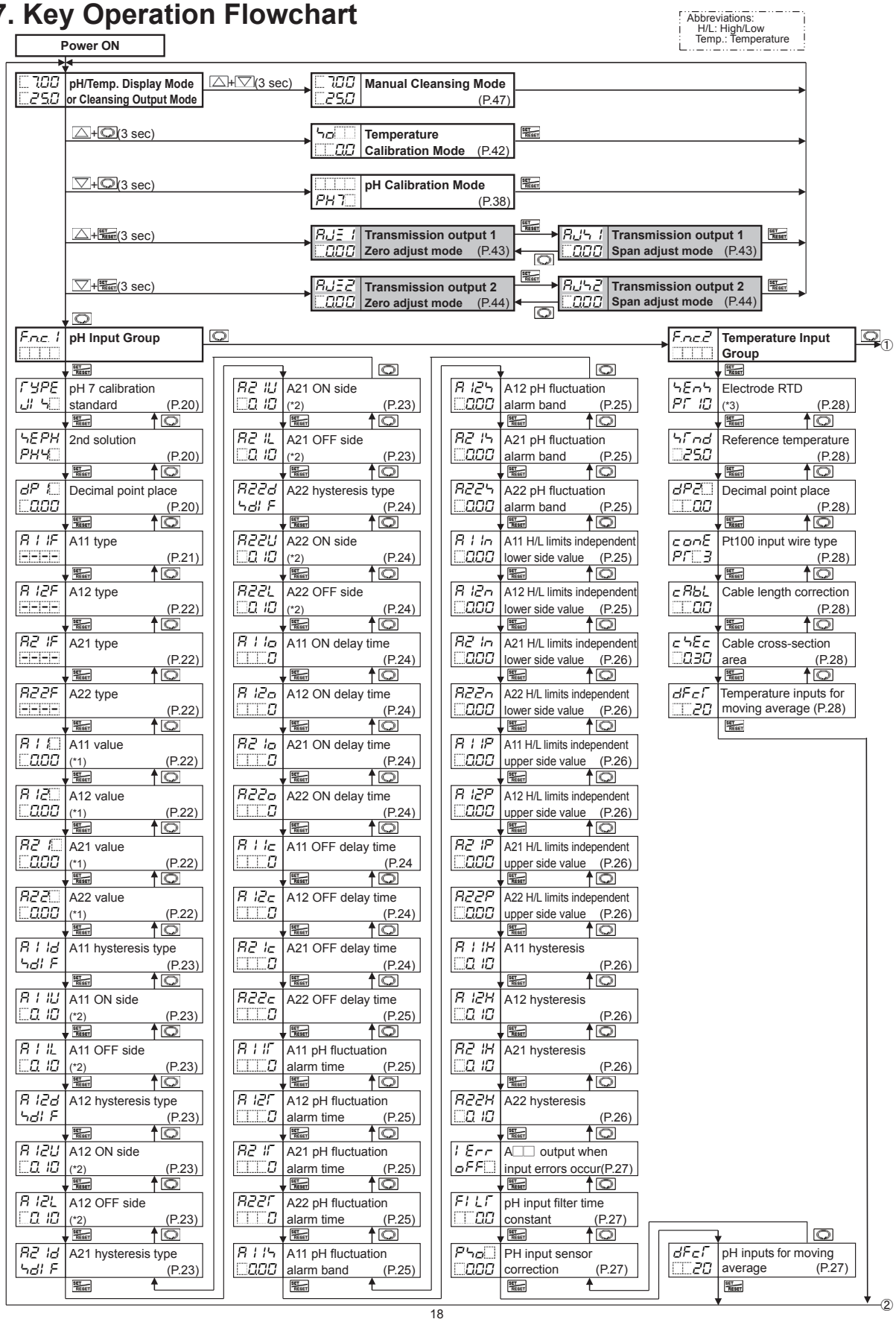
(*2) If cLEO (Cleansing output) is selected in [A11, A12, A21, A22 type], the unit can enter Manual Cleansing mode.
After cleansing action is complete, the unit automatically reverts to Cleansing Output Mode.

Available only when the TA or TA2 option is ordered.

About Key Operation

- △+▽ (3 sec): Press and hold the △ key and ▽ key (in that order) together for 3 seconds. The unit will proceed to Manual Cleansing mode.
- △+◎ (3 sec): Press and hold the △ key and ◎ key (in that order) together for 3 seconds. The unit will proceed to Temperature calibration mode.
- ▽+◎ (3 sec): Press and hold the ▽ key and ◎ key (in that order) together for 3 seconds. The unit will proceed to pH calibration mode.
- △+SET/RESET (3 sec): Press and hold the △ key and SET/RESET key (in that order) together for 3 seconds. The unit will proceed to Transmission output 1 Zero adjustment mode.
- ▽+SET/RESET (3 sec): Press and hold the ▽ key and SET/RESET key (in that order) together for 3 seconds. The unit will proceed to Transmission output 2 Zero adjustment mode.
- ◎ or SET/RESET: Press the ◎ or SET/RESET key. The unit will proceed to the next setting item, illustrated by an arrow.
- SET/RESET or ◎ : Press the SET/RESET or ◎ key multiple times until the desired setting mode appears.
- To revert to pH/Temperature Display Mode, or Cleansing Output Mode, press and hold the ◎ key for 3 seconds while in any mode.

7. Key Operation Flowchart



● **About Setting Items**

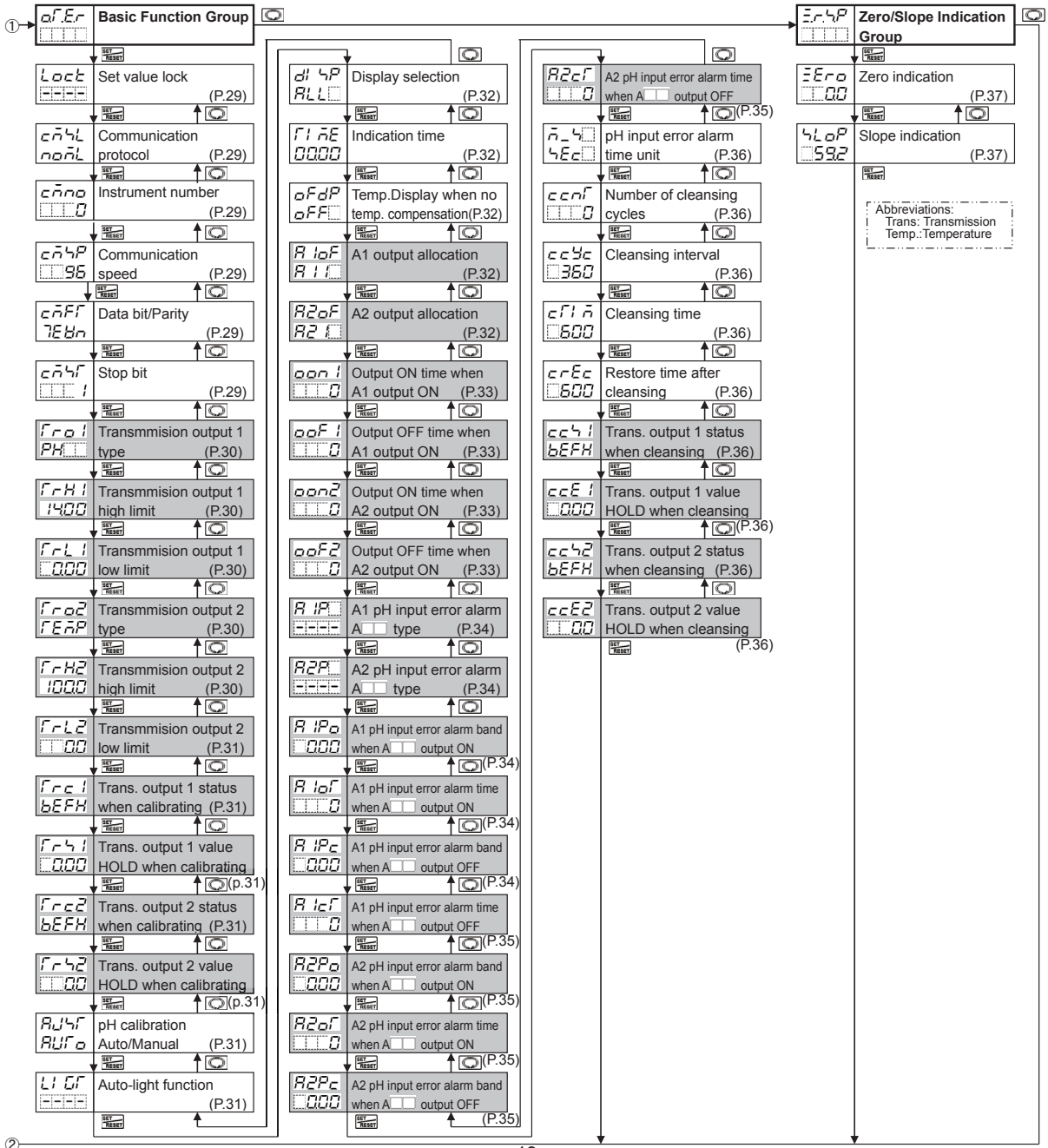
TYPE JI 4	pH 7 calibration standard (P.20)
Tro1 PH	Transmission output 1 type (P.30)

• **Upper left**: pH Display: Indicates the setting item characters. • **Lower left**: Temperature Display: Indicates the factory default.
• **Right side**: Indicates the setting item and reference page.
Setting item in shaded section will be displayed only when the corresponding option is ordered.
If the TA option is added, A2 related setting items are not available.
If the TA2 option is added, A1 and A2 related setting items are not available.

(*1): Factory default value is different depending on the A□□ type selection. pH input: pH 0.00, Temperature input: 0.0℃
(*2): Factory default value is different depending on the A□□ type selection. pH input: pH 0.10, Temperature input: 1.0℃
(*3): Factory default value is different depending on the input spec. Pt spec: Pt 100, Cu spec: Cu5□

● **About Key Operation**

- △+▽(3 sec): Press and hold the △, ▽ keys (in that order) for 3 sec. The unit enters Manual Cleansing mode.
- △+◯(3 sec): Press and hold the △, ◯ keys (in that order) for 3 sec. The unit enters Temperature calibration mode.
- ▽+◯(3 sec): Press and hold the ▽, ◯ keys (in that order) for 3 sec. The unit enters pH calibration mode.
- △+SET/RESET(3 sec): Press and hold the △, SET/RESET keys (in that order) for 3 sec. The unit enters Transmission output 1 Zero adjustment mode.
- ▽+SET/RESET(3 sec): Press and hold the ▽, SET/RESET keys (in that order) for 3 sec. The unit enters Transmission output 2 Zero adjustment mode.
- ◯ or SET/RESET: Press the ◯ or SET/RESET key. The unit enters the next setting item.
- To revert to pH/Temperature Display Mode, or Cleansing Output Mode, press and hold the ◯ key for 3 sec while in any mode.



8. Setup

Setup should be done before using this instrument, according to the user's conditions:
Setting the 2nd Solution, A11, A12, A21, A22 types, Electrode RTD, Communication, pH Calibration Auto/Manual, etc.

Setup can be conducted in the pH Input group, Temperature Input Group and Basic Function Group.

If the user's specification is the same as the factory default of the WIL-102-PH, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to Section "9. Calibration (p.38)".

8.1 Turn the Power Supply to the WIL-102-PH ON.

For approx. 4 seconds after the power is switched ON, the input characters are indicated on the pH Display and Temperature Display.

Depending on the input specification, indication on the Temperature Display differs as follows.

Pt spec

pH Display	Temperature Display	Item selected in [Electrode RTD (p.28)]	Item selected in [Pt100 input wire type (p.28)]
PH□□	Unlit	nonE : No temperature compensation	
	Pt 10	Pt 10 : Pt1000	
	Pt□2	Pt 1□ : Pt100	Pt□2 : 2-wire type
	Pt□3		Pt□3 : 3-wire type

Cu spec

pH Display	Temperature Display	Item selected in [Electrode RTD (p.28)]
PH□□	Unlit	nonE : No temperature compensation
	cU5□	cU5□ : Cu500

During this time, all outputs are in OFF status, and all LED indicators except the PWR indicator turns off.

After that, measurement starts, indicating the item selected in [Display selection (p.32)].

This status is called pH/Temperature Display Mode, or Cleansing Output Mode.

8.2 pH Input Group

To enter the pH Input group, follow the procedure below.

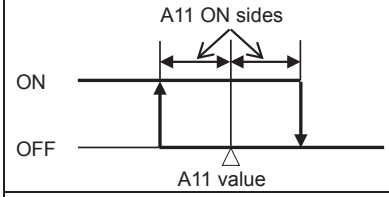
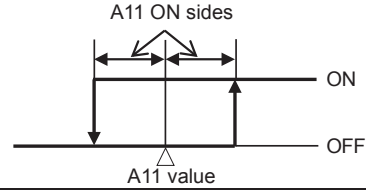
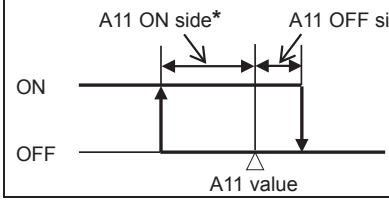
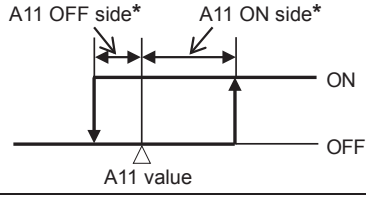
① F.nc. 1 Press the ◎ key in pH/Temperature Display Mode, or Cleansing Output Mode.

② 5EPH Press the SET/RESET key.

The unit proceeds to the pH Input group, and 'pH 7 calibration standard' appears.

Character	Setting Item, Function, Setting Range	Factory Default
TYPE JI 5□	**pH 7 calibration standard** • Selects the pH 7 calibration value standard. • Not available if mAnU (Manual) is selected in [pH calibration Auto/Manual]. • JI 5□ : JIS (Japanese Industrial Standards) U5□□ : US standard	JIS
5EPH PH4□	**2nd solution** • Selects the 2nd solution for the automatic pH calibration from pH 2, pH 4, pH 9, pH 10 (JIS). [The 1st solution is fixed at pH 7 (JIS or US standard).] • Not available if mAnU (Manual) is selected in [pH calibration Auto/Manual]. • PH2□ : pH 2 PH4□ : pH 4 PH9□ : pH 9 PH 10 : pH 10 (JIS: Japanese Industrial Standards)	pH 4
dP 1□ □0.00	**Decimal point place** • Selects the decimal point place. • □□□0 : No decimal point □□0.0 : 1 digit after decimal point □0.00 : 2 digits after decimal point	2 digits after decimal point

Character	Setting Item, Function, Setting Range	Factory Default
A11F -----	**A11 type** • Selects an A11 type. **Note: If A11 type is changed, A11 value defaults to 0.00.** • ----: No action PH_L : pH input low limit action (Fig. 8.2-1) PH_H : pH input high limit action (Fig. 8.2-1) rAPL : Temperature input low limit action (Fig. 8.2-1) rAPH : Temperature input high limit action (Fig. 8.2-1) Error : Error output [When the error type is “Error”(Table 8.2-1), the output is turned ON.] FAIL : Fail output [When the error type is “Fail” (Table 8.2-1), the output is turned ON.] cLEG : Cleansing output [10.6 Cleansing Output (P.46, 47)] EPUA: pH fluctuation alarm output [10.10 pH Fluctuation Alarm Output (P.48)] PHHL : pH input High/Low limits independent action (Fig. 8.2-2) rAHL : Temperature input High/Low limits independent action (Fig. 8.2-2) • **A11 Action** (Activated based on the indication value.)	No action

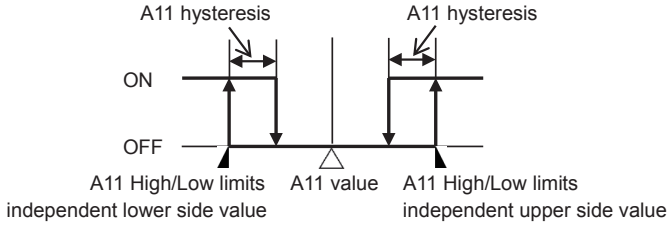
pH input low limit action, Temperature input low limit action	pH input high limit action, Temperature input high limit action
If Medium Value is selected in [A11 hysteresis type]:  	If Medium Value is selected in [A11 hysteresis type]: 
If Reference Value is selected in [A11 hysteresis type]:  	If Reference Value is selected in [A11 hysteresis type]: 

(Fig. 8.2-1)

*** Setting Example:**

If [A11 ON side (A11U)] is set to 0.00 or 0.0, A11 output can be turned ON at the value set in [A11 value (A11□)].

If [A11 OFF side (A11L)] is set to 0.00 or 0.0, A11 output can be turned OFF at the value set in [A11 value (A11□)].

pH input High/Low limits independent action, Temperature input High/Low limits independent action


(Fig. 8.2-2)

<table>
<tr><th>Character</th><th>Setting Item, Function, Setting Range</th><th>Factory Default</th></tr>
<tr><td></td><td colspan="2">• Error output, Fail output
(Table 8.2-1)
<table>
<tr><th>Error Type</th><th>Error Contents</th><th>Description</th></tr>
<tr><td>Error</td><td>Response Speed Error</td><td>When calibrating, the response of the pH Combined Electrode Sensor is slow.
When the difference between the input and each of the 1st and 2nd solutions are within pH ±1.50, and input fluctuation is over pH ±0.05 (in 10 seconds of assessment cycles) for 5 minutes, this is assumed to be an error.
However, if input fluctuation is less than or equal to pH ±0.05, this is assumed to be within the normal range.</td></tr>
<tr><td>Error</td><td>Electrode Sensitivity Error</td><td>When calibrating, sensitivity of the pH Combined Electrode Sensor has deteriorated.
The difference between 1st and 2nd standard solution value after calibration is less than or equal to pH 2.00.</td></tr>
<tr><td>Error</td><td>Asymmetry Potential Error</td><td>When calibrating pH 7, the difference in electromotive force between the sensor-measured value and standard value exceeds the equivalent of pH ±1.50.</td></tr>
<tr><td>Error</td><td>Standard Solution Error</td><td>The specified standard solution has not been used.
When pH ±1.50 is exceeded for the 1st & 2nd solutions.</td></tr>
<tr><td>Error</td><td>Solution Temperature Error</td><td>When temperature is higher than (and including) 55℃ at pH 10 solution.</td></tr>
<tr><td>Error</td><td>Outside Temp. Compen. Range</td><td>Measured temperature has exceeded 110.0℃.</td></tr>
<tr><td>Error</td><td>Outside Temp. Compen. Range</td><td>Measured temperature is less than 0.0℃.</td></tr>
<tr><td>Fail</td><td>Temp. Sensor Burnout</td><td>Temperature sensor lead wire is burnt out.</td></tr>
<tr><td>Fail</td><td>Temp. Sensor Short-circuited</td><td>Temperature sensor lead wire is short-circuited.</td></tr>
</table>
(Abbreviations: Temp.: Temperature, Compen.: Compensation)</td></tr>
<tr><td>A12F
----</td><td>A12 type
• Selects an A12 type.
Note: If A12 type is changed, A12 value defaults to 0.00.
• For the selection item and action, refer to [A11 type (pp. 21, 22)].</td><td>No action</td></tr>
<tr><td>A21F
----</td><td>A21 type
• Selects an A21 type.
Note: If A21 type is changed, A21 value defaults to 0.00.
• For the selection item and action, refer to [A11 type (pp. 21, 22)].</td><td>No action</td></tr>
<tr><td>A22F
----</td><td>A22 type
• Selects an A22 type.
Note: If A22 type is changed, A22 value defaults to 0.00.
• For the selection item and action, refer to [A11 type (pp. 21, 22)].</td><td>No action</td></tr>
<tr><td>A11
□0.00</td><td>A11 value
• Selects an A11 value.
• Not available if ---- (No action), Error (Error output), FAIL (Fail output), cLEG (Cleansing output) is selected in [A11 type].
• Setting range:
pH input: pH 0.00 to 14.00 (*)
Temperature input: 0.0 to 100.0℃ (*)
(*) The placement of the decimal point does not follow the selection. It is fixed.</td><td>pH input: pH 0.00, Temperature input: 0.0℃</td></tr>
<tr><td>A12□
□0.00</td><td>A12 value
• Selects an A12 value.
• For the indication condition and setting range, refer to [A11 type (pp. 21, 22)].</td><td>pH input: pH 0.00, Temperature input: 0.0℃</td></tr>
<tr><td>A21□
□0.00</td><td>A21 value
• Selects an A21 value.
• For the indication condition and setting range, refer to [A11 type (pp. 21, 22)].</td><td>pH input: pH 0.00, Temperature input: 0.0℃</td></tr>
<tr><td>A22□
□0.00</td><td>A22 value
• Selects an A22 value.
• For the indication condition and setting range, refer to [A11 type (pp. 21, 22)].</td><td>pH input: pH 0.00, Temperature input: 0.0℃</td></tr>
</table>

