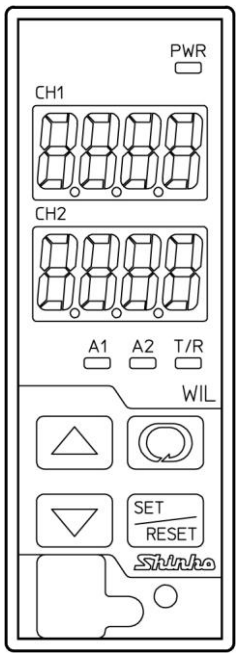
Plug-in Type
Digital Indicating ORP Meter
WIL-101-ORP

Instruction Manual



Shinko

Preface

Thank you for purchasing our WIL-101-ORP, Plug-in Type Digital Indicating ORP Meter.
This manual contains instructions for the mounting, functions, operations and notes when operating the WIL-101-ORP. 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 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-101-ORP 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-101-ORP.
- 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 ORP Combined Electrode Sensor in accordance with the sensor input specifications of the WIL-101-ORP.
- Keep the input wires and power lines separate.

Note about the ORP Combined Electrode Sensor Cable

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

- The ORP Combined Electrode Sensor cable should be wired directly to the socket.
- Do not allow terminals and socket of the ORP 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 ORP Combined Electrode Sensor cable should be wired with sufficient length.
- Keep the ORP 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 ORP Combined Electrode Sensor cable has the following terminals.

Code	Terminal
M	Metal electrode terminal
R	Reference electrode terminal

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

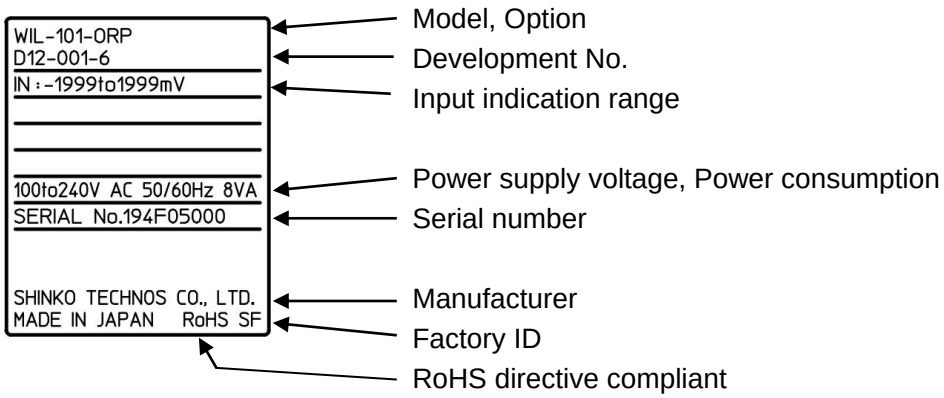
W I L - 1 0	1	-ORP		, □□□	
Input Points	1				1 point
Input		ORP			ORP Combined Electrode Sensor
Power Supply Voltage					100 to 240 V AC (standard)
			1		24 V AC/DC (*1)
Option				EVT	A□□ output (A11, A12, A21, A22)
				TA	Transmission output (*2)

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

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

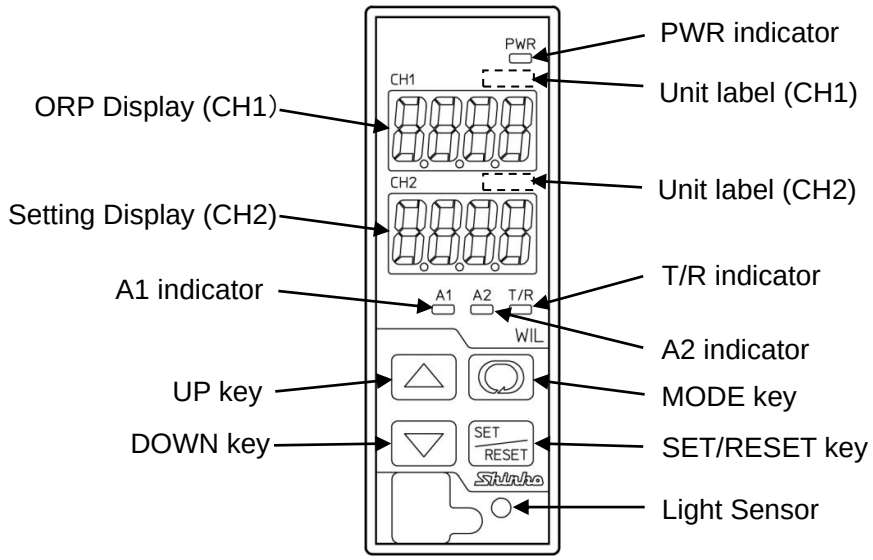
1.2 How to Read the Model Label

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



(Fig. 1.2-1)

2. Names and Functions of Instrument



(Fig. 2-1)

Displays

ORP Display (CH1)	ORP value or characters in setting mode are indicated in red.
Setting Display (CH2)	Values in setting mode are indicated in red. Indications differ depending on the selections in [Setting Display indication (p.28)].

Unit labels

Unit label (CH1)	Attach the user's unit of ORP Display (CH1) from the included unit labels if necessary.
Unit label (CH2)	Attach the user's unit of Setting Display (CH2) from the included unit labels if necessary.

Action Indicators

PWR indicator	When power supply to the instrument is turned ON, the yellow LED lights up.
A1 indicator	When A1 output (Contact output 1) is ON, the red LED lights up.
A2 indicator	When A2 output (Contact output 2) is ON, the yellow LED lights up.
T/R indicator	The yellow LED lights up 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 **SET/RESET key**	Switches the setting modes, and registers the set value.

Light Sensor	Automatically measures and controls brightness of the ORP Display, Setting 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 (pages 16 to 32)" 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

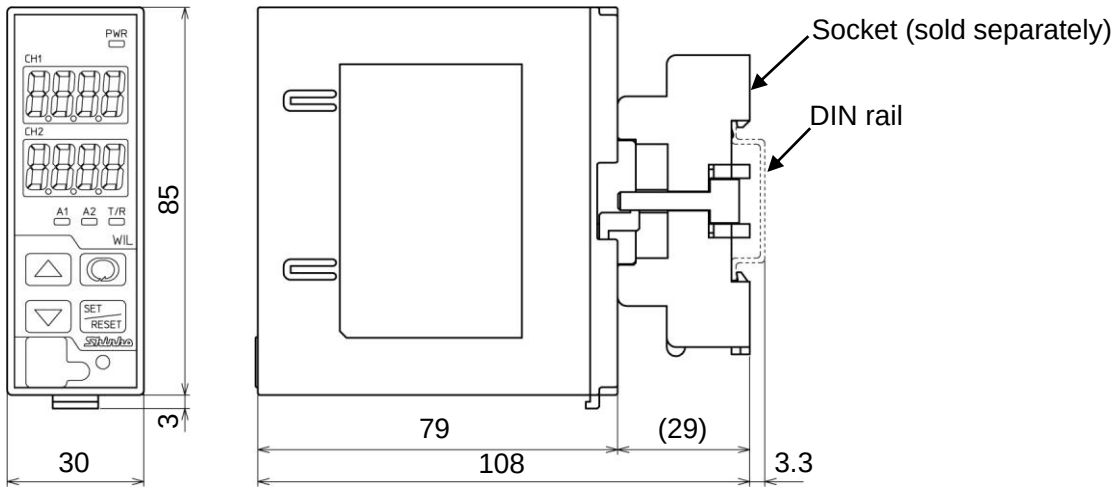
> **⚠ Caution**
>
> Use within the following temperature and humidity ranges.
> Temperature: 0 to 50℃ (32 to 122℉) (No icing), Humidity: 35 to 85 %RH (Non-condensing)
> If the WIL-101-ORP is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control 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 large current is flowing
- No water, oil, chemicals or the vapors of these substances can come into direct contact with the unit.

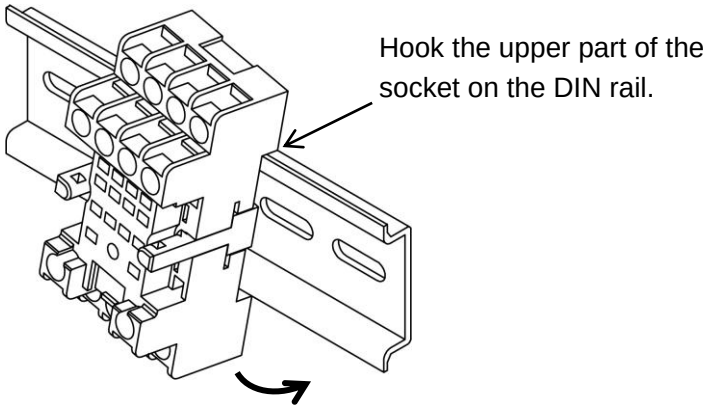
3.2 External Dimensions (Scale: mm)



(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).

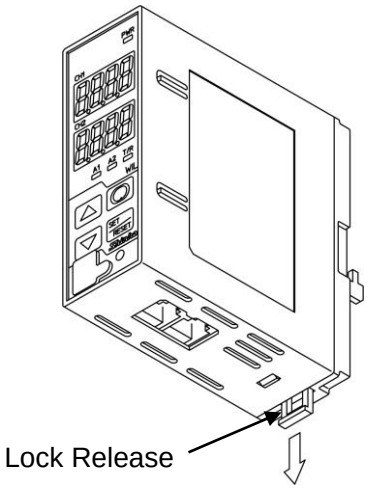


(Fig. 3.3-1)

⚠ Caution

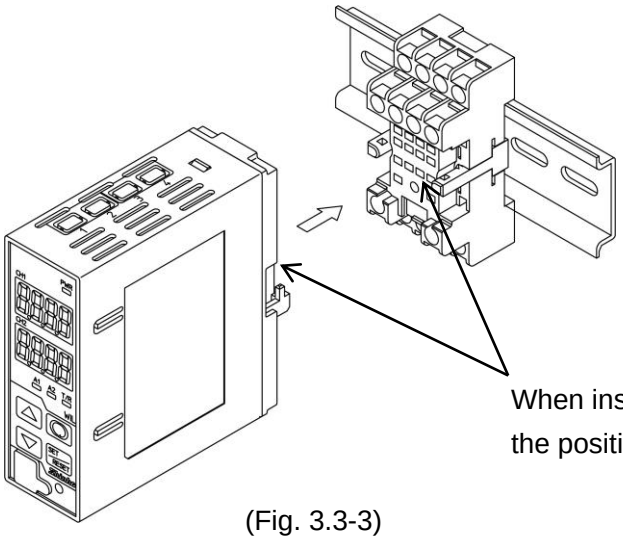
Before inserting the WIL-101-ORP into the socket, wire the unit while referring to Section “5. Wiring” (p.12).

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



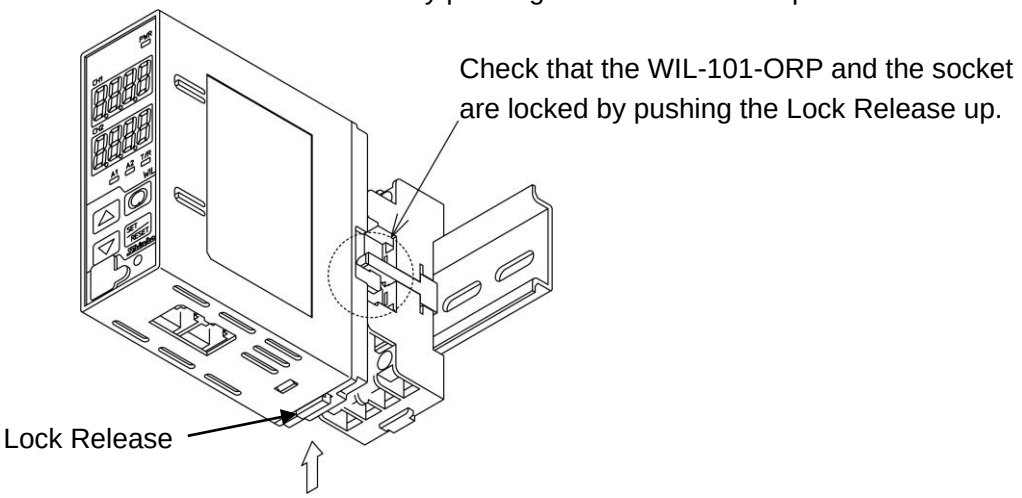
(Fig. 3.3-2)

(3) Insert the WIL-101-ORP into the socket.