Character	Setting Item, Function, Setting Range	Factory Default
A11d hdiF	**A11 hysteresis type** • Selects A11 hysteresis type (Medium or Reference Value). • Not available if ----- (No action), Error (Error output), FAIL (Fail output), cLEG (Cleansing output) is selected in [A11 type]. • cdiF: Medium Value Sets the same value for both ON and OFF sides in relation to A11 value. Only ON side needs to be set. hdiF: Reference Value Sets individual values for ON and OFF sides in relation to A11 value. Both ON and OFF sides need to be set individually.	Reference Value
A11U □0.10	**A11 ON side** • Sets the span of A11 ON side. If cdiF (Medium Value) is selected in [A11 hysteresis type], the span of ON/OFF side will be the same value. • Not available if ----- (No action), Error (Error output), FAIL (Fail output), cLEG (Cleansing output) is selected in [A11 type]. • Setting range: pH input: pH 0.00 to 4.00 (*) Temperature input: 0.0 to 10.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH input: pH 0.10, Temperature input: 1.0℃
A11L □0.10	**A11 OFF side** • Sets the span of A11 OFF side. • Not available if cdiF (Medium Value) is selected in [A11 hysteresis type]. • Not available if ----- (No action), Error (Error output), FAIL (Fail output), cLEG (Cleansing output) is selected in [A11 type]. • Setting range: pH input: pH 0.00 to 4.00 (*) Temperature input: 0.0 to 10.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH input: pH 0.10, Temperature input: 1.0℃
A12d hdiF	**A12 hysteresis type** • Selects A12 hysteresis type (Medium or Reference Value). • For the indication condition and selection item, refer to [A11 hysteresis type].	Reference Value
A12U □0.10	**A12 ON side** • Sets the span of A12 ON side. If cdiF (Medium Value) is selected in [A12 hysteresis type], the span of ON/OFF side will be the same value. • For the indication condition and setting range, refer to [A11 ON side].	pH input: pH 0.10, Temperature input: 1.0℃
A12L □0.10	**A12 OFF side** • Sets the span of A12 OFF side. • For the indication condition and setting range, refer to [A11 OFF side].	pH input: pH 0.10, Temperature input: 1.0℃
A21d hdiF	**A21 hysteresis type** • Selects A21 hysteresis type (Medium or Reference Value). • For the indication condition and selection item, refer to [A11 hysteresis type].	Reference Value
A21U □0.10	**A21 ON side** • Sets the span of A21 ON side. If cdiF (Medium Value) is selected in [A21 hysteresis type], the span of ON/OFF side will be the same value. • For the indication condition and setting range, refer to [A11 ON side].	pH input: pH 0.10, Temperature input: 1.0℃
A21L □0.10	**A21 OFF side** • Sets the span of A21 OFF side. • For the indication condition and setting range, refer to [A11 OFF side].	pH input: pH 0.10, Temperature input: 1.0℃

Character	Setting Item, Function, Setting Range	Factory Default
A22d hdiF	**A22 hysteresis type** • Selects A22 output hysteresis type (Medium or Reference Value). • For the indication condition and selection item, refer to [A11 hysteresis type (p.23)].	Reference Value
A22U □0.10	**A22 ON side** • Sets the span of A22 ON side. If cdiF (Medium Value) is selected in [A22 hysteresis type], the span of ON/OFF side will be the same value. • For the indication condition and setting range, refer to [A11 ON side (p.23)].	pH input: pH 0.10, Temperature input: 1.0℃
A22L □0.10	**A22 OFF side** • Sets the span of A22 OFF side. • For the indication condition and setting range, refer to [A11 OFF side (p.23)].	pH input: pH 0.10, Temperature input: 1.0℃
A11o □□□0	**A11 ON delay time** • Sets A11 ON delay time. The A11 output does not turn ON (under the conditions of turning ON) until the time set in [A11 ON delay time] elapses. • Not available if ---- (No action), Eror (Error output), FAIL (Fail output), cLEO (Cleansing output) is selected in [A11 type]. • Setting range: 0 to 9999 seconds	0 seconds
A12o □□□0	**A12 ON delay time** • Sets A12 ON delay time. The A12 output does not turn ON (under the conditions of turning ON) until the time set in [A12 ON delay time] elapses. • For the indication condition and setting range, refer to [A11 ON delay time].	0 seconds
A21o □□□0	**A21 ON delay time** • Sets A21 ON delay time. The A21 output does not turn ON (under the conditions of turning ON) until the time set in [A21 ON delay time] elapses. • For the indication condition and setting range, refer to [A11 ON delay time].	0 seconds
A22o □□□0	**A22 ON delay time** • Sets A22 ON delay time. The A22 output does not turn ON (under the conditions of turning ON) until the time set in [A22 ON delay time] elapses. • For the indication condition and setting range, refer to [A11 ON delay time].	0 seconds
A11c □□□0	**A11 OFF delay time** • Sets A11 OFF delay time. The A11 output does not turn OFF (under the conditions of turning OFF) until the time set in [A11 OFF delay time] elapses. • Not available if ---- (No action), Eror (Error output), FAIL (Fail output), cLEO (Cleansing output) is selected in [A11 type]. • Setting range: 0 to 9999 seconds	0 seconds
A12c □□□0	**A12 OFF delay time** • Sets A12 OFF delay time. The A12 output does not turn OFF (under the conditions of turning OFF) until the time set in [A12 OFF delay time] elapses. • For the indication condition and setting range, refer to [A11 OFF delay time].	0 seconds
A21c □□□0	**A21 OFF delay time** • Sets A21 OFF delay time. The A21 output does not turn OFF (under the conditions of turning OFF) until the time set in [A21 OFF delay time] elapses. • For the indication condition and setting range, refer to [A11 OFF delay time].	0 seconds

Character	Setting Item, Function, Setting Range	Factory Default
A22c □□□0	**A22 OFF delay time** • Sets A22 OFF delay time. The A22 output does not turn OFF (under the conditions of turning OFF) until the time set in [A22 OFF delay time] elapses. • For the indication condition and setting range, refer to [A11 OFF delay time (p.24)].	0 seconds
A11r □□□0	**A11 pH fluctuation alarm time** • Sets time to assess A11 pH fluctuation alarm. Disabled when set to 0 (zero). • Available only when EPUA (pH fluctuation alarm output) is selected in [A11 type]. • Setting range: 0 to 72 hours	0 hours
A12r □□□0	**A12 pH fluctuation alarm time** • Sets time to assess A12 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm time].	0 hours
A21r □□□0	**A21 pH fluctuation alarm time** • Sets time to assess A21 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm time].	0 hours
A22r □□□0	**A22 pH fluctuation alarm time** • Sets time to assess A22 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm time].	0 hours
A11h □0.00	**A11 pH fluctuation alarm band** • Sets the band to assess A11 pH fluctuation alarm. Disabled when set to pH 0.00. • Available only when EPUA (pH fluctuation alarm output) is selected in [A11 type]. • Setting range: pH 0.00 to 14.00	pH 0.00
A12h □0.00	**A12 pH fluctuation alarm band** • Sets the band to assess A12 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm band].	pH 0.00
A21h □0.00	**A21 pH fluctuation alarm band** • Sets the band to assess A21 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm band].	pH 0.00
A22h □0.00	**A22 pH fluctuation alarm band** • Sets the band to assess A22 pH fluctuation alarm. • For the action, indication condition and setting range, refer to [A11 pH fluctuation alarm band].	pH 0.00
A11n □0.00	**A11 High/Low limits independent lower side value** • Sets the lower side value of A11 High/Low limits independent action. Disabled when set to pH 0.00 or 0.0℃. • Available when PHHL (pH input High/Low limits independent action) or THHL (Temperature input High/Low limits independent action) is selected in [A11 type]. • Setting range: pH input: pH 0.00 to 14.00 (*) Temperature input: 0.0 to 100.0℃(*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH input: pH 0.00, Temperature input: 0.0℃
A12n □0.00	**A12 High/Low limits independent lower side value** • Sets the lower side value of A12 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent lower side value].	pH input: pH 0.00, Temperature input: 0.0℃

Character	Setting Item, Function, Setting Range	Factory Default
A2 1n □0.00	**A21 High/Low limits independent lower side value** • Sets the lower side value of A21 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent lower side value (p.25)].	pH input: pH 0.00, Temperature input: 0.0℃
A22n □0.00	**A22 High/Low limits independent lower side value** • Sets the lower side value of A22 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent lower side value (p.25)].	pH input: pH 0.00, Temperature input: 0.0℃
A 11P □0.00	**A11 High/Low limits independent upper side value** • Sets the upper side value of A11 High/Low limits independent action. Disabled when set to pH 0.00 or 0.0℃. • Available when PHHL (pH input High/Low limits independent action) or THHL (Temperature input High/Low limits independent action) is selected in [A11 type]. • Setting range: pH input: pH 0.00 to 14.00 (*) Temperature input: 0.0 to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH input: pH 0.00, Temperature input: 0.0℃
A 12P □0.00	**A12 High/Low limits independent upper side value** • Sets the upper side value of A12 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent upper side value].	pH input: pH 0.00, Temperature input: 0.0℃
A2 1P □0.00	**A21 High/Low limits independent upper side value** • Sets the upper side value of A21 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent upper side value].	pH input: pH 0.00, Temperature input: 0.0℃
A22P □0.00	**A22 High/Low limits independent upper side value** • Sets the upper side value of A22 High/Low limits independent action. • For the action, indication condition and setting range, refer to [A11 High/Low limits independent upper side value].	pH input: pH 0.00, Temperature input: 0.0℃
A 1 1H □0.10	**A11 hysteresis** • Sets hysteresis of A11 High/Low limits independent action. • Available when PHHL (pH input High/Low limits independent action) or THHL (Temperature input High/Low limits independent action) is selected in [A11 type]. • Setting range: pH input: pH 0.01 to pH 4.00 (*) Temperature input: 0.1 to 10.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH input: pH 0.10, Temperature input: 1.0℃
A 12H □0.10	**A12 hysteresis** • Sets hysteresis of A12 High/Low limits independent action. • For the indication condition and setting range, refer to [A11 hysteresis].	pH input: pH 0.10, Temperature input: 1.0℃
A2 1H □0.10	**A21 hysteresis** • Sets hysteresis of A21 High/Low limits independent action. • For the indication condition and setting range, refer to [A11 hysteresis].	pH input: pH 0.10, Temperature input: 1.0℃
A22H □0.10	**A22 hysteresis** • Sets hysteresis of A22 High/Low limits independent action. • For the indication condition and setting range, refer to [A11 hysteresis].	pH input: pH 0.10, Temperature input: 1.0℃

Character	Setting Item, Function, Setting Range	Factory Default
I Err oFF□	**A□□ output when input errors occur** • If input errors occur, such as pH Combined Electrode Sensor is burnt out or short-circuited, A□□ output Enabled/Disabled can be selected. If "Enabled" is selected, A□□ output and A□□ output status will be maintained when input errors occur. If "Disabled" is selected, A□□ output and A□□ output status will be turned OFF when input errors occur. • Available when PH_L (pH input low limit action), PH_H (pH input high limit action), rAPL (Temperature input low limit action), or rAPH (Temperature input high limit action) is selected in [A□□ type]. • Selection item: on□□ : Enabled oFF□ : Disabled	Disabled
FILT □□0.0	**pH input filter time constant** • Sets pH input filter time constant. If the value is set too large, it affects A□□ output due to the delay of response. • Setting range: 0.0 to 60.0 seconds	0.0 seconds
PHo□ □0.00	**pH input sensor correction** • Sets pH input sensor correction value. This corrects the measured value from the pH Combined Electrode Sensor. When a sensor cannot be set at the exact location where measurement is desired, pH value measured by the sensor may deviate from the pH in the measured location. In this case, desired pH can be obtained by adding a sensor correction value. However, it is effective within the measurement range regardless of the sensor correction value. pH value after sensor correction = Current pH value + (Sensor correction value) • Setting range: pH -1.40 to 1.40 (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	0.00
dFcT □□20	**pH inputs for moving average** • Sets the number of pH inputs used to obtain a moving average. An average pH input value is calculated using the selected number of pH inputs. The pH input value is replaced every input sampling period. However, the pH input moving average function is disabled in pH calibration mode. • Setting range: 1 to 120	20

8.3 Temperature Input Group

To enter the Temperature Input group, follow the procedure below.

① F.nc.2 Press the ◎ key twice in pH/Temperature Display Mode, or Cleansing Output Mode.

② tEn1 Press the SET/RESET key.

The unit enters the Temperature Input group, and 'Electrode RTD' appears.

Character	Setting Item, Function, Setting Range	Factory Default
tEn1 Pt 10	**Electrode RTD** • Selects RTD type of the electrode. • Depending on the input specification, the following items can be selected. **Pt spec** nonE: No temperature compensation Pt 10: Pt1000 Pt 1□: Pt100 **Cu spec** nonE: No temperature compensation cU5□: Cu500	Pt spec: Pt1000 Cu spec: Cu500
trnd □25.0	**Reference temperature** • Sets the reference temperature for temperature compensation. • If nonE (No temperature compensation) is selected in [Electrode RTD], the temperature set in [Reference temperature] will be indicated on the Temperature Display. • Setting range: 5.0 to 95.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	25.0℃
dP2□ □□0.0	**Decimal point place** • Selects decimal point place. • □□□0 : No decimal point □□0.0 : 1 digit after decimal point	1 digit after decimal point
conE Pr□3	**Pt100 input wire type** • Selects the input wire type when Pt100 is selected in [Electrode RTD]. • Available only when Pt 1□ (Pt100) is selected in [Electrode RTD]. • Pr□2 : 2-wire type Pr□3 : 3-wire type	3-wire type
cAbL □□0.0	**Cable length correction** • Sets the cable length correction value. • Available when Pt 1□ (Pt100) is selected in [Electrode RTD]. Available when Pr□2 (2-wire Type) is selected in [Pt100 input wire type]. • Setting Range: 0.0 to 100.0 m	0.0 m
cSEc □0.30	**Cable cross-section area** • Sets the cable cross-section area. • Available when Pt 1□ (Pt100) is selected in [Electrode RTD]. Available when Pr□2 (2-wire Type) is selected in [Pt100 input wire type]. • Setting Range: 0.10 to 2.00 mm^2	0.30 mm^2
dFcT □□20	**Temperature inputs for moving average** • Sets the number of temperature inputs used to obtain a moving average. An average temperature input value is calculated using the selected number of temperature inputs. The temperature input value is replaced every input sampling period. However, the temperature input moving average function is disabled in temperature calibration mode. • Setting range: 1 to 120	20

8.4 Basic Function Group

To enter the Basic Function group, follow the procedure below.

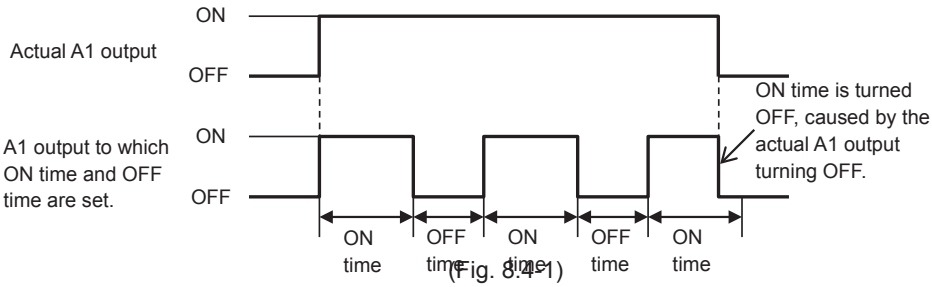
① aT.Er Press the ◯ key 3 times in pH/Temperature Display Mode, or Cleansing Output Mode.
② Lock Press the SET/RESET key.
The unit enters the Basic Function group, and the 'Set value lock' appears.

Character	Setting Item, Function, Setting Range	Factory Default
Lock ----	**Set value lock** • Locks the set values to prevent setting errors. • ---- (Unlock): All set values can be changed. Loc 1 (Lock 1): None of the set values can be changed. Loc2 (Lock 2): Only A11, A12, A21, A22 values can be changed. Loc3 (Lock 3): All set values – except Electrode RTD, Temperature calibration value, pH calibration value, pH calibration Auto/Manual, Transmission output 1 Zero adjustment value, Transmission output 1 Span adjustment value, Transmission output 2 Zero adjustment value, Transmission output 2 Span adjustment value – can be temporarily changed. However, they revert to their previous value after the power is turned off because they are not saved in the non-volatile IC memory. Do not change setting items (A11, A12, A21, A22 types). If they are changed, they will affect other setting items. Be sure to select Lock 3 when changing the set value frequently via software communication. (If a value set via software communication is the same as the value before the setting, the value will not be written in non-volatile IC memory.)	Unlock
cAnL noAL	**Communication protocol** • Selects communication protocol. • noAL : Shinko protocol AodA : MODBUS ASCII mode Aodr : MODBUS RTU mode	Shinko protocol
cAno □□□0	**Instrument number** • Sets the instrument number. (The instrument numbers should be set one by one when multiple instruments are connected.) • Setting range: 0 to 95	0
cAsP □□96	**Communication speed** • Selects a communication speed equal to that of the host computer. • □□96 : 9600 bps □ 192 : 19200 bps □384 : 38400 bps	9600 bps
cAFr 7Evn	**Data bit/Parity** • Selects data bit and parity. • 8non : 8 bits/No parity 7non : 7 bits/No parity 8Evn : 8 bits/Even 7Evn : 7 bits/Even 8odd : 8 bits/Odd 7odd : 7 bits/Odd	7 bits/Even
cAsT □□□ 1	**Stop bit** • Selects the stop bit. • □□□ 1 : 1 bit □□□2 : 2 bits	1 bit

Character	Setting Item, Function, Setting Range	Factory Default
rro1 PH□□	**Transmission output 1 type** • Selects Transmission output 1 type. If nonE (No Temperature Compensation) is selected in [Electrode RTD (p.28)], and if rEmP (Temperature transmission) is selected in [Transmission output 1 type], the value set in [Reference temperature (p.28)] will be output. • Available only when Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • PH□□ : pH transmission rEmP : Temperature transmission	pH transmission
rrH1 14.00	**Transmission output 1 high limit** • Sets the Transmission output 1 high limit value. (This value correponds to 20 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Available when Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 1 type]: Transmission output 1 low limit to pH 14.00 (*) When rEmP (Temperature Transmission) is selected in [Transmission output 1 type]: Transmission output 1 low limit to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH 14.00
rrL1 □0.00	**Transmission output 1 low limit** • Sets the Transmission output 1 low limit value. (This value correponds to 4 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Available when Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 1 type]: pH 0.00 to Transmission output 1 high limit (*) When rEmP (Temperature Transmission) is selected in [Transmission output 1 type]: 0.0℃ to Transmission output 1 high limit (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH 0.00
rro2 rEmP	**Transmission output 2 type** • Selects Transmission output 2 type. If nonE (No Temperature Compensation) is selected in [Electrode RTD (p.28)], and if rEmP (Temperature transmission) is selected in [Transmission output 2 type], the value set in [Reference temperature (p.28)] will be output. • Available only when Transmission output 2 (TA2 option) is ordered. • PH□□ : pH transmission rEmP : Temperature transmission	Temperature transmission
rrH2 100.0	**Transmission output 2 high limit** • Sets the Transmission output 2 high limit value. (This value correponds to 20 mA DC output.) If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Available only when Transmission output 2 (TA2 option) is ordered. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 2 type]: Transmission output 2 low limit to pH 14.00 (*) When rEmP (Temperature Transmission) is selected in [Transmission output 2 type]: Transmission output 2 low limit to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	100.0℃

Character	Setting Item, Function, Setting Range	Factory Default
rrL2 □□0.0	**Transmission output 2 low limit** • Sets the Transmission output 2 low limit value. (This value correponds to 4 mA DC output.) If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Available only when Transmission output 2 (TA2 option) is ordered. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 2 type]: pH 0.00 to Transmission output 2 high limit (*) When rEnP (Temperature Transmission) is selected in [Transmission output 2 type]: 0.0℃ to Transmission output 2 high limit (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	0.0℃
rrc1 bEFH	**Transmission output 1 status when calibrating** • Selects Transmission output 1 output status when calibrating pH. • Available when Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Selection item: bEFH: Last value HOLD (Retains the last value before pH calibration, and outputs it.) SEtH: Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when calibrating].) PVH□: Measured value (Outputs the measured value when calibrating pH.)	Last value HOLD
rrS1 □0.00	**Transmission output 1 value HOLD when calibrating** • Sets Transmission output 1 value HOLD. • Available only when SEtH (Set value HOLD) is selected in [Transmission output 1 status when calibrating]. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 1 type]: pH 0.00 to 14.00 (*) When rEnP (Temperature Transmission) is selected in [Transmission output 1 type]: 0.0 to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH transmission: pH 0.00 Temperature transmission: 0.0℃
rrc2 bEFH	**Transmission output 2 status when calibrating** • Selects Transmission output 2 output status when calibrating pH. • Available only when Transmission output 2 (TA2 option) is ordered. • Selection range bEFH: Last value HOLD (Retains the last value before pH calibration, and outputs it.) SEtH: Set value HOLD (Outputs the value set in [Transmission output 2 value HOLD when calibrating].) PVH□: Measured value (Outputs the measured value when calibrating pH.)	Last value HOLD
rrS2 □□0.0	**Transmission output 2 value HOLD when calibrating** • Sets Transmission output 2 value HOLD. • Available only when SEtH (Set value HOLD) is selected in [Transmission output 2 status when calibrating]. • Setting range: When PH□□ (pH Transmission) is selected in [Transmission output 2 type]: pH 0.00 to 14.00 (*) When rEnP (Temperature Transmission) is selected in [Transmission output 2 type]: 0.0 to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH transmission: pH 0.00 Temperature transmission: 0.0℃
AJSt AUto	**pH calibration Auto/Manual** • Selects either automatic or manual pH calibration. • AUto : Automatic mAnU : Manual	Automatic
LI Gt ----	**Auto-light function** • Selects Auto-light Enabled/Disabled. • ---- : Disabled USE□ : Enabled	Disabled