(Fig. 3.3-3)

(4) Fix the WIL-101-ORP and the socket by pushing the Lock Release up.

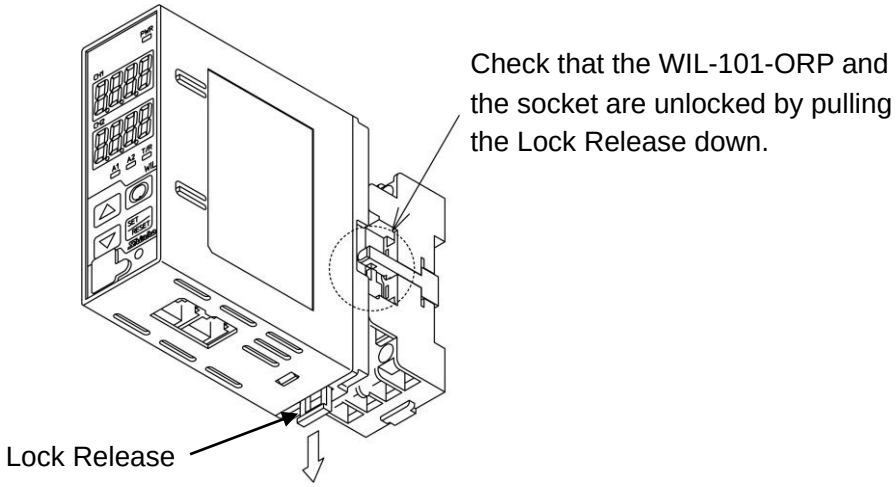


(Fig. 3.3-4)

4. Removal

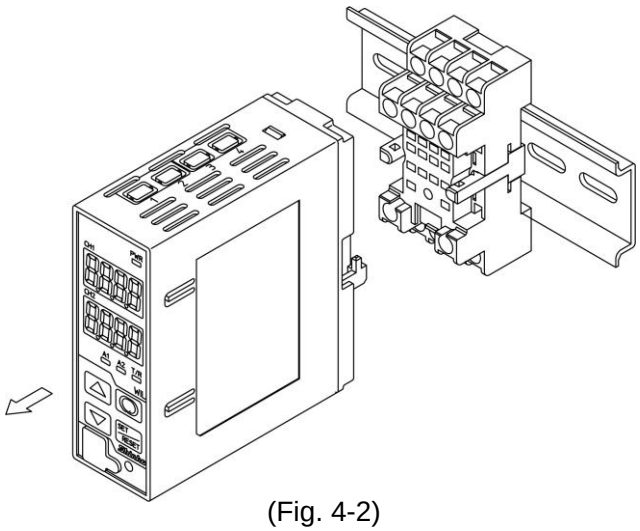
(1) Turn the power supply to the unit OFF.

(2) Pull the Lock Release down, and release the WIL-101-ORP from the socket.



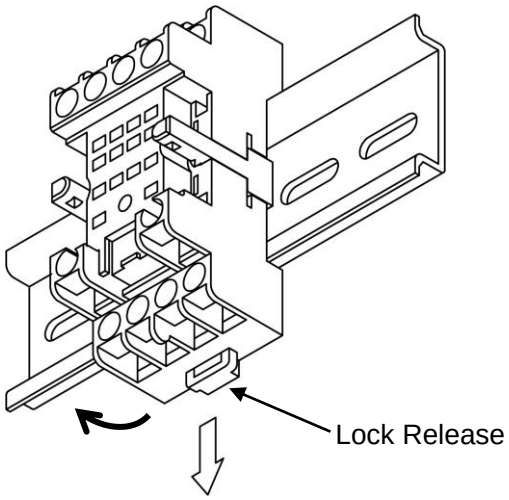
(Fig. 4-1)

(3) Separate the WIL-101-ORP 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 ORP Combined Electrode Sensor in accordance with the sensor input specifications of this unit.
- Keep the input wires and power lines separate.

Note about the ORP Combined Electrode Sensor Cable

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

- The ORP Combined Electrode Sensor cable should be wired directly to the socket.
- Do not allow terminals and socket of the ORP 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 ORP Combined Electrode Sensor cable should be wired with sufficient length.
- Keep the ORP Combined Electrode Sensor cable and junction cable away from electrical devices, such as motors or their power lines from which inductive interference emanates.

Connection

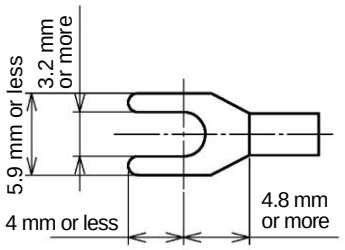
The ORP Combined Electrode Sensor cable has the following terminals.

Code	Terminal
M	Metal electrode terminal
R	Reference electrode terminal

5.1 Lead Wire Solderless Terminal

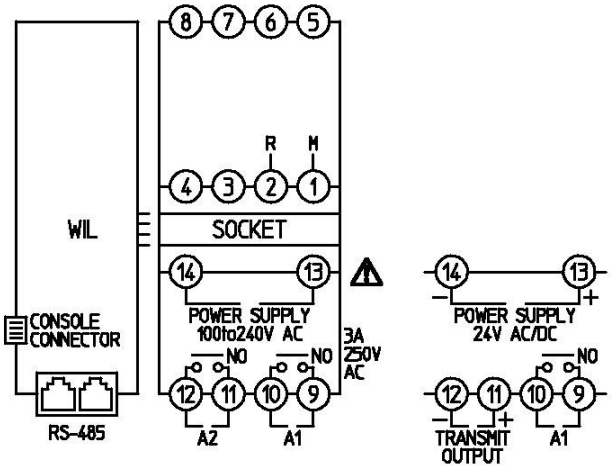
Use a solderless terminal with an insulation sleeve in which an M3 screw fits as follows.
The tightening torque should be 0.63 N•m.

Solderless Terminal	Manufacturer	Model
Y-type	NICHIFU TERMINAL INDUSTRIES CO., LTD.	TMEX1.25Y-3S



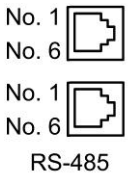
(Fig. 5.1-1)

5.2 Terminal Arrangement



M, R: Electrode sensor terminals (①-②)
ORP Combined Electrode Sensor
A1: A1 output (Contact output 1) terminals (⑨-⑩)
(When the EVT option or TA option is ordered)
A2: A2 output (Contact output 2) terminals (⑪-⑫)
(When the EVT option is ordered)
TRANSMIT OUTPUT:
Transmission output terminals (⑪-⑫)
(When the TA option is ordered)
POWER SUPPLY: Power terminals (⑬-⑭)
24 V AC/DC (Enter 1 after 'ORP'.)
RS-485: Serial Communication modular jack

Modular Jack Pin (WIL-101-ORP side arrangement)



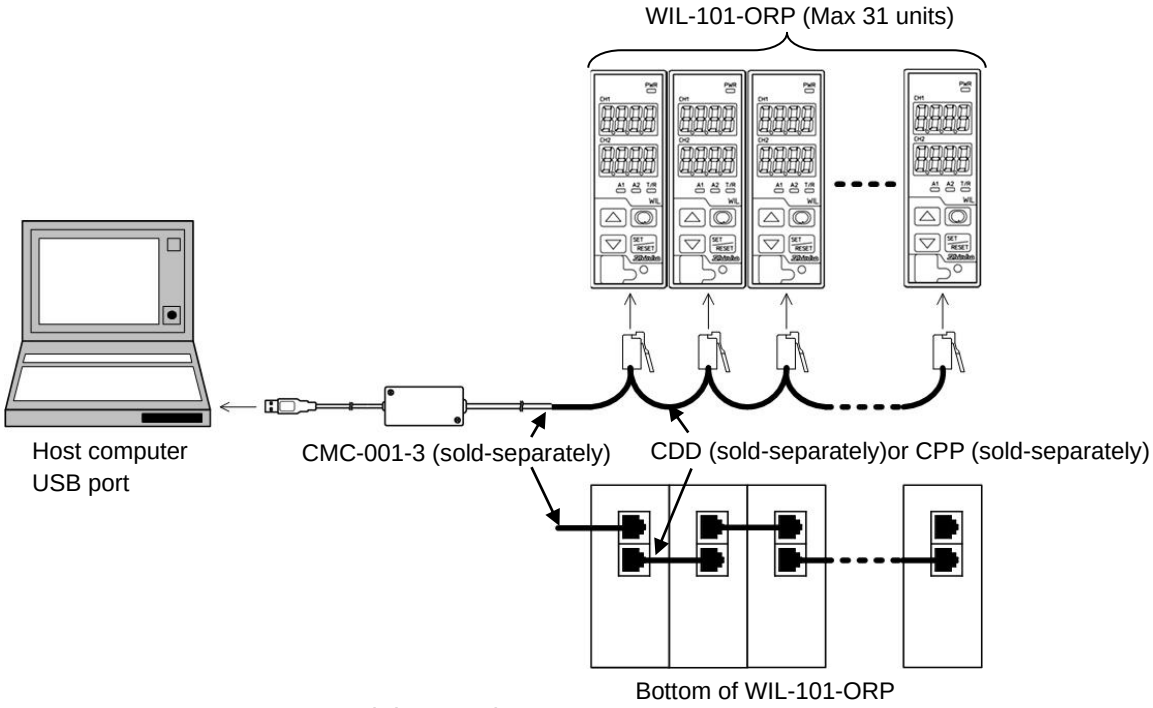
No. 1	COM
No. 2	NC
No. 3	YB(+)
No. 4	YA(−)
No. 5	NC
No. 6	COM

(Fig. 5.2-1)

5.3 Wire the Communication Line

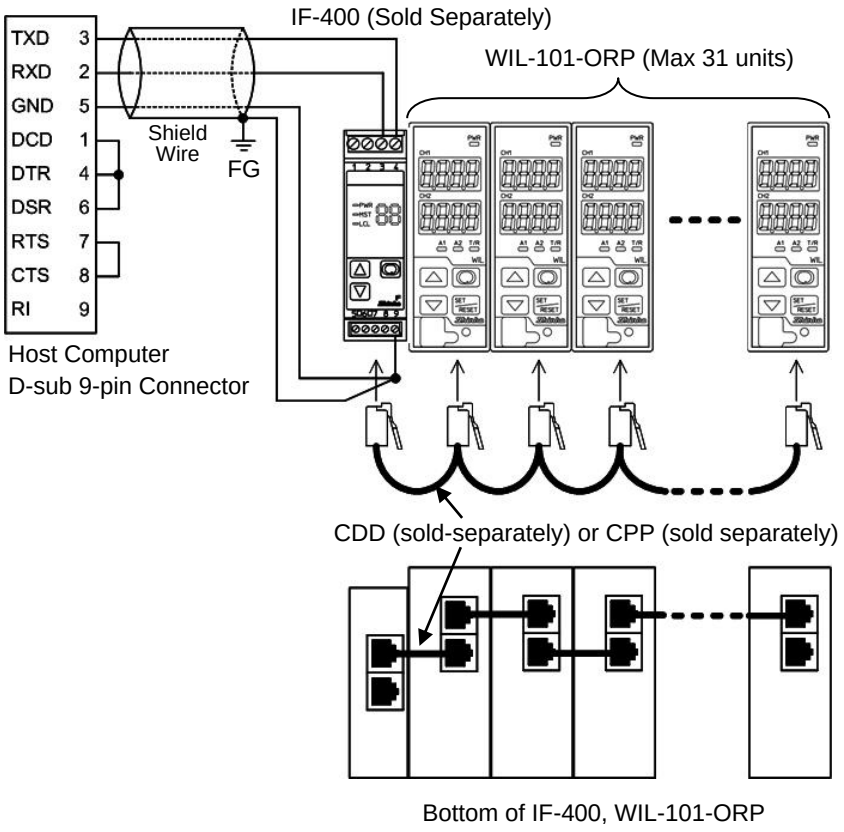
Connect to the modular jack at the bottom of the instrument, using CDD (sold separately) or CPP (sold separately).