<table>
<tr><th>Character</th><th>Setting Item, Function, Setting Range</th><th>Factory Default</th></tr>
<tr><td>dI SP
ALL□</td><td colspan="2">Display selection pH/Temperature
• Selects items to be indicated on the pH Display and Temperature Display.
• Selection: (Table 8.4-1)
<table>
<tr><th></th><th>pH Display</th><th>Temperature Display</th></tr>
<tr><td>ALL□</td><td>pH</td><td>Temperature</td></tr>
<tr><td>PH□□</td><td>pH</td><td>No indication</td></tr>
<tr><td>TEMP</td><td>No indication</td><td>Temperature</td></tr>
<tr><td>nonE</td><td>No indication</td><td>No indication</td></tr>
</table></td></tr>
<tr><td>TIME
00.00</td><td colspan="2">Indication time 00.00
• Sets the indication time of the displays from no key operation until displays turn off.
Displays remain lit when set to 00.00.
Displays light up when any key is pressed while in unlit status.
• Not available if nonE (No indication) is selected in [Display selection].
• Setting range: 00.00 (Remains lit)
00.01 to 60.00 (Minutes.Seconds)</td></tr>
<tr><td>oFdP
oFF□</td><td colspan="2">Temperature Display when no temperature compensation Unlit
• If nonE (No temperature compensation) is selected in [Electrode RTD], the reference temperature set in [Reference temperature] can be indicated on the Temperature Display.
• Available only when nonE (No temperature compensation) is selected in [Electrode RTD (p.28)].
• Srd□ : Reference temperature
oFF□ : Unlit</td></tr>
<tr><td>A1oF
A11□</td><td colspan="2">A1 output allocation A11 type
• Selects A1 output allocation.
For A1 output, A11 type, A12 type, A21 type and/or A22 type can be allocated.
Output is OR output.
However, if cLEG (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp. 21 22)], the Cleansing output will be given priority.
• Not Available if Transmission output 2 (TA2 option) is ordered.
• A11□ : A11 type
A12□ : A12 type
A21□ : A21 type
A22□ : A22 type
A1AL : A11, A12 types
A2AL : A21, A22 types
A1A2 : A11, A21 types
A2A2 : A12, A22 types
ALL□ : A11, A12, A21, A22 types</td></tr>
<tr><td>A2oF
A21□</td><td colspan="2">A2 output allocation A21 type
• Selects A2 output allocation.
For A2 output, A11 type, A12 type, A21 type and/or A22 type can be allocated.
Output is OR output.
However, if cLEG (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21 22)], the Cleansing output will be given priority.
• Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered.
• For the selection item, refer to [A1 output allocation].</td></tr>
</table>

Character	Setting Item, Function, Setting Range	Factory Default
oon1 □□□0	**Output ON time when A1 output ON** • Sets the Output ON time when A1 output is ON. If Output ON time and OFF time are set, A1 output can be turned ON/OFF in a configured cycle when A1 output is ON. (Fig. 8.4-1) • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds **Timing chart (Output ON time and OFF time when A1 output is ON)**  (Fig. 8.4-1)	0 seconds
ooF1 □□□0	**Output OFF time when A1 output ON** • Sets Output OFF time when A1 output is ON. If Output ON time and OFF time are set, A1 output can be turned ON/OFF in a configured cycle when A1 output is ON. (Fig. 8.4-1) • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds	0 seconds
oon2 □□□0	**Output ON time when A2 output ON** • Sets Output ON time when A2 output is ON. If Output ON time and OFF time are set, A2 output can be turned ON/OFF in a configured cycle when A2 output is ON. (Fig. 8.4-1) • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds	0 seconds
ooF2 □□□0	**Output OFF time when A2 output ON** • Sets Output OFF time when A2 output is ON. If Output ON time and OFF time are set, A2 output can be turned ON/OFF in a configured cycle when A2 output is ON. (Fig. 8.4-1) • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds	0 seconds

Character	Setting Item, Function, Setting Range	Factory Default
A1P□ -----	**A1 pH input error alarm A□□ type** • Selects A□□ type in order to assess A1 pH input error alarm. • Not available if Transmission output 2 (TA2 option) is ordered. • Selection item -----: No action A11□: A11 type A12□: A12 type A21□: A21 type A22□: A22 type	No action
A2P□ -----	**A2 pH input error alarm A□□ type** • Selects A□□ type in order to assess A2 pH input error alarm. • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • For the selection item, refer to [A1 pH input error alarm A□□ type].	No action
A1Po □0.00	**A1 pH input error alarm band when A□□ output ON** • Sets the band to assess A1 pH input error alarm when A□□ output (selected in [A1 pH input error alarm A□□ type]) is ON. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: pH 0.00 to 14.00 When set to 0.00, pH input error alarm is disabled.	pH 0.00
A1oT □□□0	**A1 pH input error alarm time when A□□ output ON** • Sets time to assess A1 pH input error alarm when A□□ output (selected in [A1 pH input error alarm A□□ type]) is ON. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [pH input error alarm time unit].) When set to 0, pH input error alarm is disabled.	0 seconds
A1Pc □0.00	**A1 pH input error alarm band when A□□ output OFF** • Sets the band to assess A1 pH input error alarm when A□□ output (selected in A1 pH input error alarm A□□ type]) is OFF. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: pH 0.00 to 14.00 When set to 0.00, pH input error alarm is disabled.	pH 0.00

Character	Setting Item, Function, Setting Range	Factory Default
A1cT □□□0	**A1 pH input error alarm time when A□□ output OFF** • Sets time to assess A1 pH input error alarm when A□□ output (selected in [A1 pH input error alarm A□□ type]) is OFF. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [pH input error alarm time unit].) When set to 0, pH input error alarm is disabled.	0 seconds
A2Po □0.00	**A2 pH input error alarm band when A□□ output ON** • Sets the band to assess A2 pH input error alarm when A□□ output (selected in [A2 pH input error alarm A□□ type]) is ON. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: pH 0.00 to 14.00 When set to 0.00, pH input error alarm is disabled.	pH 0.00
A2oT □□□0	**A2 pH input error alarm time when A□□ output ON** • Sets time to assess A2 pH input error alarm when A□□ output (selected in [A2 pH input error alarm A□□ type]) is ON. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [pH input error alarm time unit].) When set to 0, pH input error alarm is disabled.	0 seconds
A2Pc □0.00	**A2 pH input error alarm band when A□□ output OFF** • Sets the band to assess A2 pH input error alarm when A□□ output (selected in [A2 pH input error alarm A□□ type]) is OFF. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: pH 0.00 to 14.00 When set to 0.00, pH input error alarm is disabled.	pH 0.00
A2cT □□□0	**A2 pH input error alarm time when A□□ output OFF** • Sets time to assess A2 pH input error alarm when A□□ output (selected in [A2 pH input error alarm A□□ type]) is OFF. Refer to Section '10.3 pH Input Error Alarm' on p.46. • Not available if Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [pH input error alarm time unit].) When set to 0, pH input error alarm is disabled.	0 seconds

Character	Setting Item, Function, Setting Range	Factory Default
ñ_5 5Ec	**pH input error alarm time unit** • Selects the time unit of pH input error alarm. • Selection item 5Ec: Second(s) ñ1 n: Minute(s)	Second(s)
ccnr 0	**Number of cleansing cycles** • Sets the number of cleansing outputs. (Fig. 8.4-2) (p.37) • Available for this setting item and all subsequent items if cLEO (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21, 22)]. • Setting range: 0 to 10 (0: Continuous cleansing)	0 (Continuous cleansing)
ccyc 360	**Cleansing interval** • Sets an interval between cleansings. (Fig. 8.4-2) (p.37) • Setting range: 60 to 3000 minutes	360 minutes
cñ1 ñ 600	**Cleansing time** • Sets the cleansing output time during the cleansing output interval. (Fig. 8.4-2) (p.37) • Setting range: 1 to 1800 seconds	600 seconds
crEc 600	**Restore time after cleansing** • Sets the time to restore instruments to normal operation after cleansing output. (Fig. 8.4-2) (p.37) • Setting range: 1 to 1800 seconds	600 seconds
cch1 bEFH	**Transmission output 1 status when cleansing** • Selects Transmission output 1 output status when cleansing action is performing. • Available when Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered. • bEFH: Last value HOLD (Retains the last value before cleansing action, and outputs it.) 5ETH: Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when cleansing].) PVH: Measured value (Outputs the measured value when cleansing action is performing.)	Last value HOLD
ccE1 0.00	**Transmission output 1 value HOLD when cleansing** • Sets the Transmission output 1 value HOLD. • Available only when 5ETH (Set value HOLD) is selected in [Transmission output 1 status when cleansing]. • Setting range: When PH (pH Transmission) is selected in [Transmission output 1 type]: pH 0.00 to 14.00 (*) When TEMP (Temperature Transmission) is selected in [Transmission output 1 type]: 0.0 to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH transmission: pH 0.00 Temperature transmission: 0.0℃
cch2 bEFH	**Transmission output 2 status when cleansing** • Selects Transmission output 2 output status when cleansing action is performing. • Available only when Transmission output 2 (TA2 option) is ordered. • bEFH: Last value HOLD (Retains the last value before cleansing action, and outputs it.) 5ETH: Set value HOLD (Outputs the value set in [Transmission output 2 value HOLD when cleaning].) PVH: Measured value (Outputs the measured value when cleansing action is performing.)	Last value HOLD
ccE2 0.0	**Transmission output 2 value HOLD when cleansing** • Sets the Transmission output 2 value HOLD. • Available only when 5ETH (Set value HOLD) is selected in [Transmission output 2 status when cleansing]. • Setting range: When PH (pH Transmission) is selected in [Transmission output 2 type]: pH 0.00 to 14.00 (*) When TEMP (Temperature Transmission) is selected in [Transmission output 2 type]: 0.0 to 100.0℃ (*) (*) The placement of the decimal point does not follow the selection. It is fixed.	pH transmission: pH 0.00 Temperature transmission: 0.0℃

• **pH Input Error Alarm**

pH input error alarm is used for detecting actuator trouble.

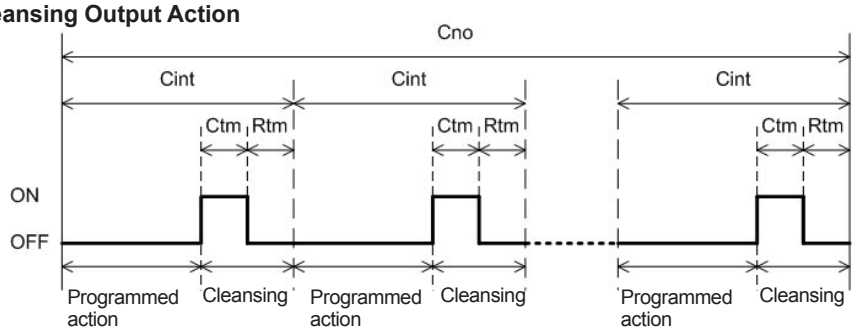
Even if pH input error alarm time has elapsed – if the change in pH input is smaller than the pH input error alarm band – the instrument assumes that actuator trouble has occurred, and sets Status flag 2 (A1, A2 pH input error alarm output flag bit).

In Serial communication, status can be read by reading Status flag 2 (A1, A2 pH input error alarm output flag bit).

pH input error alarm is enabled only when PH_L (pH input low limit action) PH_H (pH input high limit action) is selected in [A11, A12, A21, A22 type (p.21, 22)].

pH input error alarm is disabled during pH calibration.

• **Cleansing Output Action**



Cno: Number of cleansing cycles
Cint: Cleansing interval
Ctm: Cleansing time
Rtm: Restore time after cleansing

(Fig. 8.4-2)

8.5 Zero/Slope Indication Group

To enter the Zero/Slope Indication group, follow the procedure below.

① Er.4P Press the ◎ key 4 times in pH/Temperature Display Mode, or Cleansing Output Mode.

② ZEro Press the SET/RESET key.
The unit enters the Zero/Slope Indication group, and the 'Zero indication' appears.

Character	Setting Item, Function, Setting Range	Factory Default
ZEro □□0.0	**Zero indication** • Indicates potential difference when pH 7 is calibrated. However, if manual calibration is performed, zero indication value calculated at previous automatic calibration will not be updated. If calibration is not successfully completed, zero indication will show the value before calibration. • Indication range: Voltage equivalent to pH ±1.5	0.0 mV
SLoP □59.2	**Slope indication** • From the voltage equivalent to the calibrated pH, electromotive force for the change of pH 1 will be indicated. If calibration is not successfully completed, slope indication will show the value before calibration. • Indication range: Voltage equivalent to pH 0.00 to 14.00	59.2 mV

9. Calibration

The pH calibration mode, Temperature calibration mode, Transmission output 1 adjustment mode, and Transmission output 2 adjustment mode are described below.

9.1 pH Calibration Mode

For pH measurement using the glass electrode method, pH in the sensor location, electrode performance and standard solution accuracy respectively play an important role for obtaining reliable data.
There are 2 methods in pH calibration: Automatic Calibration and Manual Calibration
When AUTo (Automatic) is selected in [pH Calibration Auto/Manual (p.31)], pH will be automatically calibrated.
When MANU (Manual) is selected in [pH Calibration Auto/Manual (p.31)], pH will be calibrated manually.

When nonE (No Temperature Compensation) is selected in [Electrode RTD (p.28)], calibration will be automatically performed at 25℃ basis.
Perform pH calibration while pH measured value is in a stable status.

The unit cannot enter pH calibration mode in the following cases:
- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.29)].
- When CLEG (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21, 22)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

9.1.1 Automatic Calibration

The 1st point standard solution [pH 7 (JIS or US standard)] selected in [pH 7 calibration standard (p.20)] is automatically calibrated first. Then, the 2nd point standard solution [any one of pH 2, pH 4, pH 9 or pH 10 (JIS)] selected in [2nd Solution (p.20)] is calibrated.
The pH value (based on JIS Z8802) at each temperature of pH standard solution to be calibrated will be automatically calculated.

The following outlines the procedure for automatic calibration.

(1) The 1st Point Calibration

① Immerse the pH Combined Electrode Sensor in the 1st point standard solution (pH 7).
When selecting bEFH (Last value HOLD) in [Transmission output 1 status when calibrating (p.31)] or [Transmission output 2 status when calibrating] (p.31)], select it while the pH Combined Electrode Sensor is being immersed in the solution currently calibrated.
After that, immerse the pH Combined Electrode Sensor in the 1st point standard solution (pH 7).

② Press and hold the ▽ key and ◎ key (in that order) together for 3 seconds in pH/Temperature Display Mode, or Cleansing Output Mode.
The unit enters pH calibration mode, and indicates the following.

Display	Indication
pH Display	pH
Temperature Display	PH7

③ Press the ◎ key.
Automatic calibration of the 1st point starts.
During Automatic calibration, pH on the pH Display flashes.
Automatic calibration is carried out using the Automatic electrode quality evaluation function (*).
When flashing stops, automatic calibration of the 1st point is complete.

(*) Depending on the selection in [pH 7 calibration standard (p.20)], the value calibrated by the Automatic electrode quality evaluation function will be as follows.

pH7 Calibration Standard	Value Calibrated by the Automatic Electrode Quality Evaluation Function
JIS	pH 6.86
US standard	pH 7.00

(2) The 2nd Point Calibration

① Confirm that automatic calibration of the 1st point is complete, then press the ◎ key.
The 2nd standard solution will be shown on the display as follows.

Display	Indication
pH Display	pH
Temperature Display	pH standard solution selected in [2nd Solution (p.20)]

② Rinse the electrode, and immerse the pH Combined Electrode Sensor in the 2nd Standard solution.

③ Press the ◎ key.
Automatic calibration for the 2nd point starts.
During Automatic calibration, pH on the pH Display flashes.
Automatic calibration is carried out using the Automatic electrode quality evaluation function.
When flashing stops, automatic calibration of the 2nd point will be complete.

④ Confirm that automatic calibration of the 2nd point is complete, then press the ◎ key.
The newly calibrated values will be applied to the unit, indicated as follows.

Display	Indication
pH Display	cAL□
Temperature Display	Good

pH automatic calibration is now complete.

⑤ Press the SET/RESET key.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

9.1.2 Manual Calibration

Manual calibration can be carried out using 2 types of solution with a difference of pH 2 or more.

The following outlines the procedure for manual calibration.

(1) The 1st Point Calibration

① Immerse the pH Combined Electrode Sensor in the 1st standard solution.
When selecting bEFH (Last value HOLD) in [Transmission output 1 status when calibrating (p.31)] or [Transmission output 2 status when calibrating] (p.31)], select it while the pH Combined Electrode Sensor is being immersed in the solution currently calibrated.
After that, immerse the pH Combined Electrode Sensor in the 1st point standard solution.

② Press and hold the ▽ key and ◎ key (in that order) together for 3 seconds in pH/Temperature Display Mode, or Cleansing Output Mode.
The unit enters pH calibration mode, and indicates the following.

Display	Indication
pH Display	pH is flashing.
Temperature Display	- 1-

③ Press the ◎ key.
The unit enters the 1st point manual calibration mode, and indicates the following.

Display	Indication
pH Display	- 1- and pH are indicated alternately.
Temperature Display	The calibrated value is indicated.

④ Set the calibration value with the △ or ▽ key while checking the pH.
pH calibration value setting range: -7.00 to 7.00

⑤ Press the ◎ key.
The 1st point calibration is completed, and indicates the following.

Display	Indication
pH Display	pH is flashing.
Temperature Display	-2-

(2) The 2nd Point Calibration

① Rinse the electrode, and immerse the pH Combined Electrode Sensor in the 2nd Standard solution.

② Press the ◎ key.
The 2nd point can be calibrated manually, indicated as follows.

Display	Indication
pH Display	-2- and pH are indicated alternately.
Temperature Display	The calibration value is indicated.

③ Set the calibration value with the △ or ▽ key while checking the pH.
pH calibration value setting range: -7.00 to 7.00

④ Press the ◎ key.
The 2nd point calibration is completed. The newly calibrated values will be applied to the unit, indicated as follows.

Display	Indication
pH Display	CAL
Temperature Display	Good

Now, pH manual calibration is complete.

⑤ Press the SET/RESET key.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

9.1.3 Error Code during pH Calibration

During pH calibration, if pH calibration cannot be performed due to unstable pH input or temperature compensation error, etc., the error code (Table 9.1.3-1) will flash on the Temperature Display.

(Table 9.1.3-1)

Error Code	Error Type	Error	Description	Occurrence
E-11	Error	Response Speed Error	When calibrating, the response of the pH Combined Electrode Sensor is slow. When the difference between the input and each of the 1st and 2nd solutions are within pH ±1.50, and input fluctuation is over pH ±0.05 (in 10 seconds of assessment cycles) for 5 minutes, this is assumed to be an error. However, if input fluctuation is less than or equal to pH ±0.05, this is assumed to be within the normal range.	When calibrating
E-12	Error	Electrode Sensitivity Error	When calibrating, sensitivity of the pH Combined Electrode Sensor has deteriorated. The difference between 1st and 2nd standard solution value after calibration is less than or equal to pH 2.00.	
E-13	Error	Asymmetry Potential Error	When calibrating pH 7, the difference in electromotive force between the sensor-measured value and standard value exceeds the equivalent of pH ±1.50.	
E-14	Error	Standard Solution Error	The specified standard solution has not been used. When pH ±1.50 is exceeded for the 1st and 2nd solutions.	
E-15	Error	Solution Temperature Error	When temperature is 55℃ or more at pH 10 solution.	
E-21	Fail	Temperature Sensor Burnout	Temperature sensor lead wire is burnt out.	When measuring or calibrating
E-22	Fail	Temperature Sensor Short-circuited	Temperature sensor lead wire is short-circuited.	
E-23	Error	Outside Temperature Compensation Range	Measured temperature has exceeded 110.0℃.	
E-24	Error	Outside Temperature Compensation Range	Measured temperature is less than 0.0℃.	

9.2 Temperature Calibration Mode

To calibrate a temperature, set a temperature calibration value.
If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], Temperature calibration mode is not available.

The unit cannot enter Temperature calibration mode in the following cases:
- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.29)].
- When cLEU (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21, 22)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

When a sensor cannot be set at the exact location where measurement is desired, the resulting measured temperature may deviate from the temperature in the desired location. In this case, the desired temperature can be set for the desired location by setting a temperature calibration value. However, it is effective within the input rated range regardless of the temperature calibration value.
Temperature after calibration = Current temperature + (Temperature calibration value)
(e.g.) When current temperature is 23.5℃,
If temperature calibration value is set to 1.5℃: 23.5 + (1.5) = 25.0℃
If temperature calibration value is set to -1.5℃: 23.5 + (-1.5) = 22.0℃

The following outlines the procedure for Temperature calibration.

① Press and hold the △ key and ◎ key (in that order) together for 3 seconds in pH/Temperature Display Mode, or Cleansing Output Mode.
The unit will proceed to Temperature calibration mode, and indicates the following.

Display	Indication
pH Display	to□□ and temperature are indicated alternately.
Temperature Display	Temperature calibration value is indicated.

② Set a temperature calibration value with the △ or ▽ key while checking the temperature.
Setting range: -10.0 to 10.0℃ (The placement of the decimal point does not follow the selection. It is fixed.)

③ Press the SET/RESET key.
Temperature calibration is complete, and the unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

9.3 Transmission Output 1 Adjustment Mode

Fine adjustment of Transmission output 1 is performed.
The instrument is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and output value of this instrument.
In this case, perform Transmission output 1 Zero adjustment and Span adjustment.
Transmission output 1 adjustment mode is available only when the Transmission output 1 (TA option) or Transmission output 2 (TA2 option) is ordered.

The unit cannot enter Transmission output 1 Zero adjustment mode in the following cases.

- During pH calibration or temperature calibration
- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.29)].
- When cLEO (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21, 22)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

The following outlines the procedure for Transmission output 1 adjustment.

① Press and hold the △ and SET/RESET key (in that order) together for approx. 3 seconds in pH/Temperature Display Mode, or Cleansing Output Mode.
The unit enters Transmission output 1 Zero adjustment mode, and indicates the following.

Display	Indication
pH Display	AJE 1
Temperature Display	Transmission output 1 Zero adjustment value

② Set the Transmission output 1 Zero adjustment value with the △ or ▽ key, while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 1 Span

③ Press the SET/RESET key.
The unit enters Transmission output 1 Span adjustment mode, and indicates the following.

Display	Indication
pH Display	AJ5 1
Temperature Display	Transmission output 1 Span adjustment value

④ Set the Transmission output 1 Span adjustment value with the △ or ▽ key, while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 1 Span

⑤ Press the ◯ key.
The unit reverts to the Transmission output 1 Zero adjustment mode.
Repeat steps ② to ⑤ if necessary.