- **Wiring Example Using a USB Communication cable CMC-001-3 (sold-separately)**



(Fig. 5.3-1)

- **Wiring Example Using a Communication Converter IF-400 (sold-separately)**



(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)

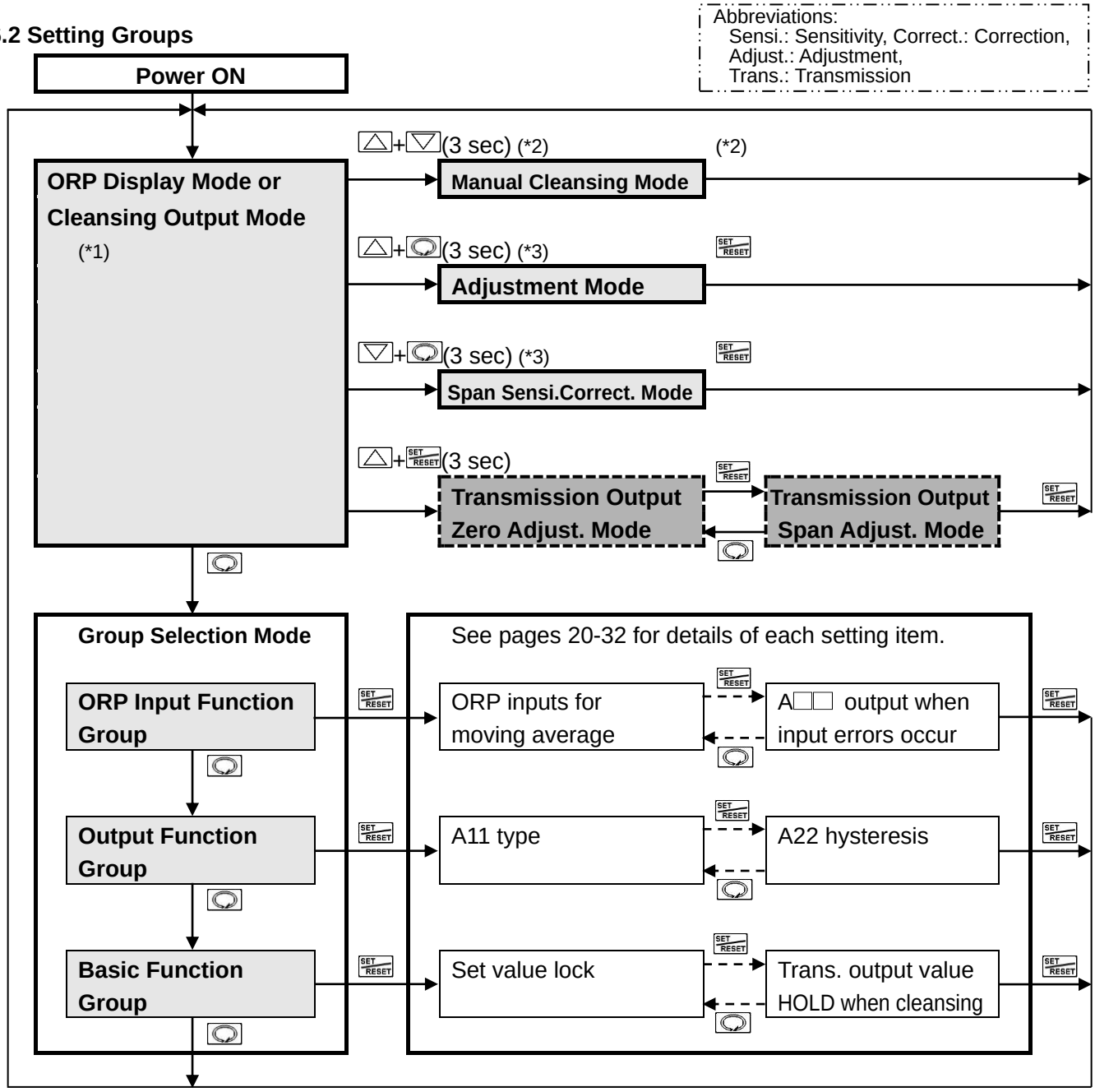
The terminator is mounted at the end of the wire when connecting a personal computer with multiple peripheral devices. The terminator prevents signal reflection and disturbance.
Do not connect a terminator with the communication line because each WIL-101-ORP has built-in pull-up and pull-down resistors.
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 ORP Display Mode or Cleansing Output Mode. The unit enters Group Selection Mode.
Select a group with the ◎ key, and press the SET/RESET key. 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) Measurement starts, indicating ORP on the ORP Display, and the item selected in [Setting Display indication (p.28)] of Basic Function Group on the Setting Display. If power is turned ON again, the last mode (ORP Display Mode or Cleansing Output Mode) from when power was turned OFF will resume.

(*2) If cLEO (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)] in the Output Function Group, the unit will enter Manual Cleansing Mode.
After cleansing action is complete, the unit automatically reverts to Cleansing Output Mode.

(*3) The unit cannot enter Adjustment Mode or Span Sensitivity Correction Mode in the following cases:

- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.27)] in the Basic Function Group.
- When cLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)] in the Output Function Group, and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

: Available only when the TA 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 Adjustment Mode.
- ▽+◎ (3 sec): Press and hold the ▽ key and ◎ key (in that order) together for 3 seconds. The unit will proceed to Span Sensitivity Correction 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 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 until the desired setting mode appears.
- To revert to ORP Display Mode or Cleansing Output Mode, press and hold the ◎ key for 3 seconds while in any mode.

7. Key Operation Flowchart

Abbreviation:
H/L: High/Low

POWER ON

ORP Display Mode or Cleansing Output Mode

In ORP Display Mode or Cleansing Output Mode, measurement starts, indicating ORP value on the ORP Display, and an item selected in [Setting Display indication (p.28)] of Special function group on the Setting Display.

If power is turned ON again, the last mode (ORP Display Mode or Cleansing Output Mode) from when power was turned OFF will resume.

△+▽(3sec) (*1) → **Manual Cleansing Mode** (P.38)

△+○(3sec) (*2) → **Adjustment Mode** (P.33)

▽+○(3sec) (*2) → **Span Sensitivity Correction Mode** (P.34)

△+SET/RESET(3sec) → **Transmission Output Zero Adjustment Mode** (P.35) ⇄ **Transmission Output Span Adjustment Mode** (P.35)

○ → **ORP Input Function Group** → **Output Function Group** → ①

- dFcT 20 — ORP inputs for moving average (P.20)
- dSPH 1999 — Input indication high limit (P.20)
- dSPL -1999 — Input indication low limit (P.20)
- FILT 0.0 — ORP input filter time constant (P.20)
- I Err oFF — A□□ output type when input errors occur (P.20)

- A1IF ---- — A11 type (P.21)
- A12F ---- — A12 type (P.22)
- A2 1F ---- — A21 type (P.22)
- A22F ---- — A22 type (P.22)
- A11 0 — A11 value (P.22)
- A12 0 — A12 value (P.22)
- A21 0 — A21 value (P.22)
- A22 0 — A22 value (P.22)
- A1Id hdIF — A11 hysteresis type (P.22)
- A1IU 10 — A11 ON side (P.22)
- A1IL 10 — A11 OFF side (P.23)
- A12d hdIF — A12 hysteresis type (P.23)
- A12U 10 — A12 ON side (P.23)
- A12L 10 — A12 OFF side (P.23)
- A21d hdIF — A21 hysteresis type (P.23)
- A21U 10 — A21 ON side (P.23)
- A21L 10 — A21 OFF side (P.23)
- A22d hdIF — A22 hysteresis type (P.23)

- A22U 10 — A22 ON side (*2) (P.23)
- A22L 10 — A22 OFF side (*2) (P.23)
- A11o 0 — A11 ON delay time (P.23)
- A12o 0 — A12 ON delay time (P.24)
- A21o 0 — A21 ON delay time (P.24)
- A22o 0 — A22 ON delay time (P.24)
- A11c 0 — A11 OFF delay time (P.24)
- A12c 0 — A12 OFF delay time (P.24)
- A21c 0 — A21 OFF delay time (P.24)
- A22c 0 — A22 OFF delay time (P.24)
- A11F 0 — A11 ORP fluctuation alarm time (P.24)
- A12F 0 — A12 ORP fluctuation alarm time (P.24)
- A21F 0 — A21 ORP fluctuation alarm time (P.24)
- A22F 0 — A22 ORP fluctuation alarm time (P.25)
- A11H 0 — A11 ORP fluctuation alarm band (P.25)
- A12H 0 — A12 ORP fluctuation alarm band (P.25)
- A21H 0 — A21 ORP fluctuation alarm band (P.25)
- A22H 0 — A22 ORP fluctuation alarm band (P.25)

- A11n 0 — A11 H/L limits independent lower side value (P.25)
- A12n 0 — A12 H/L limits independent lower side value (P.25)
- A21n 0 — A21 H/L limits independent lower side value (P.25)
- A22n 0 — A22 H/L limits independent lower side value (P.25)
- A11P 0 — A11 H/L limits independent upper side value (P.25)
- A12P 0 — A12 H/L limits independent upper side value (P.25)
- A21P 0 — A21 H/L limits independent upper side value (P.26)
- A22P 0 — A22 H/L limits independent upper side value (P.26)
- A1IH 10 — A11 hysteresis (P.26)
- A12H 10 — A12 hysteresis (P.26)
- A21H 10 — A21 hysteresis (P.26)
- A22H 10 — A22 hysteresis (P.26)

② (returns to POWER ON)

● About Setting Items

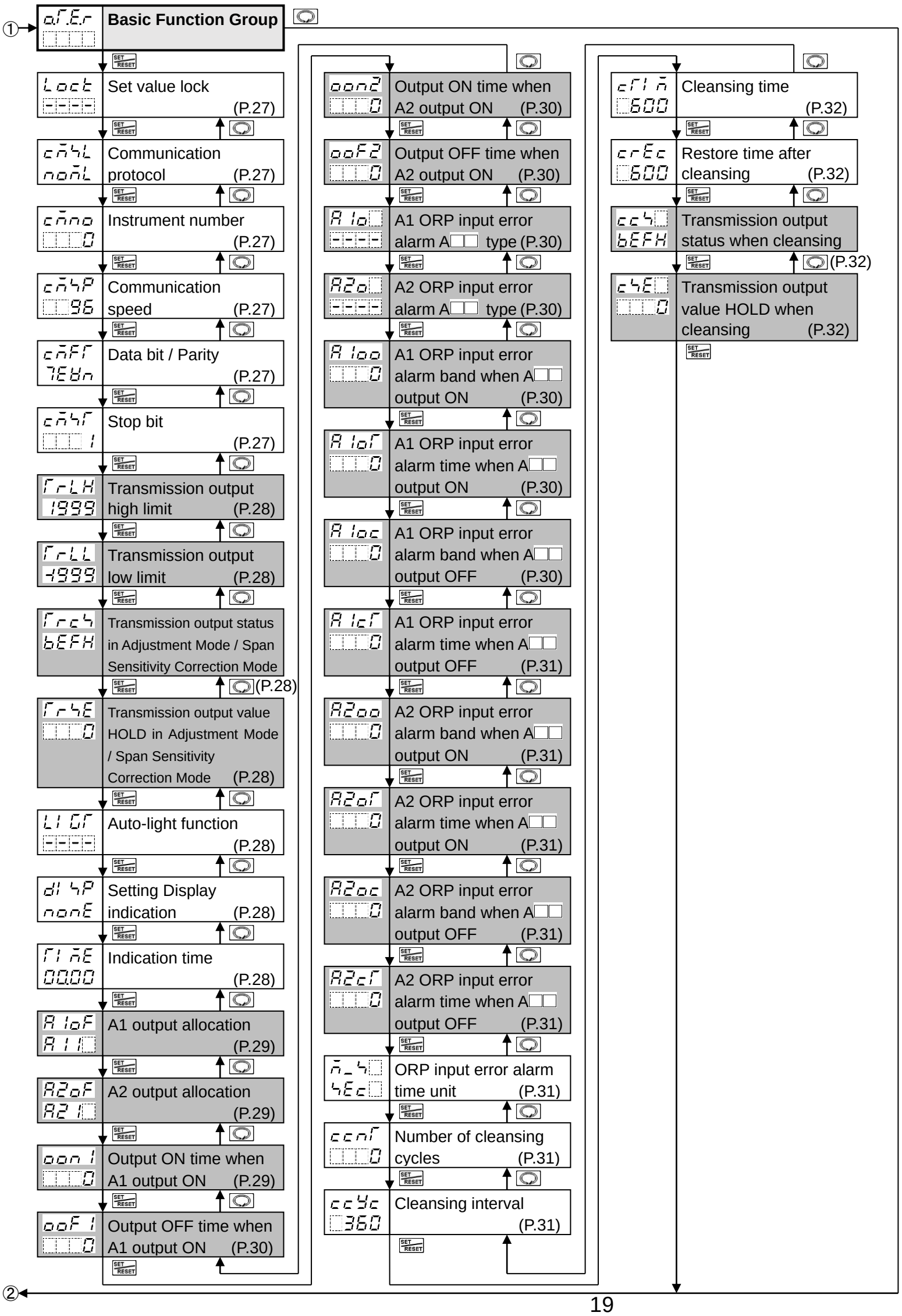
dFcr 20	ORP input for moving average (P.20)
rrLH 1999	Transmission output high limit (P.28)

• **Upper left**: ORP Display: Indicates the setting item characters.
• **Lower left**: Setting Display: Indicates the factory default. • **Right side**: Setting Display: Indicates the setting item.
Setting item in shaded section will be indicated only when the corresponding option is ordered.
If the TA option is ordered, A2 related items cannot be used.