⑥ To finish Transmission output 1 adjustment, press the SET/RESET key in Transmission output 1 Span adjustment mode.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

9.4 Transmission Output 2 Adjustment Mode

Fine adjustment of Transmission output 2 is performed.
The instrument is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and output value of this instrument.
In this case, perform Transmission output 2 Zero adjustment and Span adjustment.
Transmission output 2 adjustment mode is available only when Transmission output 2 (TA2 option) is ordered.

The unit cannot enter Transmission output 2 Zero adjustment mode in the following cases.

- During pH calibration or temperature calibration
- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.29)].
- When cLEO (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp.21, 22)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

The following outlines the procedure for Transmission output 2 adjustment.

① Press and hold the ▽ and SET/RESET key (in that order) together for approx. 3 seconds in pH/Temperature Display Mode, or Cleansing Output Mode.
The unit enters Transmission output 2 Zero adjustment mode, and indicates the following.

Display	Indication
pH Display	AJE2
Temperature Display	Transmission output 2 Zero adjustment value

② Set the Transmission output 2 Zero adjustment value with the △ or ▽ key, while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 2 Span

③ Press the SET/RESET key.
The unit enters Transmission output 2 Span adjustment mode, and indicates the following.

Display	Indication
pH Display	AJH2
Temperature Display	Transmission output 2 Span adjustment value

④ Set the Transmission output 2 Span adjustment value with the △ or ▽ key, while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 2 Span

⑤ Press the ◯ key.
The unit reverts to the Transmission output 2 Zero adjustment mode.
Repeat steps ② to ⑤ if necessary.

⑥ To finish the Transmission output 2 adjustment, press the SET/RESET key in Transmission output 2 Span adjustment mode.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

10. Measurement

10.1 Starting Measurement

After mounting to the control panel, and wiring, setup and calibration are complete, turn the power to the instrument ON.

For approx. 4 seconds after the power is switched ON, the input characters are indicated on the pH Display and Temperature Display.

Depending on the input specification, indication on the Temperature Display differs as follows.

Pt spec

pH Display	Temperature Display	Item Selected in [Electrode RTD (p.28)]	Item Selected in [Pt100 input wire type (p.28)]
PH□□	Unlit	nonE: No temperature compensation	
	Pt 10	Pt 10: Pt1000	
	Pt□2	Pt 1□: Pt100	Pt□2: 2-wire type
	Pt□3		Pt□3: 3-wire type

Cu spec

pH Display	Temperature Display	Item selected in [Electrode RTD (p.28)]
PH□□	Unlit	nonE: No temperature compensation
	cU5□	cU5□: Cu500

During this time, all outputs are in OFF status, and LED indicators except the PWR Indicator turns off. After that, measurement starts, indicating the item selected in [Display selection (p.32)].

10.2 A□□ Output

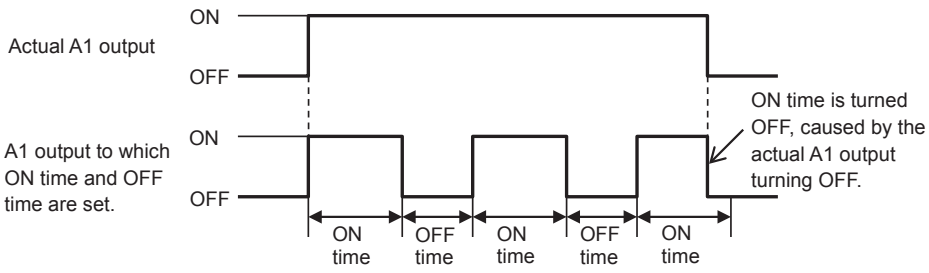
When PH_L (pH input low limit action), PH_H (pH input high limit action), TmPL (Temperature input low limit action) or TmPH (Temperature input high limit action) is selected in [A11, A12, A21, A22 type (pp.21, 22)] , the A□□ output is turned ON if measured value drops below or exceeds the A□□ value.

When PHHL (pH input High/Low limits independent action) or TmHL (Temperature input High/Low limits independent action) is selected in [A11, A12, A21, A22 type (pp.21, 22)], the alarm output is turned ON if the measured value exceeds A□□ action High/Low limits independent upper side value, or drops below A□□ action High/Low limits independent lower side value.

A1 or A2 output is turned ON depending on the settings in [A1, A2 output allocation (p.32)] and [Output ON time/OFF time when A1/A2 output ON (p.33)].

If Output ON time and OFF time are set, A1 or A2 output can be turned ON/OFF in a configured cycle when A1 or A2 output is ON. (Fig. 10.2-1)

Timing chart (Output ON time and OFF time when A1 output is ON)



(Fig. 10.2-1)

A□□ output status can be read by reading Status flag 2 (A11, A12, A21, A22 output flag bit) in Serial communication.
A□□ output status, when input errors occur, differs depending on the selection in [A□□ output when input errors occur (p.27)].

- If oFF (Disabled) is selected in [A□□ output when input errors occur (p.27)], A□□ output and A□□ output status will be turned OFF when input errors occur.
- If on (Enabled) is selected in [A□□ output when input errors occur (p.27)], A□□ output and A□□ output status will be maintained when input errors occur.
- If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)] selection, Temperature input low limit and Temperature input high limit actions will be disabled.

10.3 pH Input Error Alarm

pH input error alarm is used for detecting actuator trouble.
Even if pH input error alarm time has elapsed – if the change in pH input is smaller than the pH input error alarm band – the instrument assumes that actuator trouble has occurred, and sets Status flag 2 (A1, A2 pH input error alarm output flag bit).
In Serial communication, status can be read by reading Status flag 2 (A1, A2 pH input error alarm output flag bit).
pH input error alarm is enabled only when PH_L (pH input low limit alarm) PH_H (pH input high limit alarm) is selected in [A11, A12, A21, A22 type (p.21, 22)].
pH input error alarm is disabled during pH calibration.

10.4 Error Output

If Error (Error output) is selected in [A11, A12, A21, A22 type (pp. 21, 22)], the A1 or A2 output will be turned ON when error type is “Error”. See (Table 9.1.3-1, p.41).

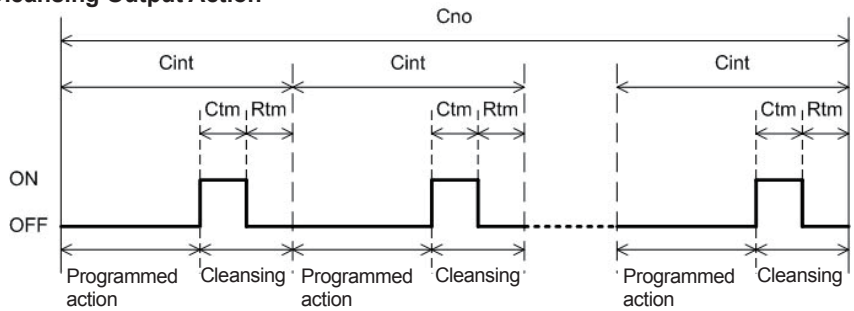
10.5 Fail Output

If FAIL (Fail output) is selected in [A11, A12, A21, A22 type (pp. 21, 22)], the A1 or A2 output will be turned ON when error type is “Fail”. See (Table 9.1.3-1, p.41).

10.6 Cleansing Output

If cLEG (Cleansing output) is selected in any one of [A11, A12, A21, A22 type (pp. 21, 22)], the unit will enter Cleansing Output Mode.
The A□□ output (for which the cleansing output is selected) will turn ON during the configured cleansing time.
When the cleansing interval finishes after restore time has passed, this is counted as one cleansing cycle, and the configured the number of cleansing cycles will be repeated.
While cleansing is being performed using the ‘Cleansing Time’ and ‘Restore Time after Cleansing’ settings, other outputs are in OFF status.
Measured values (pH, temperature) are constantly updated.
When cleansing is not being performed, programmed operation continues.
When power is turned ON again, the unit starts cleansing action from the first cleansing cycle.
After the configured number of cleansing cycles are finished, the A□□ output (for which the cleansing output is selected) is turned OFF, and other outputs perform their operations selected in [A11, A12, A21, A22 type (p.21, 22)]. However, they are in Cleansing Output Mode.
If any output other than cLEG (Cleansing output) is selected in [A11, A12, A21, A22 type (pp.21, 22)], the unit will revert to pH/Temperature Display Mode.

• **Cleansing Output Action**



Cno: Number of cleansing cycles
Cint: Cleansing interval
Ctm: Cleansing time
Rtm: Restore time after cleansing

(Fig. 10.6-1)

• While cleansing action is currently performing, if cLEO (Cleansing output) is selected in [A11, A12, A21, A22 type (p.21, 22)] again and it is allocated in [A1 output allocation] or [A2 output allocation], then the allocated output will be the same as the current cleansing output.

• If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], the value set in [Reference temperature] is maintained during cleansing action.
If an input error occurs [when temperature measured value is outside the measurement range (e.g.) less than 0.0℃ or exceeding 110.0℃], the following will be displayed.

pH Display	Temperature Display
pH measured value	Less than 0.0℃: E-24
pH measured value	Exceeding 110.0℃: E-23

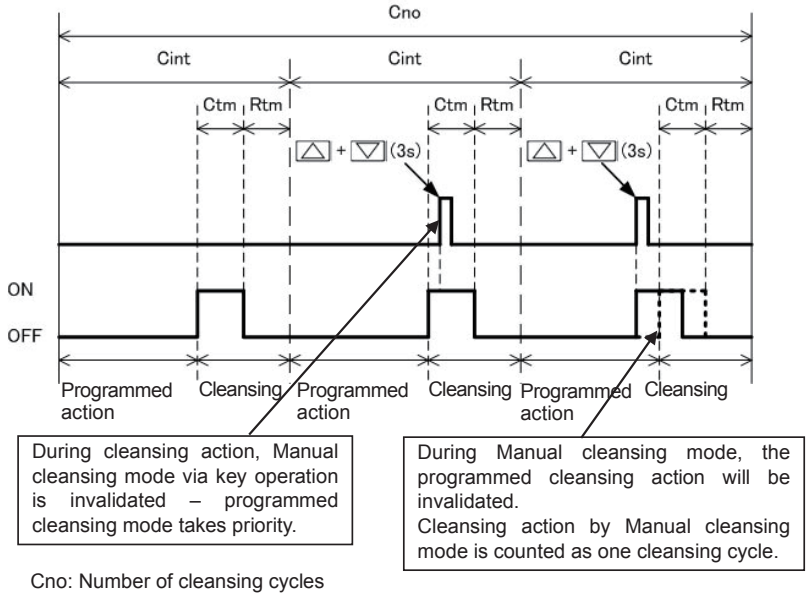
• During calibration mode, Transmission output 1 adjustment or Transmission output 2 adjustment, if cleansing action initiates after restore time has passed, the cleansing action will not be performed in the current session.
• If the number of cleansing cycles is changed in [Number of cleansing cycles] during cleansing action, the new number will be valid from the next cleansing cycle.

10.7 Manual Cleansing Mode

By pressing the △ and ▽ keys simultaneously for 3 seconds, the unit enters Manual Cleansing mode. In Manual Cleansing mode, cleansing action is performed using the 'Cleansing Time' and 'Restore Time after Cleansing' settings.
After cleansing is completed, the unit automatically reverts to Cleansing Output Mode.

During cleansing action, Manual cleansing via key operation is invalidated, so the unit cannot enter Manual cleansing mode.
During Manual cleansing mode, if programmed cleansing action initiates after Restore time has passed, the cleansing action will not be performed in the current session.
Cleansing action by Manual cleansing mode is also counted as 1 cleansing cycle.
If Lock 1, Lock 2 or Lock 3 is selected in [Set value lock], the unit cannot enter the Manual Cleansing mode.

Manual Cleansing Mode Action



Cno: Number of cleansing cycles
Cint: Cleansing interval
Ctm: Cleansing time
Rtm: Restore time after cleansing

(Fig. 10.7-1)

10.8 Error Code during Measurement

For temperature sensor error or outside temperature compensation range during measurement, their corresponding error codes flash on the Temperature Display as shown below in (Table 10.8-1).

(Table 10.8-1)

Error Code	Error Type	Error	Description	Occurrence
E-21	Fail	Temperature sensor burnout	Temperature sensor lead wire is burnt out.	When measuring or calibrating
E-22	Fail	Temperature sensor short-circuited	Temperature sensor lead wire is short-circuited.	
E-23	Error	Outside temperature compensation range	Measured temperature has exceeded 110.0℃.	
E-24	Error	Outside temperature compensation range	Measured temperature is less than 0.0℃.	

10.9 Transmission Output 1 and 2

Converting pH or temperature to analog signal every input sampling period, outputs in current.
(Factory default: Transmission output 1: pH, Transmission output 2: Temperature)

If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], and TEMP (Temperature transmission) is selected in [Transmission output 1 type (p.30)] or [Transmission output 2 type (p.30)], the value set in [Reference temperature (p.28)] will be output.

If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC.
If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC.

Resolution	12000
Current	4 to 20 mA DC (Load resistance: Max 550 Ω)
Output accuracy	Within ±0.3% of Transmission output 1 Span or Transmission output 2 Span

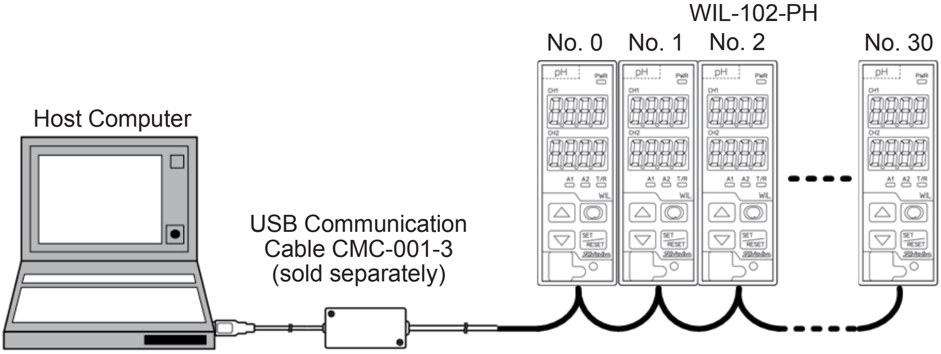
10.10 pH Fluctuation Alarm Output

pH fluctuation alarm output is used for detecting pH input fluctuation error.
Even if pH fluctuation alarm time has elapsed – if the change in pH input fluctuation is smaller than the pH fluctuation alarm band – the instrument assumes that a pH fluctuation error has occurred, and sets Status flag 2 (A11, A12, A21, A22 output flag bit).
If EPUA (pH fluctuation alarm output) is selected in [A11, A12, A21, A22 type (pp.21, 22)], the selected A□□ output will be turned ON.
In Serial communication, status can be read by reading Status flag 2 (A11, A12, A21, A22 output flag bit).
This function will be disabled if pH fluctuation alarm time is set to 0 (zero) hours, or if pH fluctuation alarm band is set to pH 0.00.

11. Communication

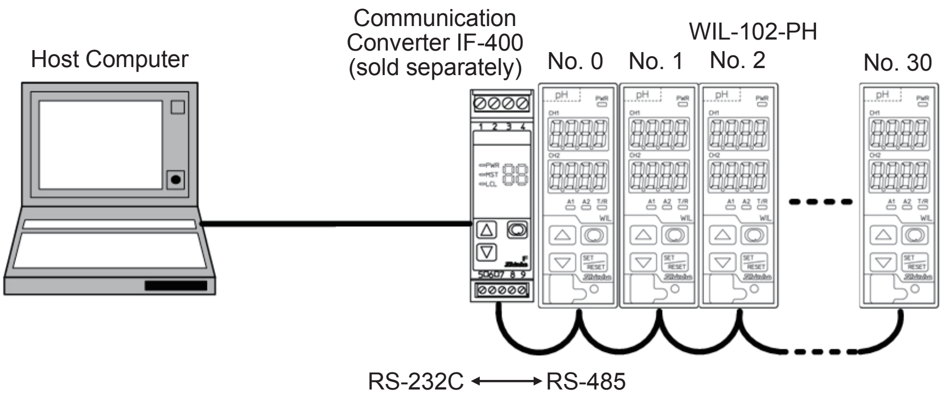
11.1 System Configuration Example

When Using USB Communication Cable CMC-001-3 (sold separately)



(Fig. 11.1-1)

When Using Communication Converter IF-400 (sold separately)



(Fig. 11.1-2)

11.2 Setting Method of the pH Meter

Communication parameters can be set in the Basic Function group.
To enter the Basic Function group, follow the procedure below.

① o.ΓE.r Press the ◎ key 3 times in pH/Temperature Display Mode, or Cleansing Output Mode.
② cmsL Press the SET/RESET key twice. 'Communication Protocol' appears.
③ Set each item. (Use the △ or ▽ key for settings, and register the value with the SET/RESET key.)

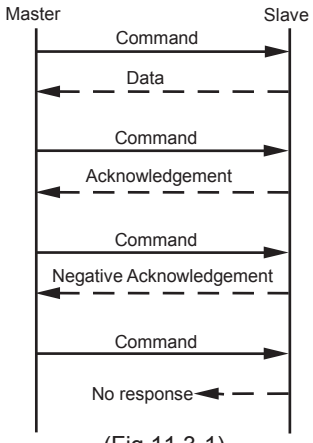
Character	Setting Item, Function, Setting Range	Factory Default
cmsL nomL	**Communication protocol** • Selects the communication protocol. • nomL : Shinko protocol modA : MODBUS ASCII mode modr : MODBUS RTU mode	Shinko protocol
cmno 0	**Instrument number** • Sets the instrument number. The instrument numbers should be set one by one when multiple instruments are connected in Serial communication, otherwise communication is impossible. • Setting range: 0 to 95	0

Character	Setting Item, Function, Setting Range	Factory Default
cnsP □□96	**Communication speed** • Selects a communication speed equal to that of the host computer. • □□96 : 9600 bps □ 192 : 19200 bps □384 : 38400 bps	9600 bps
cnFt 7Evn	**Data bit/Parity** • Selects data bit and parity. • 8non : 8 bits/No parity 7non : 7 bits/No parity 8Evn : 8 bits/Even 7Evn : 7 bits/Even 8odd : 8 bits/Odd 7odd : 7 bits/Odd	7 bits/Even
cnsT □□□1	**Stop bit** • Selects the stop bit. • □□□1 : 1 bit □□□2 : 2 bits	1 bit

④ Press the SET/RESET key multiple times. The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

11.3 Communication Procedure

Communication starts with command transmission from the host computer (hereafter Master) and ends with the response of the WIL-102-PH (hereafter Slave).



(Fig.11.3-1)

- **Response with Data**
  When the master sends the reading command, the slave responds with the corresponding set value or current status.
- **Acknowledgement**
  When the master sends the setting command, the slave responds by sending acknowledgement after processing is terminated.
- **Negative Acknowledgement**
  When the master sends a non-existent command or value out of the setting range, the slave returns a negative acknowledgement.
- **No Response**
  The slave will not respond to the master in the following cases:
  - Global address (Shinko protocol) is set.
  - Broadcast address (MODBUS protocol) is set.
  - Communication error (framing error, parity error)
  - Checksum error (Shinko protocol), LRC discrepancy (MODBUS ASCII mode), CRC-16 discrepancy (MODBUS RTU mode)

Communication Timing of the RS-485

Master Side (Take note while programming)

When the master starts transmission through the RS-485 communication line, the master is arranged so as to provide an idle status (mark status) transmission period of 1 or more character before sending the command to ensure synchronization on the receiving side.

Set the program so that the master can disconnect the transmitter from the communication line within a 1-character transmission period after sending the command in preparation for reception of the response from the slave.

To avoid collision of transmissions between the master and the slave, send the next command after carefully checking that the master has received the response.

If a response to the command is not returned due to communication errors, set the Retry Processing to send the command again. (It is recommended to execute Retry twice or more.)

Slave Side

When the slave starts transmission through the RS-485 communication line, the slave is arranged so as to provide an idle status (mark status) transmission period of 1 or more characters before sending the response to ensure synchronization on the receiving side.

The slave is arranged so as to disconnect the transmitter from the communication line within a 1-character transmission period after sending the response.

11.4 Shinko Protocol

11.4.1 Transmission Mode

Shinko protocol is composed of ASCII.
Hexadecimal (0 to 9, A to F), which is divided into high order (4-bit) and low order (4-bit) out of 8-bit binary data in command is transmitted as ASCII characters.

Data format Start bit: 1 bit
Data bit: 7 bits
Parity: Even
Stop bit: 1 bit

Error detection: Checksum

11.4.2 Command Configuration

All commands are composed of ASCII.
The data (set value, decimal number) is represented by hexadecimal numbers.
The negative numbers are represented in 2's complement.

Numerals written below the command represent the number of characters.

(1) Setting Command

Header (02H)	Address	Sub address (20H)	Command type (50H)	Data item	Data	Checksum	Delimiter (03H)
1	1	1	1	4	4	2	1

(Fig. 11.4.2-1)

(2) Reading Command

Header (02H)	Address	Sub address (20H)	Command type (20H)	Data item	Checksum	Delimiter (03H)
1	1	1	1	4	2	1

(Fig. 11.4.2-2)

(3) Response with Data

Header (06H)	Address	Sub address (20H)	Command type (20H)	Data item	Data	Checksum	Delimiter (03H)
1	1	1	1	4	4	2	1

(Fig. 11.4.2-3)

(4) Acknowledgement

Header (06H)	Address	Checksum	Delimiter (03H)
1	1	2	1

(Fig. 11.4.2-4)

(5) Negative Acknowledgement

Header (15H)	Address	Error code	Checksum	Delimiter (03H)
1	1	1	2	1

(Fig. 11.4.2-5)

Header: Control code to represent the beginning of the command or the response.
ASCII codes are used.
Setting command, Reading command: STX (02H) fixed
Response with data, Acknowledgement: ACK (06H) fixed
Negative acknowledgement: NAK (15H) fixed

Instrument Number (Address): Numbers by which the master discerns each slave.
Instrument number 0 to 94 and Global address 95.
ASCII codes (20H to 7FH) are used by adding 20H to instrument numbers 0 to 95 (00H to 5FH).
95 (7FH) is called Global address, which is used when the same command is sent to all the slaves connected. However, the response is not returned.

Sub Address: 20H fixed

Command Type: Code to discern Setting command (50H) and Reading command (20H)

Data Item: Classification of the command object.
Composed of 4-digit hexadecimal numbers, using ASCII.
[Refer to “11.6. Communication Command Table”. (pp. 57 to 65)]

Data: The contents of data (set value) differ depending on the setting command.
Composed of 4-digit hexadecimal numbers, using ASCII.
[Refer to “11.6. Communication Command Table”. (pp. 57 to 65)]

Checksum: 2-character data to detect communication errors.
Refer to “11.4.3 Checksum Calculation”.

Delimiter: Control code to represent the end of command.
ASCII code ETX (03H) fixed

Error Code: Represents an error type using ASCII.
1 (31H)-----Non-existent command
2 (32H)-----Not used
3 (33H)-----Setting outside the setting range
4 (34H)-----Status unable to be set (e.g. While Automatic electrode quality evaluation function is performing.)
5 (35H)-----During setting mode by keypad operation

11.4.3 Checksum Calculation

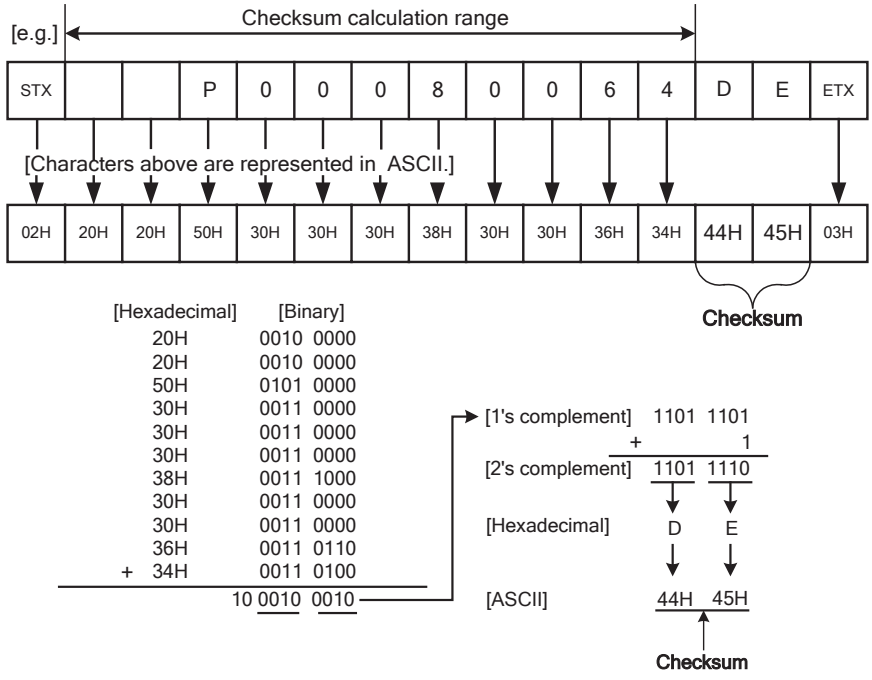
Checksum is used to detect receiving errors in the command or data.
Set the program for the master side as well to calculate the checksum of the response data from the slaves so that communication errors can be checked.

The ASCII code (hexadecimal) corresponding to the characters which range from the address to that before the checksum is converted to binary notation, and the total value is calculated.
The lower one byte of the total value is converted to 2’s complement, and then to hexadecimal numbers, that is, ASCII code for the checksum.

- 1’s complement: Reverse each binary bit. 0 will become 1 and vice versa.
- 2’s complement: Add 1 to 1’s complement.

Checksum Calculation Example

pH calibration value: 1.00 (0064H)
Address (instrument number): 0 (20H)



(Fig. 11.4.3-1)

11.5 MODBUS Protocol

11.5.1 Transmission Mode

There are 2 transmission modes (ASCII and RTU) in MODBUS protocol.

ASCII Mode

Hexadecimal (0 to 9, A to F), which is divided into high order (4-bit) and low order (4-bit) out of 8-bit binary data in command is transmitted as ASCII characters.

Data format Start bit: 1 bit
Data bit: 7 bits (8 bits) (Selectable)
Parity: Even (No parity, Odd) (Selectable)
Stop bit: 1 bit (2 bits) (Selectable)

Error detection : LRC (Longitudinal Redundancy Check)

RTU Mode

8-bit binary data in command is transmitted as it is.

Data format Start bit: 1 bit
Data bit: 8 bits
Parity: No parity (Even, Odd) (Selectable)
Stop bit: 1 bit (2 bits) (Selectable)

Error detection: CRC-16 (Cyclic Redundancy Check)

11.5.2 Data Communication Interval

ASCII Mode

Max.1 second of interval between ASCII mode characters

RTU Mode

Communication speed 9600 bps, 19200 bps:
To transmit continuously, an interval between characters which consist of one message, must be within 1.5-character transmission times.

Communication speed 38400 bps:
To transmit continuously, an interval between characters which consist of one message, must be within 750 μs.

If an interval lasts longer than 1.5-character transmission times or 750 μs, the WIL-102-PH assumes that transmission from the master is finished, which results in a communication error, and will not return a response.

11.5.3 Message Configuration

ASCII Mode

ASCII mode message is configured to start by Header [: (colon)(3AH)] and end by Delimiter [CR (carriage return) (0DH) + LF (Line feed)(0AH)].

Header (:)	Slave address	Function Code	Data	Error check LRC	Delimiter (CR)	Delimiter (LF)

RTU Mode

Communication speed 9600 bps, 19200 bps: RTU mode is configured to start after idle time is processed for more than 3.5-character transmissions, and end after idle time is processed for more than 3.5-character transmissions.

Communication speed 38400 bps: RTU mode is configured to start after idle time is processed for more than 1.75 ms, and end after idle time is processed for more than 1.75 ms.

3.5 idle characters	Slave address	Function code	Data	Error check CRC-16	3.5 idle characters

(1) Slave Address

Slave address is an individual instrument number on the slave side, and is set within the range 0 to 95 (00H to 5FH).
The master identifies slaves by the slave address of the requested message.
The slave informs the master which slave is responding to the master by placing its own address in the response message.
Slave address 00H (Broadcast address) can identify all the slaves connected. However, slaves do not respond.

(2) Function Code

The function code is the command code for the slave to undertake the following action types.

(Table 11.5.3-1)

Function Code	Contents
03 (03H)	Reading the set value and information from slaves
06 (06H)	Setting to slaves

Function code is used to discern whether the response is normal (acknowledgement) or if any error (negative acknowledgement) has occurred when the slave returns the response message to the master.
When acknowledgement is returned, the slave simply returns the original function code.
When negative acknowledgement is returned, the MSB of the original function code is set as 1 for the response.
(For example, when the master sends request message setting 10H to the function code by mistake, slave returns 90H by setting the MSB to 1, because the former is an illegal function.)
For negative acknowledgement, the exception codes below (Table 11.5.3-2) are set to the data of the response message, and returned to the master in order to inform it of what kind of error has occurred.

(Table 11.5.3-2)

Exception Code	Contents
1 (01H)	Illegal function (Non-existent function)
2 (02H)	Illegal data address (Non-existent data address)
3 (03H)	Illegal data value (Value out of the setting range)
17 (11H)	Shinko protocol error code 4 [Status unable to be set (e.g.) Automatic electrode quality evaluation function is being performed.]
18 (12H)	Shinko protocol error code 5 (During setting mode by keypad operation)

(3) Data

Data differs depending on the function code.
A request message from the master is composed of data item, amount of data and setting data.
A response message from the slave is composed of the byte count, data and exception codes in negative acknowledgements, corresponding to the request message.
Effective range of data is -32768 to 32767 (8000H to 7FFFH).

(4) Error Check

ASCII Mode

After calculating LRC (Longitudinal Redundancy Check) from the slave address to the end of data, the calculated 8-bit data is converted to two ASCII characters, and are appended to the end of message.

How to Calculate LRC

① Create a message in RTU mode.
② Add all the values from the slave address to the end of data. This is assumed as X.
③ Make a complement for X (bit reverse). This is assumed as X.
④ Add a value of 1 to X. This is assumed as X.
⑤ Set X as an LRC to the end of the message.
⑥ Convert the whole message to ASCII characters.

RTU Mode

After calculating CRC-16 (Cyclic Redundancy Check) from the slave address to the end of the data, the calculated 16-bit data is appended to the end of message in sequence from low order to high order.

How to calculate CRC-16

In the CRC-16 system, the information is divided by the polynomial series. The remainder is added to the end of the information and transmitted. The generation of a polynomial series is as follows.
(Generation of polynomial series: $X^{16} + X^{15} + X^2 + 1$)

① Initialize the CRC-16 data (assumed as X) (FFFFH).
② Calculate exclusive OR (XOR) with the 1st data and X. This is assumed as X.
③ Shift X one bit to the right. This is assumed as X.

④ When a carry is generated as a result of the shift, XOR is calculated by X of ③ and the fixed value (A001H). This is assumed as X. If a carry is not generated, go to step ⑤.
⑤ Repeat steps ③ and ④ until shifting 8 times.
⑥ XOR is calculated with the next data and X. This is assumed as X.
⑦ Repeat steps ③ to ⑤.
⑧ Repeat steps ③ to ⑤ up to the final data.
⑨ Set X as CRC-16 to the end of message in sequence from low order to high order.

11.5.4 Message Example

ASCII Mode

Numerals written below the command represent the number of characters.

① **Reading [Slave address 1, Data item 0080H (pH)]**

• A request message from the master

Amount of data means how many data items are to be read. It is fixed as (30H 30H 30H 31H).

Header	Slave Address	Function Code	Data Item [0080H]	Amount of Data [0001H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)	(30H 30H 38H 30H)	(30H 30H 30H 31H)	(37H 42H)	(0DH 0AH)
1	2	2	4	4	2	2

• Response message from the slave in normal status [pH 1.00 (0064H)]

The response byte count means the byte count of the data which has been read.
It is fixed as (30H 32H).

Header	Slave Address	Function Code	Response Byte Count [02H]	Data [0064H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)	(30H 32H)	(30H 30H 36H 34H)	(39H 36H)	(0DH 0AH)
1	2	2	2	4	2	2

• Response message from the slave in exception (error) status (When a data item is incorrect)

The function code MSB is set to 1 for the response message in exception (error) status (83H).
The exception code 02H (Non-existent data address) is returned (error).

Header	Slave Address	Function Code	Exception Code [02H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(38H 33H)	(30H 32H)	(37H 41H)	(0DH 0AH)
1	2	2	2	2	2

② **Setting [Slave address 1, Data item 0008H (pH calibration value)]**

• A request message from the master [When pH calibration value is set to 1.00 (0064H)]

Header	Slave Address	Function Code	Data Item [0008H]	Data [0064H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 30H 38H)	(30H 30H 36H 34H)	(38H 44H)	(0DH 0AH)
1	2	2	4	4	2	2

• Response message from the slave in normal status

Header	Slave Address	Function Code	Data Item [0008H]	Data [0064H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 30H 38H)	(30H 30H 36H 34H)	(38H 44H)	(0DH 0AH)
1	2	2	4	4	2	2

• Response message from the slave in exception (error) status (When a value out of the setting range is set)

The function code MSB is set to 1 for the response message in exception (error) status (86H).
The exception code 03H (Value out of the setting range) is returned (error).

Header	Slave Address	Function Code	Exception Code [03H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(38H 36H)	(30H 33H)	(37H 36H)	(0DH 0AH)
1	2	2	2	2	2

RTU Mode

Numerals written below the command represent the number of characters.

① **Reading [Slave address 1, Data item 0080H (pH)]**

• A request message from the master

Amount of data means how many data items are to be read. It is fixed as (0001H).

3.5 Idle Characters	Slave Address (01H)	Function Code (03H)	Data Item (0080H)	Amount of data (0001H)	Error Check CRC-16 (85E2H)	3.5 idle characters
	1	1	2	2	2	

• Response message from the slave in normal status [pH 1.00 (0064H)]

The response byte count means the byte count of the data which has been read.
It is fixed as (02H).

3.5 Idle Characters	Slave Address (01H)	Function Code (03H)	Response Byte Count (02H)	Data (0064H)	Error Check CRC-16 (B9AFH)	3.5 idle characters
	1	1	1	2	2	

• Response message from the slave in exception (error) status (When data item is incorrect).

The function code MSB is set to 1 for the response message in exception (error) status (83H).
The exception code (02H: Non-existent data address) is returned (error).

3.5 Idle Characters	Slave Address (01H)	Function Code (83H)	Exception Code (02H)	Error Check CRC-16 (C0F1H)	3.5 idle characters
	1	1	1	2	

② **Setting [Slave address 1, Data item 0008H (pH calibration value)]**

• A request message from the master [When pH calibration value is set to 1.00 (0064H)]

3.5 Idle Characters	Slave Address (01H)	Function Code (06H)	Data Item (0008H)	Data (0064H)	Error Check CRC-16 (D9E3H)	3.5 idle characters
	1	1	2	2	2	

• Response message from the slave in normal status

3.5 Idle Characters	Slave Address (01H)	Function Code (06H)	Data Item (0008H)	Data (0064H)	Error Check CRC-16 (D9E3H)	3.5 idle characters
	1	1	2	2	2	

• Response message from the slave in exception (error) status (When a value out of the setting range is set)

The function code MSB is set to 1 for the response message in exception (error) status (86H).
The exception code (03H: Value out of the setting range) is returned (error).

3.5 Idle Characters	Slave Address (01H)	Function Code (86H)	Exception Code (03H)	Error Check CRC-16 (0261H)	3.5 idle characters
	1	1	1	2	

11.6 Communication Command Table

11.6.1 Notes about Setting/Reading Command

- The data (set value, decimal) is converted to hexadecimal numbers.
  A negative number is represented in 2's complement.
- When connecting multiple slaves, the address (instrument number) must not be duplicated.
- Data items 0200H to 0209H (User save area 1 to 10) can be read or set in 1 word units.
  Effective range of data is -32768 to 32767 (8000H to 7FFFH).
- MODBUS protocol uses Holding Register addresses. The Holding Register addresses are created as follows. A Shinko command data item is converted to decimal number, and the offset of 40001 is added.
  The result is the Holding Register address.
  Using Data item 0001H (2nd solution) as an example:
  Data item in the sending message is 0001H, however, MODBUS protocol Holding Register address is 40002 (1 + 40001).
- Even if options are not ordered, setting or reading via software communication will be possible. Command contents of the A11, A12, A21, A22 will function, however, Transmission output 1 and Transmission output 2 command contents will not function.

(1) Setting Command

- Up to 1,000,000 (one million) entries can be stored in non-volatile IC memory. If the number of settings exceeds the limit, the data will not be saved. So, ensure the set values are not frequently changed via software communication. (If a value set via software communication is the same as the value before the setting, the value will not be written in non-volatile IC memory.)
- Be sure to select Lock 3 when changing the set value frequently via software communication. If Lock 3 is selected, all set values – except Electrode RTD, Temperature calibration value, pH calibration value, pH calibration Auto/Manual, Transmission output 1 Zero adjustment value, Transmission output 1 Span adjustment value, Transmission output 2 Zero adjustment value, Transmission output 2 Span adjustment value – can be temporarily changed. However, they revert to their previous value after the power is turned off because they are not saved in the non-volatile IC memory.
  Do not change setting items (A11, A12, A21, A22 type). If they are changed, they will affect other setting items.
- Setting range of each item is the same as that of keypad operation.
- When the data (set value) has a decimal point, a whole number (hexadecimal) without a decimal point is used.
- If A11, A12, A21 or A22 type is changed at Data items 0003H (A11 type), 0050H (A12 type), 0051H (A21 type) or 0052H (A22 type), the A11, A12, A21 or A22 value will default to 0 (zero).
  The output status of A11, A12, A21 or A22 will also be initialized.
- Settings via software communication are possible while in Set value lock status.
- Communication parameters such as Instrument Number, Communication Speed of the slave cannot be set by the software communication function. They can only be set via the keypad. (pp.49, 50)
- When sending a command by Global address [95 (7FH), Shinko protocol] or Broadcast address [00H, MODBUS protocol], the same command is sent to all the slaves connected. However, the response is not returned.

(2) Reading Command

- When the data (set value) has a decimal point, a whole number (hexadecimal) without a decimal point is used for a response.

11.6.2 Setting/Reading Command

<table>
<tr><th>Shinko Command Type</th><th>MODBUS Function Code</th><th colspan="2">Data Item</th><th>Data</th></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0001H</td><td>2nd solution</td><td>0000H: pH 2
0001H: pH 4
0002H: pH 9
0003H: pH 10</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0002H</td><td>pH input decimal point place</td><td>0000H: No decimal point
0001H: 1 digit after decimal point
0002H: 2 digits after decimal point</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0003H</td><td>A11 type</td><td>0000H: No action
0001H: pH input low limit action
0002H: pH input high limit action
0003H: Temperature input low limit
0004H: Temperature input high limit
0005H: Error output
0006H: Fail output
0007H: Cleansing output
0008H: pH fluctuation alarm output
0009H: pH input High/Low limits independent
000AH: Temperature input High/Low limits independent</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0004H</td><td>A11 value</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0005H</td><td>A11 ON side</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0006H</td><td>A11 ON delay time</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0007H</td><td>A11 OFF delay time</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0008H</td><td>pH calibration value</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0009H</td><td>pH 7 calibration standard</td><td>0000H: JIS
0001H: US standard</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0021H</td><td>Electrode RTD</td><td>Pt spec
0000H: No temperature compensation
0001H: Pt1000
0002H: Pt100
Cu spec
0000H: No temperature compensation
0001H: Cu500</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0022H</td><td>Temperature input decimal point place</td><td>0000H: No decimal point
0001H: 1 digit after decimal point</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0023H</td><td>Reference temperature</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0028H</td><td>Temperature calibration value</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0030H</td><td>Set value lock</td><td>0000H: Unlock
0001H: Lock 1
0002H: Lock 2
0003H: Lock 3</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0031H</td><td>Transmission output 1 type</td><td>0000H: pH transmission
0001H: Temperature transmission</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0032H</td><td>Transmission output 1 high limit</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0033H</td><td>Transmission output 1 low limit</td><td>Set value</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0034H</td><td>pH calibration Auto/Manual</td><td>0000H: Automatic
0001H: Manual</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0035H</td><td>Auto-light function</td><td>0000H: Disabled
0001H: Enabled</td></tr>
<tr><td>50H/20H</td><td>06H/03H</td><td>0036H</td><td>Display selection</td><td>
<table>
<tr><th>Data</th><th>pH Display</th><th>Temperature Display</th></tr>
<tr><td>0000H</td><td>pH</td><td>Temperature</td></tr>
<tr><td>0001H</td><td>pH</td><td>No indication</td></tr>
<tr><td>0002H</td><td>No indication</td><td>Temperature</td></tr>
<tr><td>0003H</td><td>No indication</td><td>No indication</td></tr>
</table>
</td></tr>
</table>

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0037H	Indication time	Set value
50H	06H	0038H	pH calibration mode	0000H: pH/Temperature Display Mode, or Cleansing Output Mode 0001H: Calibration mode
50H	06H	0039H	pH calibration start	0001H: 1st point calibration start 0002H: 1st point calibration complete 0003H: 2nd point calibration start 0004H: 2nd point calibration complete
50H/20H	06H/03H	0040H	pH input filter time constant	Set value
50H/20H	06H/03H	0041H	A□□ output when input errors occur	0000H: Enabled 0001H: Disabled
50H/20H	06H/03H	0042H	Cable length correction	Set value
50H/20H	06H/03H	0043H	Cable cross-section area	Set value
50H/20H	06H/03H	0048H	Output ON time when A1 output ON	Set value
50H/20H	06H/03H	0049H	Output OFF time when A1 output ON	Set value
50H/20H	06H/03H	004AH	Output ON time when A2 output ON	Set value
50H/20H	06H/03H	004BH	Output OFF time when A2 output ON	Set value
50H/20H	06H/03H	0050H	A12 type	0000H: No action 0001H: pH input low limit action 0002H: pH input high limit action 0003H: Temperature input low limit 0004H: Temperature input high limit 0005H: Error output 0006H: Fail output 0007H: Cleansing output 0008H: pH fluctuation alarm output 0009H: pH input High/Low limits independent 000AH: Temperature input High/Low limits independent
50H/20H	06H/03H	0051H	A21 type	0000H: No action 0001H: pH input low limit action 0002H: pH input high limit action 0003H: Temperature input low limit 0004H: Temperature input high limit 0005H: Error output 0006H: Fail output 0007H: Cleansing output 0008H: pH fluctuation alarm output 0009H: pH input High/Low limits independent 000AH: Temperature input High/Low limits independent
50H/20H	06H/03H	0052H	A22 type	0000H: No action 0001H: pH input low limit action 0002H: pH input high limit action 0003H: Temperature input low limit 0004H: Temperature input high limit 0005H: Error output 0006H: Fail output 0007H: Cleansing output 0008H: pH fluctuation alarm output 0009H: pH input High/Low limits independent 000AH: Temperature input High/Low limits independent

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0053H	A12 value	Set value
50H/20H	06H/03H	0054H	A21 value	Set value
50H/20H	06H/03H	0055H	A22 value	Set value
50H/20H	06H/03H	0056H	A12 ON side	Set value
50H/20H	06H/03H	0057H	A21 ON side	Set value
50H/20H	06H/03H	0058H	A22 ON side	Set value
50H/20H	06H/03H	0059H	A12 ON delay time	Set value
50H/20H	06H/03H	005AH	A21 ON delay time	Set value
50H/20H	06H/03H	005BH	A22 ON delay time	Set value
50H/20H	06H/03H	005CH	A12 OFF delay time	Set value
50H/20H	06H/03H	005DH	A21 OFF delay time	Set value
50H/20H	06H/03H	005EH	A22 OFF delay time	Set value
50H/20H	06H/03H	0068H	pH input sensor correction	Set value
50H/20H	06H/03H	0069H	Temperature Display when no temperature compensation	0000H: Reference temperature 0001H: Unlit
50H/20H	06H/03H	006AH	A1 output allocation	0000H: A11 type 0001H: A12 type 0002H: A21 type 0003H: A22 type 0004H: A11, A12 types 0005H: A21, A22 types 0006H: A11, A21 types 0007H: A12, A22 types 0008H: A11, A12, A21, A22 types
50H/20H	06H/03H	006BH	A2 output allocation	0000H: A11 type 0001H: A12 type 0002H: A21 type 0003H: A22 type 0004H: A11, A12 types 0005H: A21, A22 types 0006H: A11, A21 types 0007H: A12, A22 types 0008H: A11, A12, A21, A22 types
50H/20H	06H/03H	006FH	Pt100 input wire type	0000H: 2-wire type 0001H: 3-wire type
50H / 20H	06H / 03H	0070H	Reserved (*)	
50H / 20H	06H / 03H	0071H	Reserved (*)	
50H / 20H	06H / 03H	0072H	Reserved (*)	
50H / 20H	06H / 03H	0073H	Reserved (*)	
50H / 20H	06H / 03H	0074H	Reserved (*)	
50H / 20H	06H / 03H	0075H	Reserved (*)	
50H / 20H	06H / 03H	0076H	Reserved (*)	
50H / 20H	06H / 03H	0077H	Reserved (*)	
50H	06H	007FH	Key operation change flag clearing	0001H: Clear change flag

(*) If the reserved item is read, acknowledgement (undefined value) will be returned.
If the reserved item is set, the instrument action will be changed, so do not set this item.