(*1) If cLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)] in the Output Function Group, the unit can enter Manual Cleansing Mode. After cleansing action is complete, the unit automatically reverts to Cleansing Output Mode.
(*2) The unit cannot move to Adjustment Mode or Span Sensitivity Correction Mode.
- When Loc1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.26)] of Basic Function Group.
- When cLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)] in the Output Function Group, and cleansing action is performing using the 'Cleansing time' and Restore time after cleansing' settings.

● About Key Operation

- △+▽ (3 sec): Press and hold △, ▽ keys (in that order) for 3 sec. The unit enters Manual Cleansing Mode.
- △+◯ (3 sec): Press and hold △, ◯ keys (in that order) for 3 sec. The unit enters Adjustment Mode.
- ▽+◯ (3 sec): Press and hold ▽, ◯ keys (in that order) for 3 sec. The unit enters Span Sensitivity Correction Mode.
- △+SET/RESET (3 sec): Press and hold △, SET/RESET keys (in that order) for 3 sec. The unit enters Transmission Output Zero Adjustment Mode.
- ◯ or SET/RESET: Press the ◯ or SET/RESET key. The unit enters the next setting item, illustrated by an arrow.
- To revert to ORP Display Mode or Cleansing Output Mode, press and hold the ◯ key for 3 seconds while in any mode.



8. Setup

Setup should be done before using this instrument, according to the user's conditions:
Setting the ORP input function (Input indication high limit, Input indication low limit), Output function (A11, A12, A21, A22 types), Basic function (Communication, Cleansing action, etc.).
Setup can be conducted in the ORP Input Function Group, Output Function Group and Basic Function Group.

If the user's specification is the same as the factory default of the WIL-101-ORP, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to Section "9. Calibration (p.33)".

8.1 Turn the Power Supply to the WIL-101-ORP ON.

For approx. 4 seconds after the power is switched ON, orP□ is indicated on the ORP Display. During this time, all outputs are in OFF status, and LED indicators except the PWR indicator turn off. After that, measurement starts, indicating ORP on the ORP Display and an item selected in [Setting Display indication (p.27)] on the Setting Display.
This status is called ORP Display Mode or Cleansing Output Mode.

8.2 ORP Input Function Group

To enter the ORP Input Function Group, follow the procedure below.
① F.nc. 1 Press the ◎ key in ORP Display Mode or Cleansing Output Mode.
② dFcr Press the SET/RESET key.
The unit proceeds to the ORP Input Function Group, and 'ORP inputs for moving average' appears.

Character	Setting Item, Function, Setting Range	Factory Default
dFcr □□20	**ORP inputs for moving average** • Sets the number of ORP inputs used to obtain moving average. • Setting range: 1 to 120	20
d4PH 1999	**Input indication high limit** • Sets the high limit value for ORP input indication. • Setting range: Input indication low limit to 1999 mV	1999 mV
d4PL -999	**Input indication low limit** • Sets the low limit value for ORP input indication. • Setting range: -1999 mV to Input indication high limit	-1999 mV
FILr □□0.0	**ORP input filter time constant** • Sets ORP 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
IErr oFF□	**A□□ output when input errors occur** • If input errors, such as ORP Combined Electrode Sensor burnout or short-circuited occur, 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 orPL (ORP input low limit) or orPH (ORP input high limit) is selected in [A□□ type]. • If cLEG (Cleansing output) is selected in [A□□ type], cleansing action takes priority regardless of this selection. • on□□ : Enabled oFF□ : Disabled	Disabled

8.3 Output Function Group

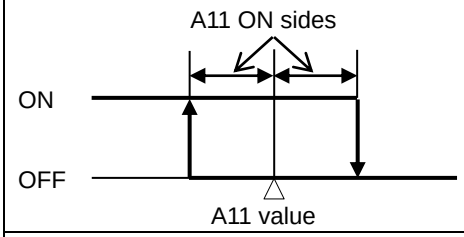
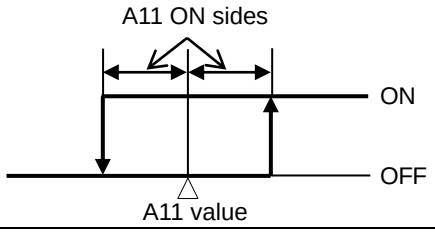
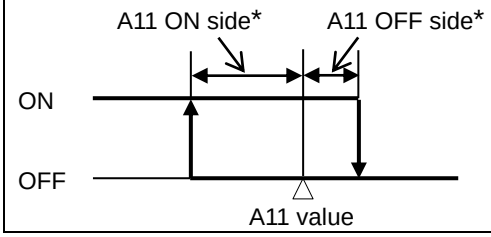
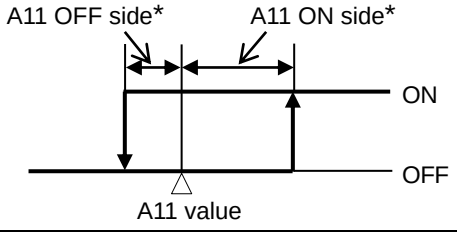
To enter the Output Function Group, follow the procedure below.

① F.nc.2 Press the ◎ key twice in ORP Display Mode or Cleansing Output Mode.

② A11F Press the SET/RESET key.

The unit enters the Output Function Group, and 'A11 type' appears.

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.** • ----: No action orPL : ORP input low limit action (Fig. 8.3-1) orPH : ORP input high limit action (Fig. 8.3-1) cLEO : Cleansing output EoUA : ORP fluctuation error alarm output [See Section "10.7 ORP fluctuation error alarm output" (P.39)] orHL : ORP input High/Low limits independent action (Fig. 8.3-2) • **A11 Action (Activated based on the indication value.)**	No action

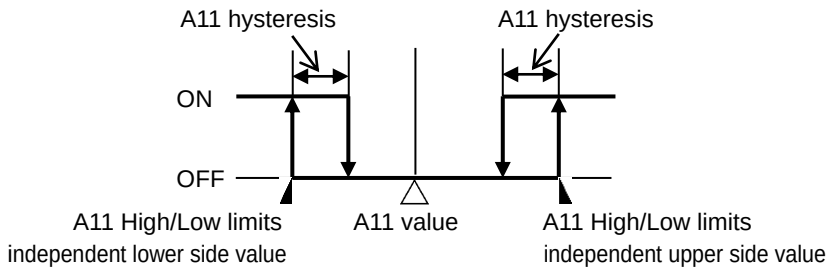
ORP input low limit action	ORP input high limit action
If Medium Value is selected in [A11 hysteresis type]: 	If Medium Value is selected in [A11 hysteresis type]: 
If Reference Value is selected in [A11 hysteresis type]: 	If Reference Value is selected in [A11 hysteresis type]: 

(Fig. 8.3-1)

*** Setting Example:**

If [A11 ON side (A11U)] is set to 0, A11 output can be turned ON at the value set in [A11 value (A11□)].

If [A11 OFF side (A11L)] is set to 0, A11 output can be turned OFF at the value set in [A11 value (A11□)].

ORP input High/Low limits independent action


(Fig. 8.3-2)

Character	Setting Item, Function, Setting Range	Factory Default
A12F ----	**A12 type** • Selects an A12 type. **Note: If A12 type is changed, A12 value defaults to 0.** • For the selection item and action, refer to A11 type (p.21).	No action
A21F ----	**A21 type** • Selects an A21 type. **Note: If A21 type is changed, A21 value defaults to 0.** • For the selection item and action, refer to A11 type (p.21).	No action
A22F ----	**A22 type** • Selects an A22 type. **Note: If A22 type is changed, A22 value defaults to 0.** • For the selection item and action, refer to A11 type (p.21).	No action
A11□ □□□0	**A11 value** • Selects an A11 value. See (Fig. 8.3-1) (p.21). • Available when orPL (ORP input low limit), orPH (ORP input high limit) or orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • A11 is activated based on the indication value. • Setting range: -1999 to 1999 mV	0 mV
A12□ □□□0	**A12 value** • Selects an A12 value. See (Fig. 8.3-1) (p.21). • For the indication condition, activation condition and setting range, refer to A11 value (p.22).	0 mV
A21□ □□□0	**A21 value** • Selects an A21 value. See (Fig. 8.3-1) (p.21). • For the indication condition, activation condition and setting range, refer to A11 value (p.22).	0 mV
A22□ □□□0	**A22 value** • Selects an A22 value. See (Fig. 8.3-1) (p.21). • For the indication condition, activation condition and setting range, refer to A11 value (p.22).	0 mV
A11d Hdif	**A11 hysteresis type** • Selects A11 output hysteresis type (Medium Value or Reference Value). See (Fig. 8.3-1) (p.21). • Available when orPL (ORP input low limit action) or orPH (ORP input high limit action) 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 □□10	**A11 ON side** • Sets the span of A11 ON side. See (Fig. 8.3-1) (p.21). If cdif (Medium Value) is selected in [A11 hysteresis type], the span of ON/OFF side will be the same value. • Available when orPL (ORP input low limit action) or orPH (ORP input high limit action) is selected in [A11 type]. • Setting range: 0 to 200 mV	10 mV

Character	Setting Item, Function, Setting Range	Factory Default
A 1 1L □□ 10	**A11 OFF side** • Sets the span of A11 OFF side. See (Fig. 8.3-1) (p.21). • Not available if cdl F (Medium Value) is selected in [A11 hysteresis type]. Available when orPL (ORP input low limit action) or orPH (ORP input high limit action) is selected in [A11 type]. • Setting range: 0 to 200 mV	10 mV
A 12d hdl F	**A12 hysteresis type** • Selects A12 output hysteresis type (Medium Value or Reference Value). • For the indication condition and selection item, refer to A11 hysteresis type (p.22).	Reference Value
A 12U □□ 10	**A12 ON side** • Sets the span of A12 ON side. If cdl F (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 (p.22).	10 mV
A 12L □□ 10	**A12 OFF side** • Sets the span of A12 OFF side. • For the indication condition and setting range, refer to A11 OFF side (p.23).	10 mV
A2 1d hdl F	**A21 hysteresis type** • Selects A21 output hysteresis type (Medium Value or Reference Value). • For the indication condition and selection item, refer to A11 hysteresis type (p.22).	Reference Value
A2 1U □□ 10	**A21 ON side** • Sets the span of A21 ON side. If cdl F (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 (p.22).	10 mV
A2 1L □□ 10	**A21 OFF side** Sets the span of A21 OFF side. • For the indication condition and setting range, refer to A11 OFF side (p.23).	10 mV
A22d hdl F	**A22 hysteresis type** • Selects A22 output hysteresis type (Medium Value or Reference Value). • For the indication condition and selection item, refer to A11 hysteresis type (p.22).	Reference Value
A22U □□ 10	**A22 ON side** • Sets the span of A22 ON side. If cdl F (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.22).	10 mV
A22L □□ 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).	10 mV
A 1 1o □□□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. • Available when orPL (ORP input low limit action), orPH (ORP input high limit action) or orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • Setting range: 0 to 9999 seconds	0 seconds

Character	Setting Item, Function, Setting Range	Factory Default
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 (p.23).	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 (p.23).	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 (p.23).	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. • Available when orPL (ORP input low limit action), orPH (ORP input high limit action) or orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • Setting range: 0 to 9999 seconds	0 seconds
A12c □□□0	**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 (p.24).	0 seconds
A21c □□□0	**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 (p.24).	0 seconds
A22c □□□0	**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 ORP fluctuation alarm time** • Sets time to assess A11 ORP fluctuation alarm. Disabled when set to 0 (zero). • Available only when EoUA (ORP fluctuation alarm output) is selected in [A11 type]. • Setting range: 0 to 72 hours	0 hours
A12r □□□0	**A12 ORP fluctuation alarm time** • Sets time to assess A12 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm time (p.24).	0 hours
A21r □□□0	**A21 ORP fluctuation alarm time** • Sets time to assess A21 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm time (p.24).	0 hours

Character	Setting Item, Function, Setting Range	Factory Default
A22T □□□0	**A22 ORP fluctuation alarm time** • Sets time to assess A22 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm time (p.24).	0 hours
A 1 1H □□□0	**A11 ORP fluctuation alarm band** • Sets the band to assess A11 ORP fluctuation alarm. • Disabled when set to 0 mV. • Available only when EoBA (ORP fluctuation alarm output) is selected in [A11 type]. • Setting range: 0 to 3998 mV	0 mV
A 12H □□□0	**A12 ORP fluctuation alarm band** • Sets the band to assess A12 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm band (p.25).	0 mV
A2 1H □□□0	**A21 ORP fluctuation alarm band** • Sets the band to assess A21 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm band (p.25).	0 mV
A22H □□□0	**A22 ORP fluctuation alarm band** • Sets the band to assess A22 ORP fluctuation alarm. • For the action, indication condition and setting range, refer to A11 ORP fluctuation alarm band (p.25).	0 mV
A 1 1n □□□0	**A11 High/Low limits independent lower side value** • Sets the lower side value of A11 High/Low limits independent action.(Fig. 8.3-2) (p.21) Disabled when set to 0 mV. • Available only when orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • Setting range: 0 to 3998 mV	0 mV
A 12n □□□0	**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 (p.25).	0 mV
A2 1n □□□0	**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).	0 mV
A22n □□□0	**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).	0 mV
A 1 1P □□□0	**A11 High/Low limits independent upper side value** • Sets the upper side value of A11 High/Low limits independent action.(Fig. 8.3-2) (p.21) Disabled when set to 0 mV. • Available only when orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • Setting range: 0 to 3998 mV	0 mV
A 12P □□□0	**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 lower side value (p.25).	0 mV

Character	Setting Item, Function, Setting Range	Factory Default
A2 1P □□□0	**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 lower side value (p.25).	0 mV
A22P □□□0	**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 lower side value (p.25).	0 mV
A 1 1H □□ 10	**A11 hysteresis** • Sets the hysteresis of A11 High/Low limits independent action. • Available only when orHL (ORP input High/Low limits independent action) is selected in [A11 type]. • Setting range: 1 to 200 mV	10 mV
A 12H □□ 10	**A12 hysteresis** • Sets the hysteresis of A12 High/Low limits independent action. • For the indication condition and setting range, refer to A11 hysteresis (p.26).	10 mV
A2 1H □□ 10	**A21 hysteresis** • Sets the hysteresis of A21 High/Low limits independent action. • For the indication condition and setting range, refer to A11 hysteresis (p.26).	10 mV
A22H □□ 10	**A22 hysteresis** • Sets the hysteresis of A22 High/Low limits independent action. • For the indication condition and setting range, refer to A11 hysteresis (p.26).	10 mV

8.4 Basic Function Group

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

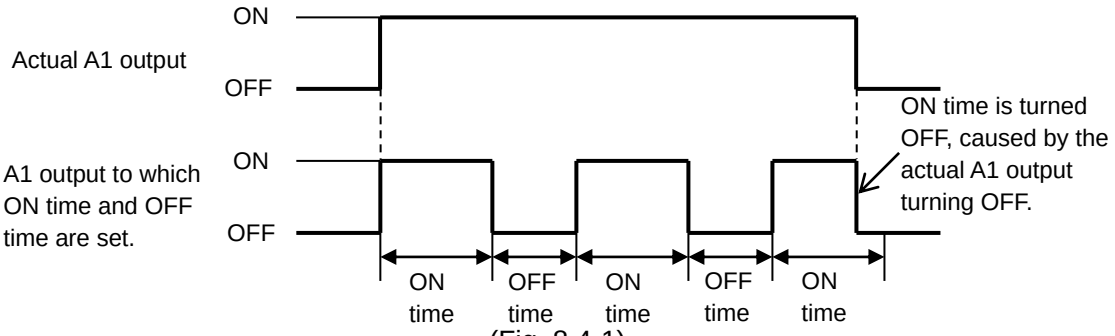
① aFEr Press the ◯ key 3 times in ORP Display Mode or Cleansing Output Mode.

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 Adjustment value, Span sensitivity correction value, Transmission output Zero adjustment value, Transmission output 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 the non-volatile IC memory.)	Unlock
cnnL nonL	**Communication protocol** • Selects communication protocol. • nonL : Shinko protocol nodA : MODBUS ASCII mode nodr : MODBUS RTU mode	Shinko protocol
cnno □□□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
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
cnFr 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

Character	Setting Item, Function, Setting Range	Factory Default
rtLH 1999	**Transmission output high limit** • Sets the Transmission output high limit value. (This value correponds to 20 mA DC output.) If Transmission output high limit and low limit are set to the same value, the transmission output will be fixed at 4 mA DC. • Available only when Transmission output (TA option) is ordered. • Setting range: Transmission output low limit to 1999 mV	1999 mV
rtLL -199	**Transmission output low limit** • Sets the Transmission output low limit value. (This value correponds to 4 mA DC output.) If Transmission output high limit and low limit are set to the same value, the transmission output will be fixed at 4 mA DC. • Available only when Transmission output (TA option) is ordered. • Setting range: -1999 mV to Transmission output high limit	-1999 mV
trch bEFH	**Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode** • Selects Transmission output status in Adjustment Mode or Span Sensitivity Correction Mode. • Available only when Transmission output (TA option) is ordered. • Selection item bEFH: Last value HOLD (Retains the last value before adjustment or span sensitivity correction, and outputs it.) SEtH: Set value HOLD (Outputs the value set in [Transmission output value HOLD in Adjustment Mode / Span Sensitivity Correction Mode].) PVH□: Measured value (Outputs the value measured in Adjustment Mode or Span Sensitivity Correction Mode.)	Last value HOLD
trtE □□□0	**Transmission output value HOLD in Adjustment Mode / Span Sensitivity Correction Mode** • Sets the transmission output value HOLD in Adjustment Mode or Span Sensitivity Correction Mode. • Available only when SEtH (Set value HOLD) is selected in [Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode]. • Setting range: -1999 to 1999 mV	0 mV
LIGt -.-.-.-	**Auto-light function** • Selects Auto-light Enabled/Disabled. • -.-.-.- : Disabled USE□ : Enabled	Disabled
diSP nonE	**Setting Display indication** • In ORP Display Mode or Cleansing Output Mode, selects an item to be indicated on the Setting Display. • nonE : No indication dA11 : A11 value dA12 : A12 value dA21 : A21 value dA22 : A22 value	No indication
tIME 00.00	**Indication time** • Sets the indication time of the displays after the last key operation until displays turn off while in ORP Display Mode or Cleansing Output Mode. 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 [Setting Display indication]. • Setting range: 00.00 (Remains lit) 00.01 to 60.00 (Minutes.Seconds)	00.00 (Remains lit)

Character	Setting Item, Function, Setting Range	Factory Default
A 1oF A 1 1□	**A1 output allocation** • Selects A1 output allocation. For A1 output, A11 type, A12 type, A21 type and/or A22 type are allocated. Output is OR output. However, if cLEC (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)], the Cleansing output will be given top priority. • Selection item: A 1 1□ : A11 type A 12□ : A12 type A2 1□ : A21 type A22□ : A22 type A 1AL : A11, A12 types A2AL : A21, A22 types A 1A2 : A11, A21 types A2A2 : A12, A22 types ALL□ : A11, A12, A21, A22 types	A11 type
A2oF A2 1□	**A2 output allocation** • Selects A2 output allocation. For A2 output, A11 type, A12 type, A21 type and/or A22 type are allocated. Output is OR output. However, if cLEC (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)], the Cleansing output will be given top priority. • Not available if Transmission output (TA option) is ordered. • Selection items are the same as those of A1 output allocation (p.29).	A21 type
oon 1 □□□0	**Output ON time when A1 output ON** • Sets Output ON time when A1 output is ON. If 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) • 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

Character	Setting Item, Function, Setting Range	Factory Default
oFF1 □□□0	**Output OFF time when A1 output ON** • Sets Output OFF time when A1 output is ON. If ON time and OFF time are set, A1 output can be turned ON/OFF in a configured cycle when A1 output is ON. See (Fig. 8.4-1) (p.29). • Setting range: 0 to 9999 seconds	0 seconds
on2 □□□0	**Output ON time when A2 output ON** • Sets Output ON time when A2 output is ON. If ON time and OFF time are set, A2 output can be turned ON/OFF in a configured cycle when A2 output is ON. See (Fig. 8.4-1) (p.29). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 9999 seconds	0 seconds
oF2 □□□0	**Output OFF time when A2 output ON** • Sets Output OFF time when A2 output is ON. If ON time and OFF time are set, A2 output can be turned ON/OFF in a configured cycle when A2 output is ON. See (Fig. 8.4-1) (p.29). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 9999 seconds	0 seconds
A1o□ -----	**A1 ORP input error alarm A□□ type** • Selects A□□ type in order to assess A1 ORP input error alarm. • ----- : No action A11□ : A11 type A12□ : A12 type A21□ : A21 type A22□ : A22 type	No action
A2o□ -----	**A2 ORP input error alarm A□□ type** • Selects A□□ type in order to assess A2 ORP input error alarm. • Not available if Transmission output (TA option) is ordered. • Selection item: Same as A1 ORP input error alarm A□□ type (p.30)	No action
A1oo □□□0	**A1 ORP input error alarm band when A□□ output ON** • Sets band to assess A1 ORP input error alarm when A□□ output (selected in [A1 ORP input error alarm A□□ type]) is ON. Refer to 'ORP Input Error Alarm' (p.32). • Setting range: 0 to 1999 mV When set to 0, ORP input error alarm is disabled.	0 mV
A1oT □□□0	**A1 ORP input error alarm time when A□□ output ON** • Sets time to assess A1 ORP input error alarm when A□□ output (selected in [A1 ORP input error alarm A□□ type]) is ON. Refer to 'ORP Input Error Alarm' (p.32). • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [ORP input error alarm time unit].) When set to 0, ORP input error alarm is disabled.	0 seconds
A1oc □□□0	**A1 ORP input error alarm band when A□□ output OFF** • Sets band to assess A1 ORP input error alarm when A□□ output (selected in [A1 ORP input error alarm A□□ type]) is OFF. Refer to 'ORP Input Error Alarm' (p.32). • Setting range: 0 to 1999 mV When set to 0, ORP input error alarm is disabled.	0 mV

Character	Setting Item, Function, Setting Range	Factory Default
A1cr □□□0	**A1 ORP input error alarm time when A□□ output OFF** • Sets time to assess A1 ORP input error alarm when A□□ output (selected in [A1 ORP input error alarm A□□ type]) is OFF. Refer to 'ORP Input Error Alarm' (p.32). • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [ORP input error alarm time unit].) When set to 0, ORP input error alarm is disabled.	0 seconds
A2oo □□□0	**A2 ORP input error alarm band when A□□ output ON** • Sets band to assess A2 ORP input error alarm when A□□ output (selected in [A2 ORP input error alarm A□□ type]) is ON. Refer to 'ORP Input Error Alarm' (p.32). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 1999 mV When set to 0, ORP input error alarm is disabled.	0 mV
A2or □□□0	**A2 ORP input error alarm time when A□□ output ON** • Sets time to assess A2 ORP input error alarm when A□□ output (selected in [A2 ORP input error alarm A□□ type]) is ON. Refer to 'ORP Input Error Alarm' (p.32). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [ORP input error alarm time unit].) When set to 0, ORP input error alarm is disabled.	0 seconds
A2oc □□□0	**A2 ORP input error alarm band when A□□ output OFF** • Sets band to assess A2 ORP input error alarm when A□□ output (selected in [A2 ORP input error alarm A□□ type]) is OFF. Refer to 'ORP Input Error Alarm' (p.32). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 1999 mV When set to 0, ORP input error alarm is disabled.	0 mV
A2cr □□□0	**A2 ORP input error alarm time when A□□ output OFF** • Sets time to assess A2 ORP input error alarm when A□□ output (selected in [A2 ORP input error alarm A□□ type]) is OFF. Refer to 'ORP Input Error Alarm' (p.32). • Not available if Transmission output (TA option) is ordered. • Setting range: 0 to 9999 seconds or minutes (Time unit follows the selection in [ORP input error alarm time unit].) When set to 0, ORP input error alarm is disabled.	0 seconds
n_4□ 4Ec□	**ORP input error alarm time unit** • Selects ORP input error alarm time unit. • Selection item: 4Ec□: Second(s) n1 n□: Minute(s)	Second(s)
ccnr □□□0	**Number of cleansing cycles** • Sets the number of cleansing outputs. (Fig. 8.4-2) (p.32) • Available when cLEO (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp. 21, 22)]. • Setting range: 0 to 10 (0: Continuous cleansing)	0 (Continuous cleansing)
cc4c □360	**Cleansing interval** • Sets an interval between cleansings. (Fig. 8.4-2) (p.32) • Available when cLEO (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp. 21, 22)]. • Setting range: 60 to 3000 minutes	360 minutes