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0100H	A11 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0101H	A12 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0102H	A21 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0103H	A22 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0104H	A11 OFF side	Set value
50H/20H	06H/03H	0105H	A12 OFF side	Set value
50H/20H	06H/03H	0106H	A21 OFF side	Set value
50H/20H	06H/03H	0107H	A22 OFF side	Set value
50H/20H	06H/03H	0108H	Number of cleansing cycles	Set value
50H/20H	06H/03H	0109H	Cleansing interval	Set value
50H/20H	06H/03H	010AH	Cleansing time	Set value
50H/20H	06H/03H	010BH	Restore time after cleansing	Set value
50H	06H	010CH	Manual cleansing mode	0001H: Manual cleansing mode
50H/20H	06H/03H	010FH	Transmission output 1 status when calibrating	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0110H	Transmission output 1 value HOLD when calibrating	Set value
50H/20H	06H/03H	0111H	A1 pH input error alarm A□□ type	0000H: No action 0001H: A11 type 0002H: A12 type 0003H: A21 type 0004H: A22 type
50H/20H	06H/03H	0112H	A2 pH input error alarm A□□ type	0000H: No action 0001H: A11 type 0002H: A12 type 0003H: A21 type 0004H: A22 type
50H/20H	06H/03H	0115H	A1 pH input error alarm band when A□□ output ON	Set value
50H/20H	06H/03H	0116H	A1 pH input error alarm time when A□□ output ON	Set value
50H/20H	06H/03H	0117H	A1 pH input error alarm band when A□□ output OFF	Set value
50H/20H	06H/03H	0118H	A1 pH input error alarm time when A□□ output OFF	Set value
50H/20H	06H/03H	0119H	A2 pH input error alarm band when A□□ output ON	Set value
50H/20H	06H/03H	011AH	A2 pH input error alarm time when A□□ output ON	Set value
50H/20H	06H/03H	011BH	A2 pH input error alarm band when A□□ output OFF	Set value

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	011CH	A2 pH input error alarm time when A□□ output OFF	Set value
50H/20H	06H/03H	0125H	pH input error alarm time unit	0000H: Second(s) 0001H: Minute(s)
50H	06H	0126H	Transmission output 1 adjustment mode	0000H: pH/Temperature Display Mode, or Cleansing Output Mode 0001H: Transmission output 1 Zero adjustment mode 0002H: Transmission output 1 Span adjustment mode
50H/20H	06H/03H	0127H	Transmission output 1 Zero adjustment value	Set value
50H/20H	06H/03H	0128H	Transmission output 1 Span adjustment value	Set value
50H/20H	06H/03H	0131H	A11 pH fluctuation alarm time	Set value
50H/20H	06H/03H	0132H	A12 pH fluctuation alarm time	Set value
50H/20H	06H/03H	0133H	A21 pH fluctuation alarm time	Set value
50H/20H	06H/03H	0134H	A22 pH fluctuation alarm time	Set value
50H/20H	06H/03H	0135H	A11 pH fluctuation alarm band	Set value
50H/20H	06H/03H	0136H	A12 pH fluctuation alarm band	Set value
50H/20H	06H/03H	0137H	A21 pH fluctuation alarm band	Set value
50H/20H	06H/03H	0138H	A22 pH fluctuation alarm band	Set value
50H/20H	06H/03H	0139H	A11 High/Low limits independent lower side value	Set value
50H/20H	06H/03H	013AH	A12 High/Low limits independent lower side value	Set value
50H/20H	06H/03H	013BH	A21 High/Low limits independent lower side value	Set value
50H/20H	06H/03H	013CH	A22 High/Low limits independent lower side value	Set value
50H/20H	06H/03H	013DH	A11 High/Low limits independent upper side value	Set value
50H/20H	06H/03H	013EH	A12 High/Low limits independent upper side value	Set value
50H/20H	06H/03H	013FH	A21 High/Low limits independent upper side value	Set value
50H/20H	06H/03H	0140H	A22 High/Low limits independent upper side value	Set value
50H/20H	06H/03H	0141H	A11 hysteresis	Set value
50H/20H	06H/03H	0142H	A12 hysteresis	Set value
50H/20H	06H/03H	0143H	A21 hysteresis	Set value
50H/20H	06H/03H	0144H	A22 hysteresis	Set value

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0145H	Transmission output 1 status when cleansing	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0146H	Transmission output 1 value HOLD when cleansing	Set value
50H/20H	06H/03H	0147H	Transmission output 2 type	0000H: pH transmission 0001H: Temperature transmission
50H/20H	06H/03H	0148H	Transmission output 2 high limit	Set value
50H/20H	06H/03H	0149H	Transmission output 2 low limit	Set value
50H	06H	014AH	Transmission output 2 adjustment mode (*)	0000H: pH/Temperature display mode, or Cleansing output mode 0001H: Transmission output 2 Zero adjustment mode 0002H: Transmission output 2 Span adjustment mode
50H/20H	06H/03H	014BH	Transmission output 2 Zero adjustment value	Set value
50H/20H	06H/03H	014CH	Transmission output 2 Span adjustment value	Set value
50H/20H	06H/03H	014DH	Transmission output 2 status when calibrating	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	014EH	Transmission output 2 value HOLD when calibrating	Set value
50H/20H	06H/03H	014FH	Transmission output 2 status when cleansing	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0150H	Transmission output 2 value HOLD when cleansing	Set value
50H/20H	06H/03H	0151H	pH inputs for moving average	Set value
50H/20H	06H/03H	0152H	Temperature inputs for moving average	Set value
50H/20H	06H/03H	0200H	User save area 1	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0201H	User save area 2	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0202H	User save area 3	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0203H	User save area 4	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0204H	User save area 5	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0205H	User save area 6	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0206H	User save area 7	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0207H	User save area 8	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0208H	User save area 9	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0209H	User save area 10	-32768 to 32767 (8000H to 7FFFH)

(*) If 'Setting' is executed while Transmission output 2 (TA2 option) is not ordered, the following error code will be returned.
- Shinko protocol: Error code 4 (34H)
- MODBUS: Exception code 17 (11H)

11.6.3 Read Only Command

<table>
<tr><th>Shinko Command Type</th><th>MODBUS Function Code</th><th colspan="2">Data Item</th><th>Data</th></tr>
<tr><td>20H</td><td>03H</td><td>0080H</td><td>pH</td><td>pH</td></tr>
<tr><td>20H</td><td>03H</td><td>0081H</td><td colspan="2">Status flag 1
0000 0000 0000 0000
2^{15} to 2^{0}
2^{0} digit: Response speed error 0: Normal 1: Error
2^{1} digit: Electrode sensitivity error 0: Normal 1: Error
2^{2} digit: Asymmetry potential error 0: Normal 1: Error
2^{3} digit: Standard solution error 0: Normal 1: Error
2^{4} digit: 2nd solution temperature error 0: Normal 1: Error
2^{5} digit: Temperature sensor burnout 0: Normal 1: Burnout
2^{6} digit: Temperature sensor short-circuited
0: Normal 1: Short-circuited
2^{7} digit: Outside temperature compensation range: Exceeding 110.0℃
0: Normal 1: Exceeding 110.0℃
2^{8} digit: Outside temperature compensation range: Less than 0.0℃
0: Normal 1: Less than 0.0℃
2^{9} digit: pH measured value exceeds pH 14.00.
0: Normal 1: Exceeding pH 14.00
2^{10} digit: pH measured value is less than pH 0.00.
0: Normal 1: Less than pH 0.00
2^{11} digit: Unit status flag
0: pH/Temperature Display Mode, or Cleansing Output Mode
1: Setting mode
2^{12}, 2^{13} digits: Calibration status flag
<table>
<tr><th>2^{13}</th><th>2^{12}</th><th>Status</th></tr>
<tr><td>0</td><td>0</td><td>Standby</td></tr>
<tr><td>0</td><td>1</td><td>During the 1st point calibration</td></tr>
<tr><td>1</td><td>0</td><td>During the 2nd point calibration</td></tr>
<tr><td>1</td><td>1</td><td>Calibration complete</td></tr>
</table>
2^{14} digit: A1 output 0: OFF 1: ON
2^{15} digit: Change in key operation 0: No 1: Yes</td></tr>
</table>

<table>
<tr><th>Shinko Command Type</th><th>MODBUS Function Code</th><th colspan="2">Data Item</th><th>Data</th></tr>
<tr><td>20H</td><td>03H</td><td>0090H</td><td>Temperature</td><td>Temperature</td></tr>
<tr><td>20H</td><td>03H</td><td>0091H</td><td colspan="2">Status flag 2
0000 0000 0000 0000
2^{15} to 2^{0}
2^{0} digit: Cleansing output 0: OFF 1: ON
2^{1} digit: A2 output 0: OFF 1: ON
2^{2} digit: Not used (Always 0)
2^{3} digit: A11 output flag (*) 0: OFF 1: ON
2^{4} digit: A12 output flag (*) 0: OFF 1: ON
2^{5} digit: A21 output flag (*) 0: OFF 1: ON
2^{6} digit: A22 output flag (*) 0: OFF 1: ON
2^{7} digit: Cleansing action (Cleansing time)
0: During programmed action
1: During cleansing time
2^{8} digit: Cleansing action (Restore time after cleansing)
0: During programmed action
1: During Restore time after cleansing
2^{9} digit: Manual cleansing action status flag
0: No Manual cleansing action
1: During Manual cleansing action
2^{10} digit: Transmission output 2 Zero adjustment status flag
0: pH/Temperature Display Mode, or Cleansing Output Mode
1: During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode
2^{11}, 2^{12} digits: Transmission output 1 adjustment status flag
<table>
<tr><th>2^{12}</th><th>2^{11}</th><th>Status</th></tr>
<tr><td>0</td><td>0</td><td>pH/Temperature Display Mode, or Cleansing Output Mode</td></tr>
<tr><td>0</td><td>1</td><td>During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode</td></tr>
<tr><td>1</td><td>0</td><td>During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode</td></tr>
</table>
2^{13} digit: A1 pH input error alarm output flag 0: OFF 1: ON
2^{14} digit: A2 pH input error alarm output flag 0: OFF 1: ON
2^{15} digit: Transmission output 2 Span adjustment status flag
0: pH/Temperature Display Mode, or Cleansing Output Mode
1: During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode</td></tr>
<tr><td>20H</td><td>03H</td><td>010DH</td><td>Zero indication</td><td>Indicated value</td></tr>
<tr><td>20H</td><td>03H</td><td>010EH</td><td>Slope indication</td><td>Indicated value</td></tr>
</table>

(*) A□□ output flag:

When cLEC (Cleansing output) is selected in [A11, A12, A21, A22 type]: The A□□ output flag changes to 1 (ON).

If any item other than cLEC (Cleansing output) is selected in [A11, A12, A21, A22 type]:

When A□□ output is turned ON: The A□□ output flag changes to 1 (ON).

When A□□ output is turned OFF: The A□□ output flag changes to 0 (OFF).

11.7 pH Calibration, Transmission Output 1 and 2 Adjustment via Communication Command

Like a keypad operation, there are also 2 methods in pH Calibration via communication command: Automatic Calibration and Manual Calibration.

Perform pH Calibration while pH measured value is in a stable status.

11.7.1 pH Calibration

(1) Automatic Calibration

Automatic Calibration is performed in sequence from the 1st standard solution pH 7 (JIS or US standard) selected at Data item 0009H (pH 7 calibration standard) first, and then the 2nd standard solution [any one of pH 2, pH 4, pH 9 or pH 10 (JIS)] selected at Data item 0001H (2nd solution). pH value (based on JIS Z8802) at each temperature of pH standard solution to be calibrated is automatically calculated.

The following outlines the procedure for Automatic Calibration.

• The 1st Point Automatic Calibration

① Immerse the pH Combined Electrode Sensor in the 1st standard solution (pH 7).
When selecting Last value HOLD (0000H) at Data item 010FH (Transmission output 1 status when calibrating) or 014DH (Transmission output 2 status when calibrating), select it while the pH Combined Electrode Sensor is being immersed in the solution currently calibrated.
After that, immerse the pH Combined Electrode Sensor in the 1st point standard solution (pH 7).

② Set Data item 0038H (pH calibration mode) to 0001H.
The unit proceeds to pH calibration mode.

③ Set Data item 0039H (pH calibration start) to 0001H.
The 1st point Automatic calibration starts.

④ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 01 (During the 1st point calibration) will be returned during automatic calibration.
Automatic Calibration is performed using the Automatic electrode quality evaluation function.

⑤ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 00 (Standby) will be returned after automatic calibration.

⑥ Set Data item 0039H (pH calibration start) to 0002H.
The 1st point automatic calibration is complete, and the unit moves to the 2nd point automatic calibration mode.

• The 2nd Point Automatic Calibration

① After the electrode is rinsed, immerse the pH Combined Electrode Sensor in the 2nd standard solution.

② Set Data item 0039H (pH calibration start) to 0003H.
Automatic calibration for the 2nd point starts.

③ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 10 (During the 2nd point calibration) will be returned during automatic calibration.
Automatic calibration is performed using the Automatic electrode quality evaluation function.

④ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 11 (Calibration complete) will be returned after automatic calibration.

⑤ Set Data item 0039H (pH calibration start) to 0004H.
Automatic calibration for the 2nd point is complete.

⑥ Set Data item 0038H (pH calibration mode) to 0000H.
The pH automatic calibration is complete, and the unit will revert to pH/Temperature Display Mode, or Cleansing Output Mode.

(2) Manual Calibration

When there is a difference of pH 2 or more, Manual Calibration can be performed using the randomly selected 2 kinds of solution.

The following outlines the procedure for Manual Calibration.

• The 1st Point Manual Calibration

① Immerse the pH Combined Electrode Sensor in the 1st standard solution.
When selecting Last value HOLD (0000H) at Data item 010FH (Transmission output 1 status when calibrating) or 014DH (Transmission output 2 status when calibrating), select it while the pH Combined Electrode Sensor is being immersed in the solution currently calibrated.
After that, immerse the pH Combined Electrode Sensor in the 1st point standard solution.

② Set Data item 0038H (pH calibration mode) to 0001H.

③ Set Data item 0039H (pH calibration start) to 0001H.
Manual calibration for the 1st point starts.

④ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 01 (During the 1st point calibration) will be returned during manual calibration.

⑤ Set a pH calibration value at Data item 0008H (pH calibration value).

⑥ Set Data item 0039H (pH calibration start) to 0002H.
Manual calibration for the 1st point is complete, and the unit will enter the 2nd point Manual Calibration mode.

⑦ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 00 (Standby) will be returned after manual calibration.

• The 2nd Point Manual Calibration

① Rinse the electrode, then immerse the pH Combined Electrode Sensor in the 2nd standard solution.

② Set Data item 0039H (pH calibration start) to 0003H.
Manual calibration for the 2nd point starts.

③ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 10 (During the 2nd point calibration) will be returned during manual calibration.

④ Set a pH calibration value at Data item 0008H (pH calibration value).

⑤ Set Data item 0039H (pH calibration start) to 0004H.
Manual calibration for the 2nd point will be complete.

⑥ If 2^{13}, 2^{12} digits are read at Data item 0081H (Status flag 1), 11 (Calibration complete) will be returned after manual calibration.

⑦ Set Data item 0038H (pH calibration mode) to 0000H.
The pH Manual calibration is complete, and the unit will revert to pH/Temperature Display Mode, or Cleansing Output Mode.

(3) Error Code during pH Calibration

If pH calibration cannot be performed due to unstable pH input, temperature compensation error, etc., Error code 1 (Error, Burnout, Short-circuited, etc.) will be returned when 2^0 digit to 2^{10} digit at Data item 0081H (Status flag 1) are read.
To release the Error code, set Data item 0038H (pH calibration mode) to 0000H.
The unit will return to pH/Temperature Display Mode, or Cleansing Output Mode.

If Data item 0039H (pH calibration start) is set during pH calibration of the 1st or 2nd point, the following error code will be returned.
Shinko protocol: Error code 34H
MODBUS protocol: Exception code 11H

11.7.2 Transmission Output 1 Adjustment

Fine adjustment of Transmission output 1 is performed.
The pH meter is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and the output value of this instrument.
In this case, perform Transmission output 1 Zero adjustment and Span adjustment.

The following outlines the procedure for Transmission output 1 adjustment.

① Set Data item 0126H (Transmission output 1 adjustment mode) to 0001H.
The unit moves to Transmission output 1 Zero adjustment mode.
If 2^{12} and 2^{11} digits are read at Data item 0091H (Status flag 2), 01 (During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode) will be returned.

② Set the Transmission output 1 Zero adjustment value at Data item 0127H (Transmission output 1 Zero adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 1 Span

③ Set Data item 0126H (Transmission output 1 adjustment mode) to 0002H.
The unit moves to Transmission output 1 Span adjustment mode.
If 2^{12} and 2^{11} digits are read at Data item 0091H (Status flag 2), 10 (During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode) will be returned.

④ Set Transmission output 1 Span adjustment value at Data item 0128H (Transmission output 1 Span adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 1 Span

⑤ Repeat steps ① to ④ if necessary.

⑥ To finish the Transmission output 1 adjustment, set Data item 0126H (Transmission output 1 adjustment mode) to 0000H.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

11.7.3 Transmission Output 2 Adjustment

Fine adjustment of Transmission output 2 is performed.
The pH meter is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and the output value of this instrument.
In this case, perform Transmission output 2 Zero adjustment and Span adjustment.

The following outlines the procedure for Transmission output 2 adjustment.

① Set Data item 014AH (Transmission output 2 adjustment mode) to 0001H.
The unit moves to Transmission output 2 Zero adjustment mode.
If 2^{10} digit is read at Data item 0091H (Status flag 2), 1 (During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode) will be returned.

② Set the Transmission output 2 Zero adjustment value at Data item 014BH (Transmission output 2 Zero adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 2 Span

③ Set Data item 014AH (Transmission output 2 adjustment mode) to 0002H.
The unit moves to Transmission output 2 Span adjustment mode.

If 2^{15} digit is read at Data item 0091H (Status flag 2), 1 (During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode) will be returned.

④ Set Transmission output 2 Span adjustment value at Data item 014CH (Transmission output 2 Span adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: ±5.00% of Transmission output 2 Span

⑤ Repeat steps ① to ④ if necessary.

⑥ To finish the Transmission output 2 adjustment, set Data item 014AH (Transmission output 2 adjustment mode) to 0000H.
The unit reverts to pH/Temperature Display Mode, or Cleansing Output Mode.

11.8 Notes on Programming Monitoring Software

11.8.1 How to Speed up the Scan Time

When monitoring multiple units of the WIL-102-PH, set the program so that the requisite minimum pieces of data such as Data item 0080H (pH), Data item 0090H (Temperature), Data item 0081H (Status flag 1), Data item 0091H (Status flag 2) can be read. For other data, set the program so that they can be read only when their set value has been changed. This will speed up the scan time.

11.8.2 How to Read the Set Value Changes Made by Front Keypad Operation

If any set value is changed by keypad operation, the instrument sets [0081H (Status flag 1) 2^{15}: Change in key operation] to 1 (Yes).

There are 2 methods of reading the set value changes made by the front keypad:

(1) Reading Method 1

① On the monitoring software side, check that [0081H (Status flag 1) 2^{15}: Change in key operation] has been set to 1 (Yes), then read all set values.

② Clear [0081H (Status flag 1) 2^{15}: Change in key operation], by setting Data item 007FH (Key operation change flag clearing) to 0001H (Clear change flag).

If Data item 007FH (Key operation change flag clearing) is set to 0001H (Clear change flag) during the setting mode of the instrument, Error code 5 (35H, Shinko protocol) or Exception Code 18 (12H, MODBUS protocol) will be returned as a negative acknowledgement. And [0081H (Status flag 1) 2^{15}: Change in key operation] cannot be cleared.

Set a program so that all set values can be read when a negative acknowledgement is returned.

③ Read all set values again after acknowledgement is returned.

(2) Reading Method 2

① On the monitoring software side, check that [0081H (Status flag 1) 2^{15}: Change in key operation] has been set to 1 (Yes), then set Data item 007FH (Key operation change flag clearing) to 0001H (Clear change flag).

② Set the program depending on the acknowledgement or negative acknowledgement as follows.

When acknowledgement is returned:

Consider it as settings completed, and read all set values.