Character	Setting Item, Function, Setting Range	Factory Default
cTIM □600	**Cleansing time** • Sets the cleansing output time during the cleansing output interval. (Fig. 8.4-2) (p.32) • Available when cLEO (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp. 21, 22)]. • Setting range: 1 to 1800 seconds	600 seconds
crEc □600	**Restore time after cleansing** • Sets the time to restore units to normal operation after cleansing output.(Fig. 8.4-2)(p.32) • Available when cLEO (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp. 21, 22)]. • Setting range: 1 to 1800 seconds	600 seconds
ccH□ bEFH	**Transmission output status when cleansing** • Selects Transmission output status when cleansing action is performing. • Available when Transmission output (TA option) is ordered. • bEFH: Last value HOLD (Retains the last value before cleansing, and outputs it.) HEFH: Set value HOLD (Outputs the value set in [Transmission output value HOLD when cleansing].) PVH□: Measured value (Outputs the measured value when cleaning action is performing.)	Last value HOLD
cHE□ □□□0	**Transmission output value HOLD when cleansing** • Sets the Transmission output value HOLD when cleansing. • Available only when HEFH (Set value HOLD) is selected in [Transmission output status when cleansing]. • Setting range: -1999 to 1999 mV	0 mV

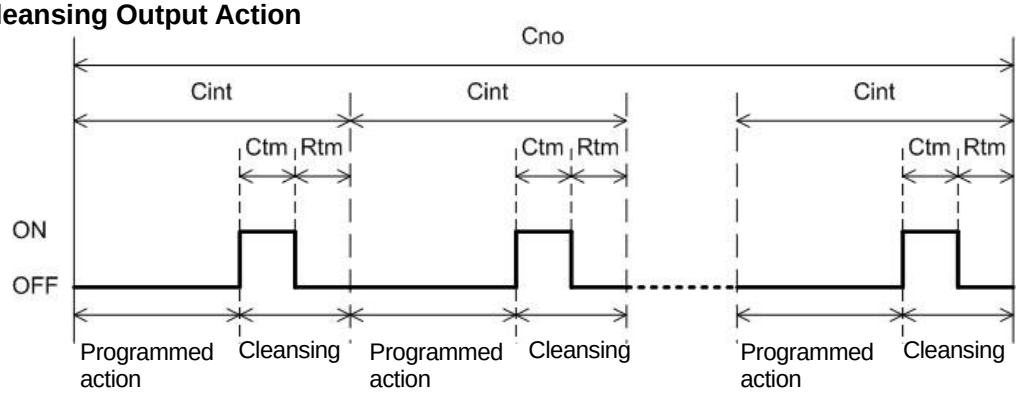
• **ORP Input Error Alarm**

ORP input error alarm is used for detecting actuator trouble. Even if ORP input error alarm time has elapsed, and if ORP input does not become higher than ORP input error alarm band, the unit assumes that actuator trouble has occurred, and writes Status flag 2 (A1, A2 ORP input error alarm output flag bit). In Serial communication, status can be read by reading Status flag 2 (A1, A2 ORP input error alarm output flag bit).

ORP input error alarm is disabled in the following cases.

- During Adjustment Mode, or Span Sensitivity Correction Mode.
- When cLEO (Cleansing output) is selected in any 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 ORP input error alarm time is set to 0 seconds, or ORP input error alarm band is set to 0 mV.

• **Cleansing Output Action**



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

(Fig. 8.4-2)

9. Calibration

Adjustment Mode, Span Sensitivity Correction Mode and Transmission Output Adjustment Mode are described below.

9.1 Adjustment Mode

Only when using a brand-new sensor, please calibrate in Adjustment Mode.

By setting the adjustment value, calibrates ORP value indicated on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

The unit cannot enter Adjustment Mode in the following cases:

- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.27)].
- When cLEG (Cleansing output) is selected in any 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 calibration.

(1) When selecting bEFH (Last value HOLD) in [Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode (p.28)], select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.

(2) Press and hold the △ and ◎ keys (in that order) together for 3 seconds in ORP Display Mode or Cleansing Output Mode.
The unit enters Adjustment Mode, and indicates the following.

Display	Indication
ORP Display	AdJ4 and ORP value are indicated alternately.
Setting Display	The adjustment value is indicated.

(3) Immerse the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

(4) Set an adjustment value with the △ or ▽ key so that ORP value is approximately 260 mV (at 20℃). For other temperature and electrical potentials, refer to the temperature characteristics of your standard solution.
Adjustment range: -200 to 200 mV

(5) Press the SET/RESET key.
Adjustment Mode is complete, and the unit reverts to ORP Display Mode or Cleansing Output Mode.

9.2 Span Sensitivity Correction Mode

When calibrating periodically, please calibrate in Span Sensitivity Correction Mode.

By setting the Span sensitivity correction value in percentage, calibrates ORP value indicated on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

The unit cannot enter Span Sensitivity Correction Mode in the following cases:

- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.27)]
- When cLEG (Cleansing output) is selected in any 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 calibration.

(1) When selecting bEFH (Last value HOLD) in [Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode (p.28)], select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.

(2) Press and hold the ▽ and ◎ keys (in that order) together for 3 seconds in ORP Display Mode or Cleansing Output Mode.
The unit enters Span Sensitivity Correction Mode, and indicates the following.

Display	Indication
ORP Display	SPAn and ORP value are indicated alternately.
Setting Display	Span sensitivity correction value is indicated.

(3) Immerse the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

(4) Set a span sensitivity correction value with the △ or ▽ key so that ORP value is approximately 260 mV (at 20℃). For other temperature and electrical potentials, refer to the temperature characteristics of your standard solution.
Setting range: 50 to 150%

(5) Press the SET/RESET key.
Span Sensitivity Correction Mode is complete, and the unit reverts to ORP Display Mode or Cleansing Output Mode.

9.3 Transmission Output Adjustment Mode

Fine adjustment of Transmission output is performed.
This ORP meter is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and output value of this unit.
In this case, perform Transmission output Zero adjustment and Span adjustment.
Transmission Output Adjustment Mode is available only when the Transmission output (TA option) is ordered.

The unit cannot enter Transmission Output Adjustment Mode in the following cases.

- During Adjustment Mode or Span Sensitivity Correction Mode
- When Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) is selected in [Set value lock (p.27)]
- When cLEG (Cleansing output) is selected in any 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 adjustment.

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

Display	Indication
ORP Display	AJ3□
Setting Display	Transmission output Zero adjustment value

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

(3) Press the SET/RESET key.
The unit enters Transmission Output Span Adjustment Mode, and indicates the following.

Display	Indication
ORP Display	AJ4□
Setting Display	Transmission output Span adjustment value

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

(5) Press the ◯ key.
The unit reverts to the Transmission Output Zero Adjustment Mode.
Repeat steps (2) to (5) if necessary.

(6) To finish the Transmission output adjustment, press the SET/RESET key in Transmission Output Span Adjustment Mode.
The unit reverts to ORP 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, orP□ characters are indicated on the ORP Display.

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

After that, measurement starts, indicating ORP value on the ORP Display and the item selected in [Setting Display indication (p.28)] on the Setting Display.

This status is called ORP Display Mode or Cleansing Output Mode.

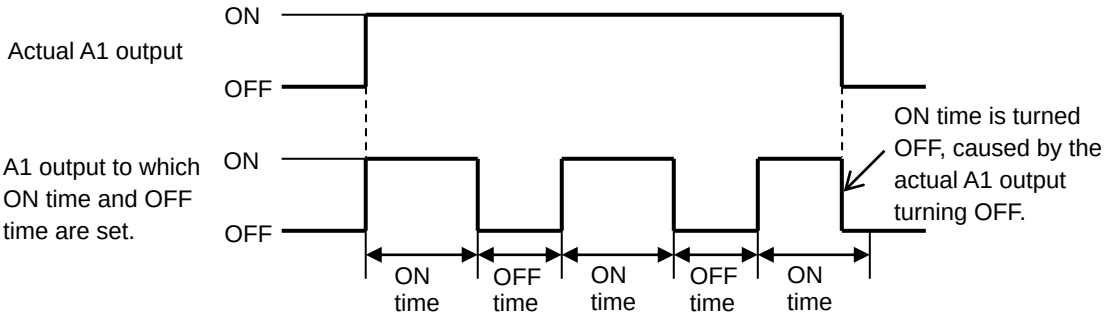
10.2 A□□ Output

When orPL (ORP input low limit action), orPH (ORP input high limit action) is selected in [A11, A12, A21, A22 type (pp.21, 22)], the A□□ output is turned ON if ORP value exceeds the A□□ value. A1 or A2 output is turned ON depending on the settings in [A1/A2 output allocation (p.29)] and [Output ON time/OFF time when A1/A2 output ON (pp.29, 30)].

However, if CLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)], the Cleansing output will be given top priority.

If 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 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.20)].

- If oFF□ (Disabled) is selected, A□□ output and A□□ output status will be turned OFF when input errors occur.
- If on□□ (Enabled) is selected, A□□ output and A□□ output status will be maintained when input errors occur.

10.3 ORP Input Error Alarm

ORP input error alarm is used for detecting actuator trouble.
Even if ORP input error alarm time has elapsed, and if ORP input does not become higher than ORP input error alarm band, the unit assumes that actuator trouble has occurred, and sets Status flag 2 (A1, A2 ORP input error alarm output flag bit).
In Serial communication, status can be read by reading Status flag 2 (A1, A2 ORP input error alarm output flag bit).

ORP input error alarm is disabled in the following cases.

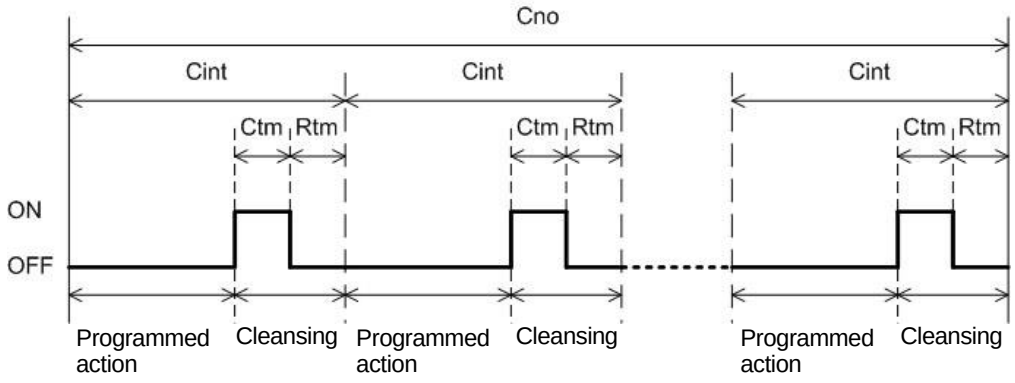
- During Adjustment Mode, Span Sensitivity Correction Mode.
- When cLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.
- When ORP input error alarm time is set to 0 seconds, or ORP input error alarm band is set to 0 mV.

10.4 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.
An 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 number of cleansing cycles will be repeated.
During cleansing output mode, the ORP value is constantly updated.
However, while cleansing is being performed using the 'Cleansing Time' and 'Restore Time after Cleansing' settings, other contact outputs are in OFF status.

When cleansing is not being performed, programmed operation continues.
When power is turned ON again, the unit starts 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 programmed operations, however, they are in Cleansing Output mode.

- **Cleansing Output Action**



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

(Fig. 10.4-1)

- While A1 is performing cleansing action, and if A□□ type (to which Cleansing output cLEG is set) is selected for A2, A2 cleansing action will be the same as the (currently performing) A1 cleansing action.
  While A2 is performing cleansing action, and if A□□ type (to which Cleansing output cLEG is set) is selected for A1, A1 cleansing action will be the same as the (currently performing) A2 cleansing action.
- During Adjustment Mode, Span Sensitivity Correction Mode or Transmission output 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.

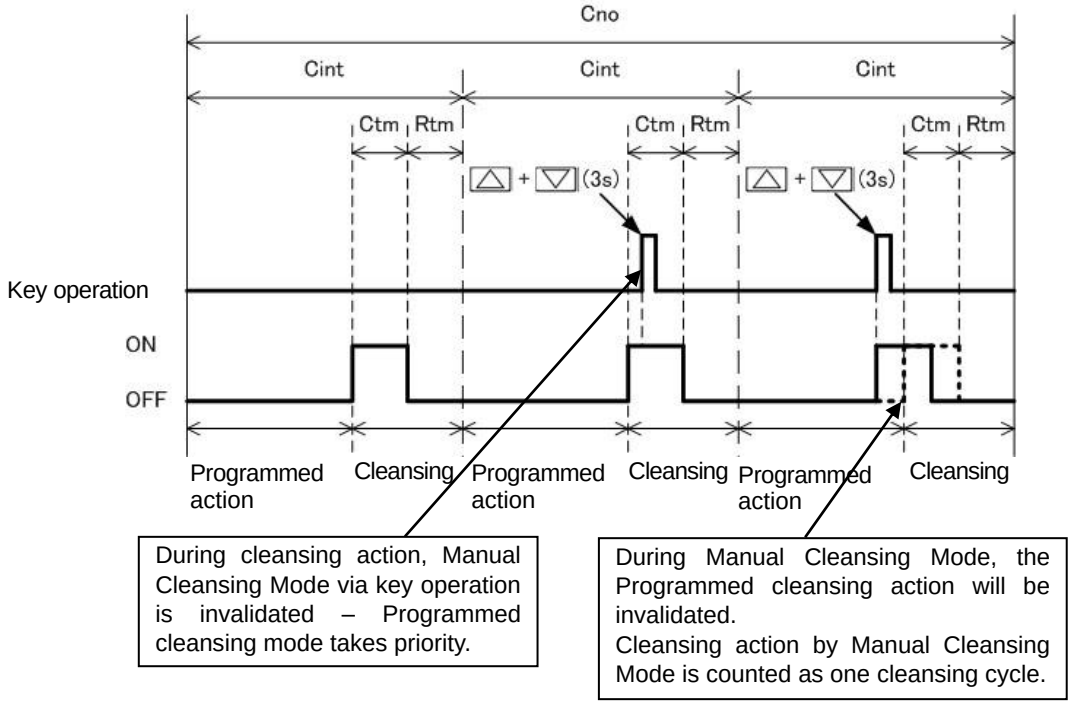
If any output other than cLEG (Cleansing output) is selected in [A11, A12, A21, A22 type (pp.21, 22)], the unit will revert to ORP Display Mode.

10.5 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 move to Manual Cleansing Mode.
During Manual Cleansing Mode, if Programmed cleansing action initiates after Restore time has passed, the programmed cleansing action will not be performed in the current session.
Cleansing action by Manual Cleansing Mode is counted as 1 cleansing cycle.

Manual Cleansing Mode Action



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

(Fig. 10.5-1)

10.6 Transmission Output

Converting ORP value to analog signal every input sampling period, outputs in current.
If Transmission output high limit and low limit are set to the same value, Transmission output 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 span

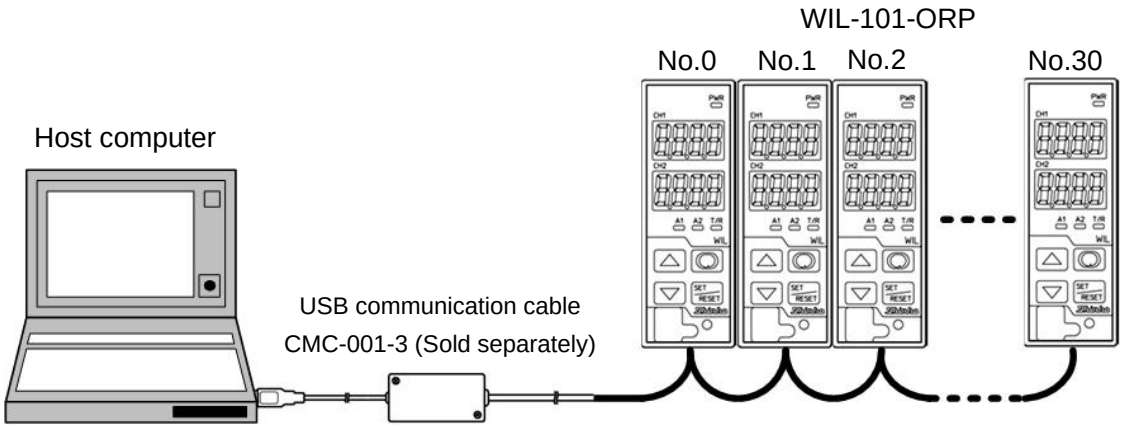
10.7 ORP Fluctuation Alarm Output

ORP fluctuation alarm output is used for detecting ORP input fluctuation error.
Even if ORP fluctuation alarm time has elapsed – if the change in ORP input fluctuation is smaller than the ORP fluctuation alarm band – the instrument assumes that an ORP fluctuation error has occurred, and sets Status flag 2 (A11, A12, A21, A22 output flag bit).
If EoBA (ORP 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 ORP fluctuation alarm time is set to 0 (zero) hours, or if ORP fluctuation alarm band is set to 0 mV.

11. Communication

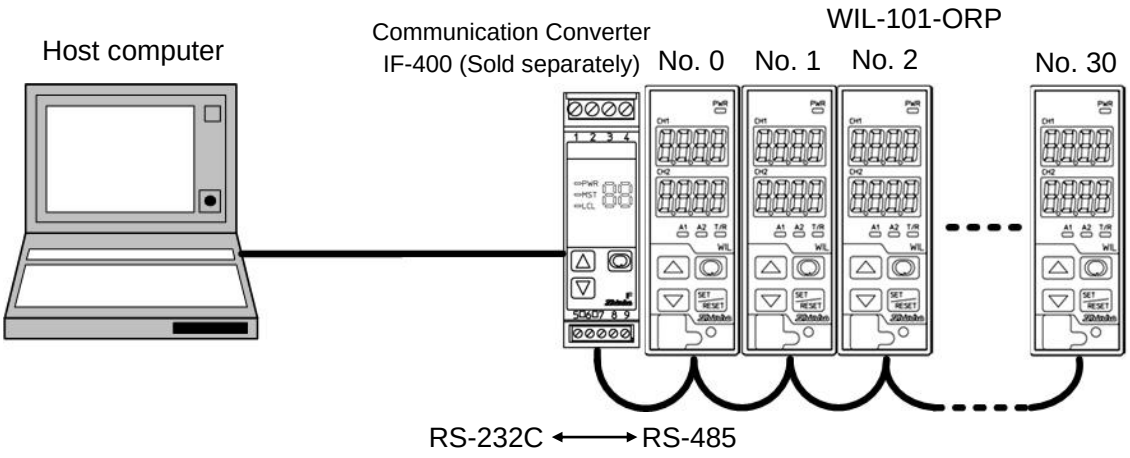
11.1 System Configuration Example

• 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 ORP Meter

Communication parameters can be set in the Basic Function Group.

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

① `oPEr` Press the [◎] key 3 times in ORP Display Mode or Cleansing Output Mode.

② `cnnL` 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.)

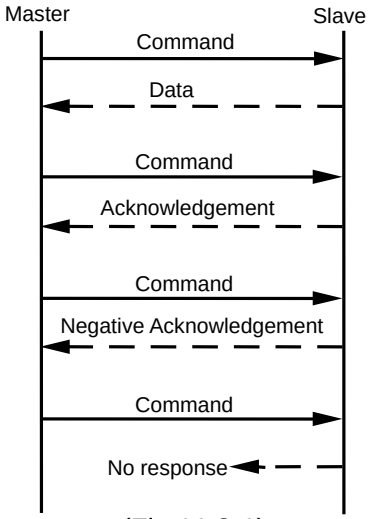
Character	Setting Item, Function, Setting Range	Factory Default
`cnnL` `nonL`	**Communication protocol** • Selects communication protocol. • `nonL` : Shinko protocol `nodA` : MODBUS ASCII mode `nodr` : MODBUS RTU mode	Shinko protocol
`cnno` `□□□0`	**Instrument number** • Sets the instrument number. The 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
cSSP □□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
cSFT 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
cSST □□□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 ORP 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-101-ORP (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 characters 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 numbers 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. 48 to 53)]

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. 48 to 53)]

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. During Adjustment Mode, Span Sensitivity Correction Mode or Transmission output adjustment, etc.)
5 (35H)-----During setting mode by keypad operation

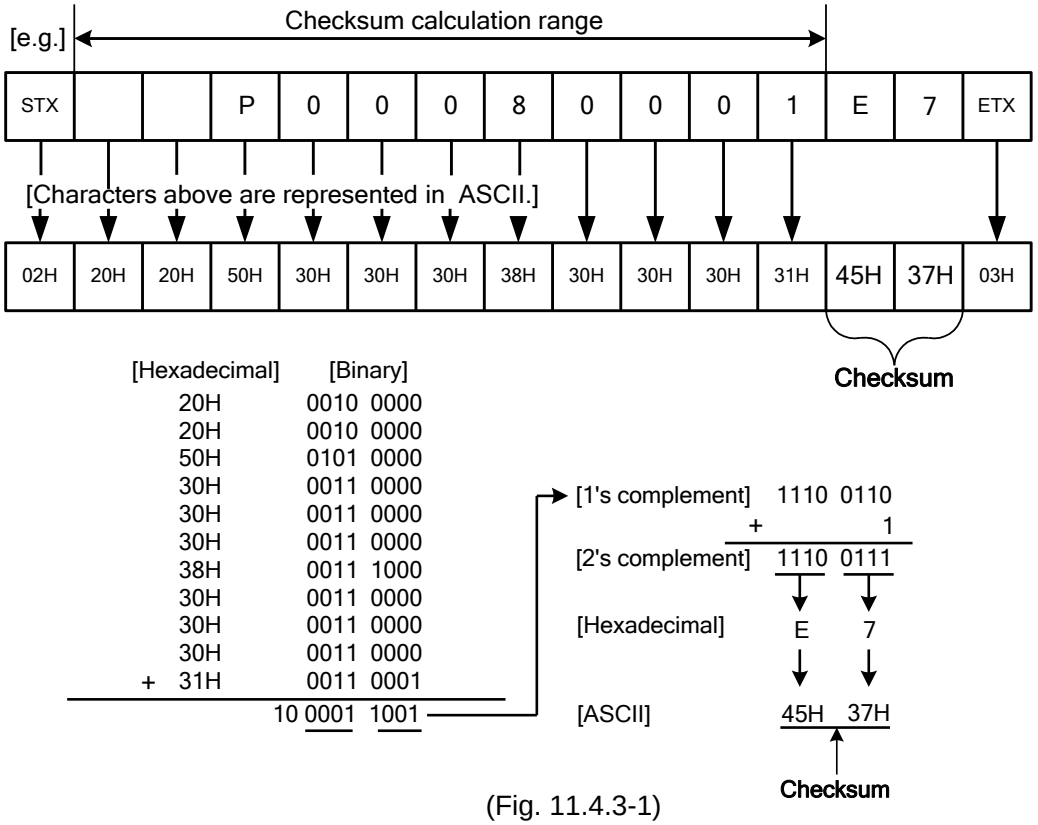
11.4.3 Checksum Calculation

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

Data item 0008H (ORP inputs for moving average): 1 (0001H)
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-101-ORP 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.) During Adjustment Mode, Span Sensitivity Correction Mode or Transmission output adjustment, etc.]
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 a 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 (ORP value)]**

• 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 [100 mV (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 (ORP inputs for moving average)]**

• A request message from the master [when setting 'ORP inputs for moving average' to 1 (0001H)]

Header	Slave Address	Function Code	Data Item [0008H]	Amount of data [0001H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 30H 38H)	(30H 30H 30H 31H)	(46H 30H)	(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]	Amount of data [0001H]	Error Check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 30H 38H)	(30H 30H 30H 31H)	(46H 30H)	(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 (ORP value)]**

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

• Response message from the slave in normal status [100 mV (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	Function Code	Response Byte Count	Data	Error Check CRC-16	3.5 idle characters
	(01H)	(03H)	(02H)	(0064H)	(B9AFH)	
	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	Function Code	Exception Code	Error Check CRC-16	3.5 idle characters
	(01H)	(83H)	(02H)	(C0F1H)	
	1	1	1	2	

② **Setting [Slave address 1, Data item 0008H (ORP inputs for moving average)]**

• A request message from the master [when setting 'ORP inputs for moving average' to 1 (0001H)]

3.5 idle Characters	Slave Address	Function Code	Data Item	Data	Error Check CRC-16	3.5 idle characters
	(01H)	(06H)	(0008H)	(0001H)	(C9C8H)	
	1	1	2	2	2	