When Error code 5 (35H, Shinko protocol) or Exception code 18 (12H, MODBUS protocol) is returned as a negative acknowledgement:

Consider it as still in setting mode, and read the requisite minimum pieces of data such as Data items 0080H (pH), 0090H (Temperature), 0081H (Status flag 1), 0091H (Status flag 2), then return to step ①.

Thus, programs which do not affect the scan time can be created using the methods described above, even if set values on the monitoring software will not be updated until settings are complete.

11.8.3 Note when Sending All Set Values Simultaneously

• If A11, A12, A21 or A22 type is changed at Data items 0003H (A11 type), 0050H (A12 type), 0051H (A21 type) or 0052H (A22 type), the A11, A12, A21 or A22 value will default to 0 (zero).
Output status of A11, A12, A21 or A22 will also be initialized.

First, send the A11, A12, A21, A22 type, then send the A11, A12, A21, A22 value set at Data items 0004H (A11 value), 0053H (A12 value), 0054H (A21 value) and 0055H (A22 value).

12. Specifications

12.1 Standard Specifications

Rating

Rated scale	**Input**		**Input Range**	**Resolution**
	pH combined electrode		pH 0.00 to 14.00	pH 0.01
	Pt spec	Pt1000	0.0 to 100.0℃	0.1℃
		Pt100	0.0 to 100.0℃	0.1℃
	Cu spec	Cu500/25℃	0.0 to 100.0℃	0.1℃
Input	pH Combined Electrode Sensor (pH sensor: JIS Z8802 Temperature element: Pt1000 or Pt100) pH Combined Electrode Sensor (pH sensor: JIS Z8802 Temperature element: Cu500/25℃)			
Power supply voltage	Model	**WIL-102-PH**	**WIL-102-PH 1**	
	Power supply voltage	100 to 240 V AC 50/60 Hz	24 V AC/DC 50/60 Hz	
	Allowable voltage fluctuation range	85 to 264 V AC	20 to 28 V AC/DC	

General Structure

External dimensions	30 x 88 x 108 mm (W x H x D, including socket)	
Mounting	DIN rail	
Case	Material: Flame-resistant resin, Color: Light gray	
Panel	Membrane sheet	
Indication structure	Display	
	pH Display	Red LED 4-digits, character size 10 x 4.6 mm (H x W)
	Temperature Display	Red LED 4-digits, character size 10 x 4.6 mm (H x W)
	Action indicator	
	PWR (Yellow)	Lit when power supply is ON.
	A1 (Red)	Lit when A1 output is ON. (Unlit when TA2 option is added)
	A2 (Yellow)	Lit when A2 output is ON. (Unlit when TA option or TA2 option is added)
	T/R (Yellow)	Lit while in Serial communication TX output (transmitting)
Setting structure	Setting method: Input system using membrane sheet key	

Indication Performance

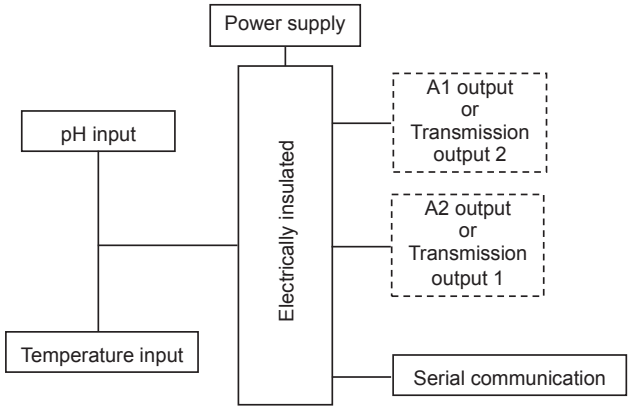
Repeatability	pH value: pH ±0.05
Linearity	pH value: pH ±0.05
Temperature indication accuracy	Temperature: ±1℃
Input sampling period	125 ms (2 inputs)
Time accuracy	Within ±1% of setting time

Standard Functions

pH calibration	For pH measurement using the glass electrode method, pH in the sensor location, electrode performance and standard solution accuracy respectively play an important role for obtaining reliable data. 2-points calibration is performed using the standard solutions. However, it is effective within the input rated range regardless of the calibration value. There are 2 calibration methods: Automatic Calibration, Manual Calibration.
Temperature calibration	When a sensor cannot be set at the exact location where measurement is desired, the resulting measured temperature may deviate from the temperature in the desired location. In this case, the desired temperature can be set for the desired location by setting a temperature calibration value. However, it is effective within the input rated range regardless of the temperature calibration value.

<table>
<tr><td colspan="2">Serial communication</td><td colspan="4">The following operations can be carried out from an external computer.
(1) Reading and setting of various set values
(2) Reading of the pH, temperature and status
(3) Function change, adjustment
(4) Reading and setting of user save area</td></tr>
<tr><td></td><td>Cable length</td><td colspan="4">1.2 km (Max.), Cable resistance: Within 50 Ω (Terminators are not necessary, but if used, use 120 Ω or more on one side.)</td></tr>
<tr><td></td><td>Communication line</td><td colspan="4">EIA RS-485</td></tr>
<tr><td></td><td>Communication method</td><td colspan="4">Half-duplex communication</td></tr>
<tr><td></td><td>Communication speed</td><td colspan="4">9600, 19200, 38400 bps (Selectable by keypad)</td></tr>
<tr><td></td><td>Synchronization method</td><td colspan="4">Start-stop synchronization</td></tr>
<tr><td></td><td>Code form</td><td colspan="4">ASCII, Binary</td></tr>
<tr><td></td><td>Communication protocol</td><td colspan="4">Shinko protocol, MODBUS ASCII, MODBUS RTU (Selectable by keypad)</td></tr>
<tr><td></td><td>Data bit/Parity</td><td colspan="4">8 bits/No parity, 7 bits/No parity, 8 bits/Even, 7 bits/Even, 8 bits/Odd, 7 bits/Odd (Selectable by keypad)</td></tr>
<tr><td></td><td>Stop bit</td><td colspan="4">1 bit, 2 bits (Selectable by keypad)</td></tr>
<tr><td></td><td>Error correction</td><td colspan="4">Command request repeat system</td></tr>
<tr><td></td><td>Error detection</td><td colspan="4">Parity check, Checksum (Shinko protocol), LRC (MODBUS protocol ASCII), CRC-16 (MODBUS protocol RTU)</td></tr>
<tr><td></td><td rowspan="5">Data format</td><td>Communication Protocol</td><td>Shinko Protocol</td><td>MODBUS ASCII</td><td>MODBUS RTU</td></tr>
<tr><td></td><td>Start bit</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td>Data bit</td><td>7</td><td>7 (8) Selectable</td><td>8</td></tr>
<tr><td></td><td>Parity</td><td>Even</td><td>Even (No parity, Odd), Selectable</td><td>No parity (Even, Odd), Selectable</td></tr>
<tr><td></td><td>Stop bit</td><td>1</td><td>1 (2), Selectable</td><td>1 (2), Selectable</td></tr>
</table>

Insulation/Dielectric Strength

<table>
<tr><td>Circuit insulation configuration</td><td> 

: When the corresponding option is ordered
Insulation Resistance: 10 MΩ minimum, at 500 V DC</td></tr>
<tr><td>Dielectric strength</td><td>Between power terminal - ground: 1.5 kV AC for 1 minute
Between input terminal - ground: 1.5 kV AC for 1 minute
Between input terminal - power terminal: 1.5 kV AC for 1 minute</td></tr>
</table>

Attached Functions

<table>
<tr><td>Set value lock</td><td>Loc 1 (Lock 1): None of the set values can be changed.
Loc2 (Lock 2): Only A11, A12, A21, A22 values can be changed.
Loc3 (Lock 3): All set values – except Electrode RTD, Temperature calibration value, pH calibration value, pH calibration Auto/Manual, Transmission output 1 Zero adjustment value, Transmission output 1 Span adjustment value, Transmission output 2 Zero adjustment value, Transmission output 2 Span adjustment value – can be temporarily changed. However, they revert to their previous value after the power is turned off because they are not saved in the non-volatile IC memory.</td></tr>
<tr><td>pH input
sensor correction</td><td>pH value measured by the pH Combined Electrode Sensor may deviate from the pH value in the measured location. In this case desired pH value can be obtained by adding a sensor correction value.
However, it is effective within the measurement range regardless of the sensor correction value.</td></tr>
<tr><td>Temperature Display when no temperature compensation</td><td>If 'Reference temperature' is selected in [Temperature Display when no temperature compensation], the value set in [Reference temperature] will be indicated on the Temperature Display.
If 'Unlit' is selected, the Temperature Display will turn off.
If 'Temperature transmission' is selected in [Transmission output 1 type] or [Transmission output 2 type], the value set in [Reference temperature] will be output.</td></tr>
<tr><td>Outside measurement range</td><td>If pH measured value or temperature measured value is outside the measurement range, the following will be indicated. However, if pH measured value is outside the measurement range, and when the unit proceeds to pH calibration mode, the pH Display will turn off, and the Temperature Display will flash oF□□.
If temperature measured value is outside the measurement range, and when the unit proceeds to pH calibration mode, the pH Display will turn off, and the Temperature Display will flash an error code.

pH measured value is outside the measurement range: If the value is less than pH 0.00 or exceeds pH 14.00, the following will be indicated.

• When nonE (No temperature compensation) is selected in [Electrode RTD (p.28)]
<table>
<tr><th>pH Display</th><th>Temperature Display</th></tr>
<tr><td>Less than pH 0.00: 0.00</td><td>oF□□ is flashing.</td></tr>
<tr><td>Exceeding pH 14.00: 14.00</td><td>oF□□ is flashing.</td></tr>
</table>
• With Pt spec, when Pt 100 (Pt1000) or Pt 1□ (Pt100) is selected in [Electrode RTD (p.28)]
• With Cu spec, when cU5□ (Cu500) is selected in [Electrode RTD (p.28)]
<table>
<tr><th>pH Display</th><th>Temperature Display</th></tr>
<tr><td>Less than pH 0.00: 0.00 is flashing.</td><td>Temperature</td></tr>
<tr><td>Exceeding pH 14.00: 14.00 is flashing.</td><td>Temperature</td></tr>
</table>
If temperature measured value is outside the measurement range (Less than 0.0℃ or exceeding 110.0℃), the following will be indicated.
<table>
<tr><th>pH Display</th><th>Temperature Display</th></tr>
<tr><td>pH</td><td>Less than 0.0℃: E-24</td></tr>
<tr><td>pH</td><td>Exceeding 110.0℃: E-23</td></tr>
</table></td></tr>
<tr><td>Power failure countermeasure</td><td>The setting data is backed up in the non-volatile IC memory.</td></tr>
<tr><td>Self-diagnosis</td><td>The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the WIL-102-PH is switched to warm-up status.</td></tr>
</table>

<table>
<tr><td>Warm-up indication</td><td>For approx. 4 seconds after the power is switched ON, the input characters are indicated on the pH Display and Temperature Display.
Depending on the input specifications, Temperature Display indicates differently as follows.

Pt spec
<table>
<tr><th>pH Display</th><th>Temperature Display</th><th>Item selected in [Electrode RTD (p.28)]</th><th>Item selected in [Pt100 input wire type (p.28)]</th></tr>
<tr><td rowspan="4">PH□□</td><td>Unlit</td><td>nonE: No temperature compensation</td><td rowspan="2"></td></tr>
<tr><td>Pt 10</td><td>Pt 10: Pt1000</td></tr>
<tr><td>Pt□2</td><td rowspan="2">Pt 1□: Pt100</td><td>Pt□2 : 2-wire type</td></tr>
<tr><td>Pt□3</td><td>Pt□3 : 3-wire type</td></tr>
</table>
Cu spec
<table>
<tr><th>pH Display</th><th>Temperature Display</th><th>Item selected in [Electrode RTD (p.28)]</th></tr>
<tr><td rowspan="2">PH□□</td><td>Unlit</td><td>nonE: No temperature compensation</td></tr>
<tr><td>cU5□</td><td>cU5□: Cu500</td></tr>
</table></td></tr>
<tr><td>Display sleep function</td><td>’pH’, ’Temperature’ or ’No indication’ – which is indicated in pH/Temperature Display Mode, or Cleansing Output Mode – can be selected in [Display selection (p.32)].
If ’pH’ or ’Temperature’ is selected, and if indication time is set, the display (no operation status) becomes unlit after the indication time has passed.
By pressing any key, the display re-lights.
If the indication time is set to 0, the display remains lit, and this function does not work.</td></tr>
<tr><td>Auto-light function</td><td>Automatically measures and controls brightness of the pH Display, Temperature Display and action indicators.</td></tr>
<tr><td>Cable length correction</td><td>If Pt□2 (2-wire type) is selected in [Pt100 input wire type (p.28)], and if sensor cable is too long, temperature measurement error will occur due to cable resistance. This can be corrected by setting the ‘cable length correction value’ and ‘cable cross-section area’.</td></tr>
<tr><td>Zero indication</td><td>Indicates potential difference when pH 7 is calibrated.
However, if Manual calibration is performed, zero indication value calculated at previous automatic calculation will not be updated.
If calibration is not successfully completed, zero indication will show the value before calibration.</td></tr>
<tr><td>Slope indication</td><td>From the voltage equivalent to the calibrated pH, electromotive force for the change of pH 1 will be indicated. If calibration is not successfully completed, slope indication will show the value before calibration.</td></tr>
</table>

Error code	Error codes below flash on the Temperature Display.				
	Error Code	**Error Type**	**Error Contents**	**Description**	**Occurrence**
	E-11	Error	Response Speed Error	When calibrating, the response of the pH Combined Electrode Sensor is slow. When the difference between the input and each of the 1st and 2nd solutions are within pH ±1.50, and input fluctuation is over pH ±0.05 (in 10 seconds of assessment cycles) for 5 minutes, this is assumed to be an error. However, if input fluctuation is less than or equal to pH ±0.05, this is assumed to be within the normal range.	When calibrating
	E-12	Error	Electrode Sensitivity Error	When calibrating, sensitivity of the pH Combined Electrode Sensor has deteriorated. The difference between 1st and 2nd standard solution value after calibration is less than or equal to pH 2.00.	
	E-13	Error	Asymmetry Potential Error	When calibrating pH 7, the difference in electromotive force between the sensor-measured value and standard value exceeds the equivalent of pH ±1.50.	
	E-14	Error	Standard Solution Error	The specified standard solution has not been used. When pH ±1.50 is exceeded for the 1st and 2nd solutions.	
	E-15	Error	Solution temperature Error	When temperature is 55℃ or more at pH 10 solution.	
	E-21	Fail	Temp. Sensor Burnout	Temperature sensor lead wire is burnt out.	When measuring or calibrating
	E-22	Fail	Temp. Sensor Short-circuited	Temperature sensor lead wire is short-circuited.	
	E-23	Error	Outside Temp. Compen.Range	Measured temperature has exceeded 110.0℃.	
	E-24	Error	Outside Temp. Compen.Range	Measured temperature is less than 0.0℃.	

(Abbreviations: Temp.: Temperature, Compen.: Compensation)

Other

Power consumption	Approx. 8 VA
Ambient temperature	0 to 50℃
Ambient humidity	35 to 85 %RH (non-condensing)
Weight	Approx. 200 g (including the socket)
Accessories included	Instruction manual: 1 copy Unit label: 1 sheet
Accessories sold separately	Socket: ASK-001-1 (Finger-safe, terminal screw fall prevention)
Environmental specification	RoHS directive compliant

12.2 Optional Specifications

A□□ Output (Option Code: EVT or TA)

A□□ output		If the measured value exceeds the A□□ value, the A□□ output will be activated for each A□□ type. Regardless of options being ordered, A□□ output status can be read by reading Status flag 2 (A11, A12, A21, A22 output flag bit) in Serial communication. If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], Temperature input low limit and Temperature input high limit actions will not work. A□□ output status, when input errors occur, differs depending on the selections in [A□□ output when input errors occur (p.27)] as follows: • If oFF (Disabled) is selected, the A□□ output and A□□ output status will be turned OFF if input errors occur. • If on (Enabled) is selected, the A□□ output and A□□ output status will be maintained if input errors occur. If Transmission output 1 (TA option) is ordered, only A1 output can be added.
Setting range		pH input: pH 0.00 to 14.00 Temperature input: 0.0 to 100.0℃ (The placement of the decimal point does not follow the selection. It is fixed.)
Action		ON/OFF action
A□□ ON side A□□ OFF side		pH input: pH 0.01 to 4.00 Temperature input: 0.1 to 10.0℃ (The placement of the decimal point does not follow the selection. It is fixed.)
A□□ type		One type can be selected from the following with the keypad. If 'No temperature compensation' is selected in [Electrode RTD (p.28)], Temperature input low limit and Temperature input high limit actions will not work. • No action • pH input low limit action • pH input high limit action • Temperature input low limit action • Temperature input high limit action • Error output: The A□□ output will be turned ON when the error type is 'Error'. (Table 9.1.3-1, p.41) • Fail output: The A□□ output will be turned ON when the error type is 'Fail'. (Table 9.1.3-1, p.41) • Cleansing output • pH fluctuation alarm output • pH input High/Low limits independent action • Temperature input High/Low limits independent action
Output		Relay contact, 1a
	Control capacity	3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load, cosϕ=0.4)
	Electrical life	100,000 cycles
A□□ ON delay time		0 to 9999 seconds
A□□ OFF delay time		0 to 9999 seconds
A1, A2 output allocation		A11 type, A12 type, A21 type and/or A22 type are allocated to A1 (or A2) output. Output is OR output. However, if Cleansing output is selected in any one of [A11, A12, A21, A22 type], the Cleansing output will be given priority.
Output ON time/ OFF time when A1/A2 output ON		If Output ON time and OFF time are set, A1 (or A2) output can be turned ON/OFF in a configured cycle when A1 (or A2) output is ON.

	pH input error alarm	Detects actuator trouble. Even if pH input error alarm time has elapsed – if the change in pH input is smaller than the pH input error alarm band – the instrument assumes that actuator trouble has occurred, and sets Status flag 2 (A1, A2 pH input error alarm output flag bit). In Serial communication, status can be read by reading Status flag 2 (A1, A2 pH input error alarm output flag bit). When pH is calibrated, this alarm is disabled. If PH_L (pH input low limit action) or PH_H (pH input high limit action) is selected in [A11, A12, A21, A22 type (pp.21, 22)], this alarm is enabled.
	pH fluctuation alarm output	Detects pH fluctuation errors. Even if pH fluctuation alarm time has elapsed, – if the change in pH input fluctuation is smaller than the pH fluctuation alarm band – the instrument assumes that a pH fluctuation error has occurred, and sets Status flag 2 (A11, A12, A21, A22 output flag bit). Outputs when EPUA (pH fluctuation alarm output) is selected in [A11, A12, A21, A22 type (pp.21, 22)]. This alarm will be disabled if pH fluctuation alarm time is set to 0 (zero) hours, or if pH fluctuation alarm band is set to pH 0.00.

Transmission Output 1 (Option Code: TA)

Transmission output 1		Converting pH or temperature to analog signal every input sampling period, and outputs the value in current. If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], and if rEmP (Temperature transmission) is selected in [Transmission output 1 type (p.30)], the value set in [Reference temperature (p.28)] will be output. If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. (The placement of the decimal point does not follow the selection. It is fixed.)	
		Resolution	12000
		Current	4 to 20 mA DC (Load resistance: Max 550 Ω)
		Output accuracy	Within ±0.3% of Transmission output 1 Span
	Transmission output 1 adjustment	Fine adjustment of Transmission output 1 can be performed via Transmission output 1 Zero adjustment and Span adjustment.	
	Transmission output 1 status when calibrating	Transmission output 1 status can be selected when calibrating pH. Last value HOLD: Retains the last value before pH calibration, and outputs it. Set value HOLD: Outputs the value set in [Transmission output 1 value HOLD when calibrating]. Measured value: Outputs the measured value when calibrating pH.	

Transmission Output 2 (Option Code: TA2)

Transmission output 2		Converting pH or temperature to analog signal every input sampling period, and outputs the value in current. If nonE (No temperature compensation) is selected in [Electrode RTD (p.28)], and if rEmP (Temperature transmission) is selected in [Transmission output 2 type (p.30)], the value set in [Reference temperature (p.28)] will be output. If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. (The placement of the decimal point does not follow the selection. It is fixed.)	
		Resolution	12000
		Current	4 to 20 mA DC (Load resistance: Max 550 Ω)
		Output accuracy	Within ±0.3% of Transmission output 2 Span
	Transmission output 2 adjustment	Fine adjustment of Transmission output 2 can be performed via Transmission output 2 Zero adjustment and Span adjustment.	
	Transmission output 2 status when calibrating	Transmission output 2 status can be selected when calibrating pH. Last value HOLD: Retains the last value before pH calibration, and outputs it. Set value HOLD: Outputs the value set in [Transmission output 2 value HOLD when calibrating]. Measured value: Outputs the measured value when calibrating pH.	

13. Troubleshooting

If any malfunction occurs, refer to the following items after checking that power is being supplied to the WIL-102-PH.

13.1 Indication

Problem	Possible Cause	Solution
The pH/Temperature Display is unlit.	nonE (No Indication) is selected in [Display selection (p.32)].	Select ALL (pH/Temperature).
	The time set in [Indication time (p.32)] has passed.	If any key is pressed while displays are unlit, it will re-light. Set the indication time to a suitable time-frame.
The pH/Temperature Display is dark.	USE (Enabled) is selected in [Auto-light function (p.31)].	Select ---- (Disabled).
Indication of the pH/Temperature Display is unstable or irregular.	pH calibration and temperature calibration may not have finished.	Perform pH calibration and temperature calibration.
	Electrode RTD selection might not be correct.	Select a correct electrode RTD.
	Specification of the pH Combined Electrode Sensor may not be suitable.	Replace the sensor with a suitable one.
	There may be equipment that interferes with or makes noise near the WIL-102-PH.	Keep WIL-102-PH clear of any potentially disruptive equipment.
Temperature Display is unlit.	oFF (Unlit) is selected in [Temperature Display when no temperature compensation (p.32)].	Select trd (Reference temperature).
[E- 11] is flashing on the Temperature Display.	This shows that the response of the pH Combined Electrode Sensor is slow when calibrating.	Rinse the pH Combined Electrode Sensor. If [E- 11] is still flashing, check if the standard solution and pH Combined Electrode Sensor are normal. If they are not normal, replace the solution or the sensor.
[E- 12] is flashing on the Temperature Display.	This shows that pH electrode sensitivity has deteriorated when calibrating.	Rinse the pH Combined Electrode Sensor, and refill the internal solution. If [E- 12] is still flashing, replace the sensor.
[E- 13] is flashing on the Temperature Display.	When calibrating, electromotive force (asymmetry potential) of pH 7 is large.	Rinse the pH Combined Electrode Sensor, and refill the internal solution. If [E- 13] is still flashing, replace the sensor.
[E- 14] is flashing on the Temperature Display.	When calibrating, the specified standard solution is not used.	Rinse the pH combined electrode sensor, and refill the internal solution. If [E- 14] is still flashing, use the specified standard solution.
[E- 15] is flashing on the Temperature Display.	When calibrating, temperature of pH 10 is 55℃ or higher.	Check the liquid temperature of pH 10.

Problem	Possible Cause	Solution
[E-21] is flashing on the Temperature Display.	This occurs when the temperature sensor lead wire is burnt out.	Replace the pH Combined Electrode Sensor.
[E-22] is flashing on the Temperature Display.	This occurs when the temperature sensor lead wire is short-circuited.	Replace the pH Combined Electrode Sensor.
[E-23] is flashing on the Temperature Display.	This occurs when measured temperature value exceeds 110.0℃.	Check the environment of measurement location.
[E-24] is flashing on the Temperature Display.	This occurs when measured temperature value is less than 0.0℃.	Check the environment of measurement location.
[Err 1] is indicating on the pH Display.	Internal memory is defective.	Contact our agency or us.

13.2 Key Operation

Problem	Possible Cause	Solution
• None of the set values can be changed. • The values do not change by the △ and ▽ keys.	Loc 1 (Lock 1) is selected in [Set value lock (p.29)].	Select ---- (Unlock).
• Only A□□ value can be set. Other settings are not possible. • The values do not change by the △ and ▽ keys.	Loc2 (Lock 2) is selected in [Set value lock (p.29)].	Select ---- (Unlock).
Unable to enter Manual cleansing mode.	cLEn (Cleansing output) is not selected in any one of [A11, A12, A21 or A22 type (pp. 21, 22)].	Select cLEn (Cleansing output) in any one of [A11, A12, A21 or A22 type (pp. 21, 22)].
	Cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.	Execute Manual cleansing after Cleansing action is completed.
Unable to enter a calibration mode (pH calibration mode or Temperature calibration mode).	Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.29)].	Select ---- (Unlock).
	cLEn (Cleansing output) has been selected in any one of [A11, A12, A21, A22 type (pp. 21, 22)], and cleansing action is performing using the 'Cleansing Time' and 'Restore Time after Cleansing' settings.	Perform calibration after cleansing action is completed.

13.3 Communication

Check that power is being supplied to the master and slave that customers use.
If communication failure still occurs, check the following.

Problem	Possible Cause	Solution
Communication failure	Communication cable is not securely connected, or is disconnected/defective.	Check the communication cable and connector.
	Incorrect wiring of the communication cable and/or connector	Check the communication cable and connector.
	Imperfect contact between the communication cable and the connector, or between the communication connector and instrument port	Check the communication cable and connector.
	Communication speed of the slave does not match that of the master.	Check the communication speed of the slave and master.
	The data bit, parity and stop bit of the master do not correspond to those of the slave.	Check the data bit, parity and stop bit of the master and the slave.
	The instrument number (address) of the slave does not correspond to that of the command.	Check the instrument number (address) of the slave and command.
	The instrument numbers (addresses) are duplicated in multiple slaves.	Check the instrument numbers (addresses) of the slave.
	Make sure that the program is appropriate for the transmission timing.	Check the program.
Although communication is occurring, the response is negative acknowledgement.	A non-existent command code has been sent.	Check the command code.
	The setting command data exceeds the setting range of the slave.	Check the setting range of the slave.
	The WIL-102-PH cannot be set while calibration is being performed using the Automatic electrode quality evaluation function.	Check the slave status.
	The WIL-102-PH is in front keypad operation setting mode.	Return the instrument to pH/Temperature Display Mode, or Cleansing Output Mode.

For all other malfunctions, please contact our main office or dealers.

14. Character Tables

The following shows our character tables. Use data column for your reference.

Setting Groups

Character	Setting Group
F.nc.1	pH Input Group
F.nc.2	Temperature Input Group
oPEr	Basic Function Group
Er.SP	Zero/Slope Indication Group

Temperature Calibration Mode

Character	Setting Item, Setting Range	Factory Default	Data
toXX (*) XX0.0	**Temperature calibration value** Setting range: -10.0 to 10.0℃	0.0℃	

(*) toXX and temperature are displayed alternately.

pH Calibration Mode (for pH manual calibration)

Character	Setting Item, Setting Range	Factory Default	Data
-1-X (*) X0.00	**pH calibration value** Setting range: -7.00 to 7.00	0.00	

(*) -1-X and pH are displayed alternately.

Transmission Output 1 Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AJE1 X0.00	**Transmission output 1 Zero adjustment value** Setting range: ±5.00% of Transmission output 1 Span	0.00%	
AJS1 X0.00	**Transmission output 1 Span adjustment value** Setting range: ±5.00% of Transmission output 1 Span	0.00%	

Transmission Output 2 Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AJE2 X0.00	**Transmission output 2 Zero adjustment value** Setting range: ±5.00% of Transmission output 2 Span	0.00%	
AJS2 X0.00	**Transmission output 2 Span adjustment value** Setting range: ±5.00% of Transmission output 2 Span	0.00%	

pH Input Group

Character	Setting Item, Setting Range	Factory Default	Data
TYPE JIS	**pH 7 calibration standard** JIS : JIS (Japanese Industrial Standards) US : US standard	JIS	
SEPH PH4	**2nd solution** PH2 : pH 2 PH4 : pH 4 PH9 : pH 9 PH10 : pH 10	pH 4	
dP 1 0.00	**Decimal point place** 0 : No decimal point 0.0 : 1 digit after decimal point 0.00 : 2 digits after decimal point	2 digits after decimal point	
A11F ----	**A11 type** ---- : No action PH_L : pH input low limit action PH_H : pH input high limit action TmPL : Temperature input low limit action TmPH : Temperature input high limit action Error : Error output FAIL : Fail output CLEG : Cleansing output EPbA : pH fluctuation alarm output PHHL : pH input High/Low limits independent action TmHL : Temperature input High/Low limits independent action	No action	
A12F ----	**A12 type** Selection item: Same as those of [A11 type]	No action	
A21F ----	**A21 type** Selection item: Same as those of [A11 type]	No action	
A22F ----	**A22 type** Selection item: Same as those of [A11 type]	No action	
A11 0.00	**A11 value** Setting range: pH input low limit, high limit actions: pH 0.00 to 14.00 (*) Temperature input low limit, high limit actions: 0.0 to 100.0℃ (*)	pH input: pH 0.00, Temperature input: 0.0℃	
A12 0.00	**A12 value** Setting range: Same as those of [A11 value]	pH input: pH 0.00, Temperature input: 0.0℃	
A21 0.00	**A21 value** Setting range: Same as those of [A11 value]	pH input: pH 0.00, Temperature input: 0.0℃	
A22 0.00	**A22 value** Setting range: Same as those of [A11 value]	pH input: pH 0.00, Temperature input: 0.0℃	
A11d rdiF	**A11 hysteresis type** cdiF : Medium Value rdiF : Reference Value	Reference Value	
A11U 0.10	**A11 ON side** Setting range: pH input: pH 0.00 to 4.00 (*) Temperature input: 0.0 to 10.0℃ (*)	pH input: pH 0.10, Temperature input: 1.0℃	
A11L 0.10	**A11 OFF side** Setting range: pH input: pH 0.00 to 4.00 (*) Temperature input: 0.0 to 10.0℃ (*)	pH input: pH 0.10, Temperature input: 1.0℃	

(*) The placement of the decimal point does not follow the selection. It is fixed.

Character	Setting Item, Setting Range	Factory Default	Data
A12d hdIF	**A12 hysteresis type** Selection item: Same as those of [A11 hysteresis type] (p.81)	Reference Value	
A12U □0.10	**A12 ON side** Setting range: Same as those of [A11 ON side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A12L □0.10	**A12 OFF side** Setting range: Same as those of [A11 OFF side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A21d hdIF	**A21 hysteresis type** Selection item: Same as those of [A11 hysteresis type] (p.81)	Reference Value	
A21U □0.10	**A21 ON side** Setting range: Same as those of [A11 ON side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A21L □0.10	**A21 OFF side** Setting range: Same as those of [A11 OFF side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A22d hdIF	**A22 hysteresis type** Selection item: Same as those of [A11 hysteresis type] (p.81)	Reference Value	
A22U □0.10	**A22 ON side** Setting range: Same as those of [A11 ON side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A22L □0.10	**A22 OFF side** Setting range: Same as those of [A11 OFF side] (p.81)	pH input: pH 0.10, Temperature input: 1.0℃	
A11o □□□0	**A11 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
A12o □□□0	**A12 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
A21o □□□0	**A21 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
A22o □□□0	**A22 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
A11c □□□0	**A11 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
A12c □□□0	**A12 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
A21c □□□0	**A21 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
A22c □□□0	**A22 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
A11F □□□0	**A11 pH fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A12F □□□0	**A12 pH fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A21F □□□0	**A21 pH fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A22F □□□0	**A22 pH fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A11H □0.00	**A11 pH fluctuation alarm band** Setting range: pH 0.00 to 14.00	pH 0.00	
A12H □0.00	**A12 pH fluctuation alarm band** Setting range: pH 0.00 to 14.00	pH 0.00	
A21H □0.00	**A21 pH fluctuation alarm band** Setting range: pH 0.00 to 14.00	pH 0.00	

Character	Setting Item, Setting Range	Factory Default	Data
A22 □0.00	**A22 pH fluctuation alarm band** Setting range: pH 0.00 to 14.00	pH 0.00	
A11n □0.00	**A11 High/Low limits independent lower side value** Setting range: pH input: pH 0.00 to 14.00 (*) Temperature input: 0.0 to 100.0℃ (*)	pH input: pH 0.00 Temperature input: 0.0℃	
A12n □0.00	**A12 High/Low limits independent lower side value** Setting range: Same as those of [A11 High/Low limits independent lower side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A21n □0.00	**A21 High/Low limits independent lower side value** Setting range: Same as those of [A11 High/Low limits independent lower side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A22n □0.00	**A22 High/Low limits independent lower side value** Setting range: Same as those of [A11 High/Low limits independent lower side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A11P □0.00	**A11 High/Low limits independent upper side value** Setting range: pH input: pH 0.00 to 14.00 (*) Temperature input: 0.0 to 100.0℃ (*)	pH input: pH 0.00 Temperature input: 0.0℃	
A12P □0.00	**A12 High/Low limits independent upper side value** Setting range: Same as those of [A11 High/Low limits independent upper side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A21P □0.00	**A21 High/Low limits independent upper side value** Setting range: Same as those of [A11 High/Low limits independent upper side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A22P □0.00	**A22 High/Low limits independent upper side value** Setting range: Same as those of [A11 High/Low limits independent upper side value]	pH input: pH 0.00 Temperature input: 0.0℃	
A11H □0.10	**A11 hysteresis** Setting range: pH input: pH 0.01 to 4.00 (*) Temperature input: 0.1 to 10.0℃ (*)	pH input: pH 0.10 Temperature input: 1.0℃	
A12H □0.10	**A12 hysteresis** Setting range: Same as those of [A11 hysteresis]	pH input: pH 0.10 Temperature input: 1.0℃	
A21H □0.10	**A21 hysteresis** Setting range: Same as those of [A11 hysteresis]	pH input: pH 0.10 Temperature input: 1.0℃	
A22H □0.10	**A22 hysteresis** Setting range: Same as those of [A11 hysteresis]	pH input: pH 0.10 Temperature input: 1.0℃	
Err oFF□	**A□□ output when input errors occur** Selection item: on□□ : Enabled oFF□ : Disabled	Disabled	
FILT □□0.0	**pH input filter time constant** Setting range: 0.0 to 60.0 seconds	0.0 seconds	
PHo□ □0.00	**pH input sensor correction** Setting range: pH -1.40 to 1.40 (*)	0.00	
dFCT □□20	**pH inputs for moving average** Setting range: 1 to 120	20	

(*) The placement of the decimal point does not follow the selection. It is fixed.

Temperature Input Group

Character	Setting Item, Setting Range	Factory Default	Data
SEnS Pt 100	**Electrode RTD** Pt spec nonE : No temperature compensation Pt 100 : Pt1000 Pt 1□ : Pt100 Cu spec nonE : No temperature compensation cU5□ : Cu500	Pt spec: Pt1000 Cu spec: Cu500	
SFnd □25.0	**Reference temperature** Setting range: 5.0 to 95.0℃ (*)	25.0℃	
dP2□ □□0.0	**Decimal point place** □□□0 : No decimal point □□0.0 : 1 digit after decimal point	1 digit after decimal point	
conE Pt□3	**Pt100 input wire type** Pt□2 : 2-wire type Pt□3 : 3-wire type	3-wire type	
cAbL □□0.0	**Cable length correction** Setting range: 0.0 to 100.0 m	0.0 m	
cSEc □0.30	**Cable cross-section area** Setting range: 0.10 to 2.00 mm^2	0.30 mm^2	
dFcT □□20	**Temperature inputs for moving average** Setting range: 1 to 120	20	

(*) The placement of the decimal point does not follow the selection. It is fixed.

Basic Function Group

Character	Setting Item, Setting Range	Factory Default	Data
Lock ----	**Set value lock** ---- : Unlock Loc 1 : Lock 1 Loc2 : Lock 2 Loc3 : Lock 3	Unlock	
cSnL noSL	**Communication protocol** noSL : Shinko protocol SodA : MODBUS ASCII mode Sodr : MODBUS RTU mode	Shinko protocol	
cSno □□□0	**Instrument number** Setting range: 0 to 95	0	
cSSP □□96	**Communication speed** □□96 : 9600 bps □192 : 19200 bps □384 : 38400 bps	9600 bps	
cSFT 7EVn	**Data bit/Parity** 8non : 8 bits/No parity 7non : 7 bits/No parity 8EVn : 8 bits/Even 7EVn : 7 bits/Even 8odd : 8 bits/Odd 7odd : 7 bits/Odd	7 bits/Even	

Character	Setting Item, Setting Range	Factory Default	Data
cSbr □□□ 1	**Stop bit** □□□ 1 : 1 bit □□□2 : 2 bits	1 bit	
Tro 1 PH□□	**Transmission output 1 type** PH□□ : pH transmission TEMP : Temperature transmission	pH transmission	
TrH 1 14.00	**Transmission output 1 high limit** pH transmission: Transmission output 1 low limit to pH 14.00 (*) Temperature transmission: Transmission output 1 low limit to 100.0℃(*)	pH 14.00	
TrL 1 □0.00	**Transmission output 1 low limit** pH transmission: pH 0.00 to Transmission output 1 high limit (*) Temperature transmission: 0.0℃ to Transmission output 1 high limit (*)	pH 0.00	
Tro2 TEMP	**Transmission output 2 type** Selection item: Same as those of [Transmission output 1 type]	Temperature transmission	
TrH2 100.0	**Transmission output 2 high limit** Setting range: Same as those of [Transmission output 1 high limit]	100.0℃	
TrL2 □□0.0	**Transmission output 2 low limit** Setting range: Same as those of [Transmission output 1 low limit]	0.0℃	
Trc 1 bEFH	**Transmission output 1 status when calibrating** bEFH : Last value HOLD SETH : Set value HOLD PVH□ : Measured value	Last value HOLD	
Trh 1 □0.00	**Transmission output 1 value HOLD when calibrating** pH transmission : pH 0.00 to 14.00 (*) Temperature transmission : 0.0 to 100.0℃ (*)	pH transmission: pH 0.00 Temperature transmission: 0.0℃	
Trc2 bEFH	**Transmission output 2 status when calibrating** Selection item: Same as those of [Transmission output 1 status when calibrating]	Last value HOLD	
Trh2 □□0.0	**Transmission output 2 value HOLD when calibrating** Setting range: Same as those of [Transmission output 1 value HOLD when calibrating]	pH transmission: pH 0.00 Temperature transmission: 0.0℃	
AJSr AUTo	**pH calibration Auto/Manual** AUTo : Automatic nAnU : Manual	Automatic	
LIGr -----	**Auto-light function** ----- : Disabled USE□ : Enabled	Disabled	
diSP ALL□	**Display selection**	pH/Temperature	

	pH Display	Temperature Display
ALL□	pH	Temperature
PH□□	pH	No indication
TEMP	No indication	Temperature
nonE	No indication	No indication

TIME 00.00	**Indication time** 00.00 (Remains lit)) 00.01 to 60.00 (Minutes.Seconds)	00.00	

(*) The placement of the decimal point does not follow the selection. It is fixed.

Character	Setting Item, Setting Range	Factory Default	Data
oFdP oFF□	**Temperature Display when no temperature compensation** hrd□ : Reference temperature oFF□ : Unlit	Unlit	
A1oF A11□	**A1 output allocation** A11□ : A11 type A12□ : A12 type A21□ : A21 type A22□ : A22 type A1AL : A11, A12 types A2AL : A21, A22 types A1A2 : A11, A21 types A2A2 : A12, A22 types ALL□ : A11, A12, A21, A22 types	A11 type	
A2oF A21□	**A2 output allocation** Selection item: Same as those of [A1 output allocation]	A21 type	
oon1 □□□0	**Output ON time when A1 output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF1 □□□0	**Output OFF time when A1 output ON** Setting range: 0 to 9999 seconds	0 seconds	
oon2 □□□0	**Output ON time when A2 output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF2 □□□0	**Output OFF time when A2 output ON** Setting range: 0 to 9999 seconds	0 seconds	
A1P□ -----	**A1 pH input error alarm A□□ type** ----- : No action A11□ : A11 type A12□ : A12 type A21□ : A21 type A22□ : A22 type	No action	
A2P□ -----	**A2 pH input error alarm A□□ type** Selection item: Same as [A1 pH input error alarm A□□ type].	No action	
A1Po □0.00	**A1 pH input error alarm band when A□□ output ON** Setting range: pH 0.00 to 14.00	pH 0.00	
A1oT □□□0	**A1 pH input error alarm time when A□□ output ON** Setting range: 0 to 9999 seconds or minutes (*)	0 seconds	
A1Pc □0.00	**A1 pH input error alarm band when A□□ output OFF** Setting range: pH 0.00 to 14.00	pH 0.00	
A1cT □□□0	**A1 pH input error alarm time when A□□ output OFF** Setting range: 0 to 9999 seconds or minutes (*)	0 seconds	
A2Po □0.00	**A2 pH input error alarm band when A□□ output ON** Setting range: pH 0.00 to 14.00	pH 0.00	

(*) The time unit depends on the selection in [pH input error alarm time unit].

Character	Setting Item, Setting Range	Factory Default	Data
A2oF □□□0	**A2 pH input error alarm time when A□□ output ON** Setting range: 0 to 9999 seconds or minutes (*1)	0 seconds	
A2Pc □0.00	**A2 pH input error alarm band when A□□ output OFF** Setting range: pH 0.00 to 14.00	pH 0.00	
A2cF □□□0	**A2 pH input error alarm time when A□□ output OFF** Setting range: 0 to 9999 seconds or minutes (*1)	0 seconds	
n_t□ tEc□	**pH input error alarm time unit** tEc□: Second(s) nin□: Minute(s)	Second(s)	
ccnF □□□0	**Number of cleansing cycles** Setting range: 0 to 10 (0: Continuous cleansing)	0 (Continuous cleansing)	
ccYc □360	**Cleansing interval** Setting range: 60 to 3000 minutes	360 minutes	
cTin □600	**Cleansing time** Setting range: 1 to 1800 seconds	600 seconds	
crEc □600	**Restore time after cleansing** Setting range: 1 to 1800 seconds	600 seconds	
cct1 bEFH	**Transmission output 1 status when cleansing** bEFH : Last value HOLD tErH : Set value HOLD PVH□ : Measured value	Last value HOLD	
ccE1 □0.00	**Transmission output 1 value HOLD when cleansing** pH transmission : pH 0.00 to 14.00 (*2) Temperature transmission : 0.0 to 100.0℃ (*2)	pH transmission: pH 0.00 Temperature transmission: 0.0℃	
cct2 bEFH	**Transmission output 2 status when cleansing** Selection item: Same as [Transmission output 1 status when cleansing]	Last value HOLD	
ccE2 □□0.0	**Transmission output 2 value HOLD when cleansing** Selection item: Same as [Transmission output 1 value HOLD when cleansing]	pH transmission: pH 0.00 Temperature transmission: 0.0℃	

(*1) The time unit depends on the selection in [pH input error alarm time unit].

(*2) The placement of the decimal point does not follow the selection. It is fixed.

Zero/Slope Indication Group

Character	Setting Item, Indication Range	Factory Default	Data
ZEro □□0.0	**Zero indication** Indication range: Voltage equivalent to pH ±1.5	0.0 mV	
SLoP □59.2	**Slope indication** Indication range: Voltage equivalent to pH 0.00 to 14.00	59.2 mV	

***** Inquiries *****

For any inquiries about this unit, please contact our agency or the vendor where you purchased the unit after checking the following.

[Example]

- Model ---------- WIL-102-PH
- Serial number ---------- No. 195F05000

In addition to the above, please let us know the details of the malfunction / discrepancy, and the operating conditions.

SHINKO TECHNOS CO., LTD.
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