• Response message from the slave in normal status

3.5 idle Characters	Slave Address	Function Code	Data Item	Data	Error Check CRC-16	3.5 idle characters
	(01H)	(06H)	(0008H)	(0001H)	(C9C8H)	
	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	Function Code	Exception Code	Error Check CRC-16	3.5 idle characters
	(01H)	(86H)	(03H)	(0261H)	
	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 item 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 (Input indication high limit) 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 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 Adjustment value, Span sensitivity correction value, Transmission output Zero and Span adjustment values – 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 and A22 types. 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 software communication. They can only be set via the keypad. (pp.40, 41)
- 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

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0001H	Input indication high limit	Set value
50H/20H	06H/03H	0002H	Input indication low limit	Set value
50H/20H	06H/03H	0003H	A11 type	0000H: No action 0001H: ORP input low limit action 0002H: ORP input high limit action 0003H: Cleansing output 0004H: ORP fluctuation alarm output 0005H: ORP input High/Low limits independent action

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0004H	A11 value	Set value
50H/20H	06H/03H	0005H	A11 ON side	Set value
50H/20H	06H/03H	0006H	A11 ON delay time	Set value
50H/20H	06H/03H	0007H	A11 OFF delay time	Set value
50H/20H	06H/03H	0008H	ORP inputs for moving average	Set value
50H/20H	06H/03H	0030H	Set value lock	0000H: Unlock 0001H: Lock 1 0002H: Lock 2 0003H: Lock 3
50H/20H	06H/03H	0032H	Transmission output high limit	Set value
50H/20H	06H/03H	0033H	Transmission output low limit	Set value
50H/20H	06H/03H	0035H	Auto-light function	0000H: Disabled 0001H: Enabled
50H/20H	06H/03H	0036H	Setting Display indication	0000H: No indication 0001H: A11 value 0002H: A12 value 0003H: A21 value 0004H: A22 value
50H/20H	06H/03H	0037H	Indication time	Set value
50H/20H	06H/03H	0040H	ORP input filter time constant	Set value
50H/20H	06H/03H	0041H	A□□ output when input errors occur	0000H: Enabled 0001H: Disabled
50H	06H	0044H	Adjustment Mode	0000H: ORP Display Mode or Cleansing Output Mode 0001H: Adjustment Mode
50H/20H	06H/03H	0045H	Adjustment value	Set value
50H	06H	0046H	Span Sensitivity Correction Mode	000H: ORP Display Mode or Cleansing Output Mode 0001H: Span Sensitivity Correction Mode
50H/20H	06H/03H	0047H	Span sensitivity correction value	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: ORP input low limit action 0002H: ORP input high limit action 0003H: Cleansing output 0004H: ORP fluctuation alarm output 0005H: ORP input High/Low limits independent action
50H/20H	06H/03H	0051H	A21 type	0000H: No action 0001H: ORP input low limit action 0002H: ORP input high limit action 0003H: Cleansing output 0004H: ORP fluctuation alarm output 0005H: ORP input High/Low limits independent action
50H/20H	06H/03H	0052H	A22 type	0000H: No action 0001H: ORP input low limit action 0002H: ORP input high limit action 0003H: Cleansing output 0004H: ORP fluctuation alarm output 0005H: ORP input High/Low limits independent action

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	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	06H	007FH	Key operation change flag clearing	0001H: Clear change flag
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

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	010FH	Transmission output status in in Adjustment Mode / Span Sensitivity Correction Mode	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0110H	Transmission output value HOLD in Adjustment Mode / Span Sensitivity Correction Mode	Set value
50H/20H	06H/03H	0111H	A1 ORP 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 ORP 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 ORP input error alarm band when A□□ output ON	Set value
50H/20H	06H/03H	0116H	A1 ORP input error alarm time when A□□ output ON	Set value
50H/20H	06H/03H	0117H	A1 ORP input error alarm band when A□□ output OFF	Set value
50H/20H	06H/03H	0118H	A1 ORP input error alarm time when A□□ output OFF	Set value
50H/20H	06H/03H	0119H	A2 ORP input error alarm band when A□□ output ON	Set value
50H/20H	06H/03H	011AH	A2 ORP input error alarm time when A□□ output ON	Set value
50H/20H	06H/03H	011BH	A2 ORP input error alarm band when A□□ output OFF	Set value
50H/20H	06H/03H	011CH	A2 ORP input error alarm time when A□□ output OFF	Set value
50H/20H	06H/03H	0125H	ORP input error alarm time unit	0000H: Second(s) 0001H: Minute(s)
50H	06H	0126H	Transmission Output Adjustment Mode	0000H: ORP Display Mode or Cleansing Output Mode 0001H: Transmission Output Zero Adjustment Mode 0002H: Transmission Output Span Adjustment Mode
50H/20H	06H/03H	0127H	Transmission output Zero adjustment value	Set value
50H/20H	06H/03H	0128H	Transmission output Span adjustment value	Set value
50H/20H	06H/03H	0131H	A11 ORP fluctuation alarm time	Set value
50H/20H	06H/03H	0132H	A12 ORP fluctuation alarm time	Set value

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0133H	A21 ORP fluctuation alarm time	Set value
50H/20H	06H/03H	0134H	A22 ORP fluctuation alarm time	Set value
50H/20H	06H/03H	0135H	A11 ORP fluctuation alarm band	Set value
50H/20H	06H/03H	0136H	A12 ORP fluctuation alarm band	Set value
50H/20H	06H/03H	0137H	A21 ORP fluctuation alarm band	Set value
50H/20H	06H/03H	0138H	A22 ORP 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
50H/20H	06H/03H	0145H	Transmission output status when cleansing	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0146H	Transmission output value HOLD when cleansing	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)

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>ORP value</td><td>ORP value</td></tr>
<tr><td>20H</td><td>03H</td><td>0081H</td><td colspan="3">Status flag 1
0000 0000 0000 0000
2^{15} to 2^{0}
2^{0} to 2^{8} digit: Not used (Always 0)
2^{9} digit: ORP value has exceeded 1999 mV
0: Normal 1: Exceeding 1999 mV
2^{10} digit: ORP value is less than -1999 mV
0: Normal 1: Less than -1999 mV
2^{11} digit: Unit status flag
0: ORP Display Mode or Cleansing Output Mode
1: Setting mode
2^{12} digit: Adjustment status flag
0: ORP Display Mode or Cleansing Output Mode
1: Adjustment Mode
2^{13} digit: Span sensitivity correction status flag
0: ORP Display Mode or Cleansing Output Mode
1: Span Sensitivity Correction Mode
2^{14} digit: A1 output 0: OFF 1: ON
2^{15} digit: Change in key operation 0: No 1: Yes</td></tr>
<tr><td>20H</td><td>03H</td><td>0091H</td><td colspan="3">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: Not used (Always 0)
2^{11} , 2^{12} digits: Transmission output 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>ORP Display Mode or Cleansing Output Mode</td></tr>
<tr><td>0</td><td>1</td><td>During transmission output Zero adjustment in Transmission Output Adjustment Mode</td></tr>
<tr><td>1</td><td>0</td><td>During transmission output Span adjustment in Transmission Output Adjustment Mode</td></tr>
</table>
2^{13} digit: A1 ORP input error alarm output flag 0: OFF 1: ON
2^{14} digit: A2 ORP input error alarm output flag 0: OFF 1: ON
2^{15} digit: Not used (Always 0)</td></tr>
</table>

(*) When cLEG (Cleansing output) is selected in [A11, A12, A21, A22 type]: The A□□ output flag changes to 1 (ON).
If any item other than cLEG (Cleansing output) is selected:
When A□□output is ON: The A□□ output flag changes to 1 (ON).
When A□□ output is OFF: The A□□ output flag changes to 0 (OFF).

11.7 ORP Calibration and Transmission Output Adjustment via Communication Command

Like a keypad operation, there are also 2 methods in calibration via communication command:

Adjustment Mode, Span Sensitivity Correction Mode

11.7.1 Adjustment Mode

Only when using a brand-new sensor, please calibrate in Adjustment Mode.

By setting the adjustment value, calibrates ORP value indicated on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

The following outlines the procedure for calibration.

① When selecting Last value HOLD (0000H) at Data item 010FH (Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode), select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.

② Set Data item 0044H (Adjustment Mode) to 0001H. The unit enters Adjustment Mode.

③ Immerse the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

④ Set the adjustment value at Data item 0045H (Adjustment value) so that ORP value is 260 mV (at 20℃).
For other temperature and electrical potentials, refer to the temperature characteristics of your standard solution.
If 2^{12} digit is read at Data item 0081H (Status flag 1), 1 (Adjustment Mode) will be returned.

⑤ Set Data item 0044H (Adjustment Mode) to 0000H.
Adjustment Mode is complete, and the unit will revert to ORP Display Mode or Cleansing Output Mode.
If 2^{12} digit is read at Data item 0081H (Status flag 1), 0 (ORP Display Mode or Cleansing Output Mode) will be returned.

If errors (e.g. ORP value is outside the measurement range) occur in Adjustment Mode, and if adjustment cannot be carried out, Error code 1 (Exceeding 1999 mV, Less than -1999 mV) will be returned when 2^9 or 2^{10} digit is read at Data item 0081H (Status flag 1).
To cancel the error code, set Data item 0044H (Adjustment Mode) to 0000H.

The unit will revert to ORP Display Mode or Cleansing Output Mode.

11.7.2 Span Sensitivity Correction Mode

When calibrating periodically, please calibrate in Span Sensitivity Correction Mode.

By setting the Span sensitivity correction value in percentage, calibrates ORP value indicated on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

The following outlines the procedure for calibration.

① When selecting Last value HOLD (0000H) at Data item 010FH (Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode), select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.

② Set Data item 0046H (Span Sensitivity Correction Mode) to 0001H. The unit enters Span Sensitivity Correction Mode.

③ Immerse the ORP Combined Electrode Sensor in the Standard solution (Quinhydrone potential difference 260 mV).

④ Set the span sensitivity correction value at Data item 0047H (Span sensitivity correction value) so that ORP value is 260 mV (at 20℃).
For other temperature and electrical potentials, refer to the temperature characteristics of your standard solution.
If 2^{13} digit is read at Data item 0081H (Status flag 1), 1 (Span Sensitivity Correction Mode) will be returned.

⑤ Set Data item 0046H (Span Sensitivity Correction Mode) to 0000H.
Span Sensitivity Correction Mode is complete, and the unit will revert to ORP Display Mode or Cleansing Output Mode.
If 2^{13} digit is read at Data item 0081H (Status flag 1), 0 (ORP Display Mode or Cleansing Output Mode) will be returned.

If errors (e.g. ORP value is outside the measurement range) occur in Span Sensitivity Correction Mode, and if span sensitivity correction cannot be carried out, Error code 1 (Exceeding 1999 mV, Less than -1999 mV) will be returned when 2^9 or 2^{10} digit is read at Data item 0081H (Status flag 1).

To cancel the error code, set Data item 0046H (Span Sensitivity Correction Mode) to 0000H.
The unit will revert to ORP Display Mode or Cleansing Output Mode.

11.7.3 Transmission Output Adjustment

Fine adjustment of Transmission output is performed.
This ORP meter 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 Zero adjustment and Span adjustment.

The following outlines the procedure for Transmission output adjustment.

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

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

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

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

⑤ Repeat steps ① to ④ if necessary.

⑥ To finish the Transmission output adjustment, set Data item 0126H (Transmission Output Adjustment Mode) to 0000H.
The unit reverts to ORP 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-101-ORP, set the program so that the requisite minimum pieces of data such as Data item 0080H (ORP value), 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 0080H (ORP value), 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 item 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 item 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
	ORP Combined Electrode Sensor	-1999 to 1999 mV	1 mV
Input	ORP Combined Electrode Sensor		

Power supply voltage	Model	WIL-101-ORP	WIL-101-ORP 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	
	ORP Display	Red LED 4-digits,character size 10 x 4.6 mm (H x W)
	Setting Display	Red LED 4-digits,character size 10 x 4.6 mm (H x W)
	Action indicator	
	PWR (Yellow)	Lights up when power supply is ON.
	A1 (Red)	Lights up when A1 output (Contact output 1) is ON.
	A2 (Yellow)	Lights up when A2 output (Contact output 2) is ON. (Turns OFF if the TA option is ordered.)
	T/R (Yellow)	Lights up while in Serial communication TX output (transmitting).
Setting structure	Setting method: Input system using membrane sheet key	

Indication Performance

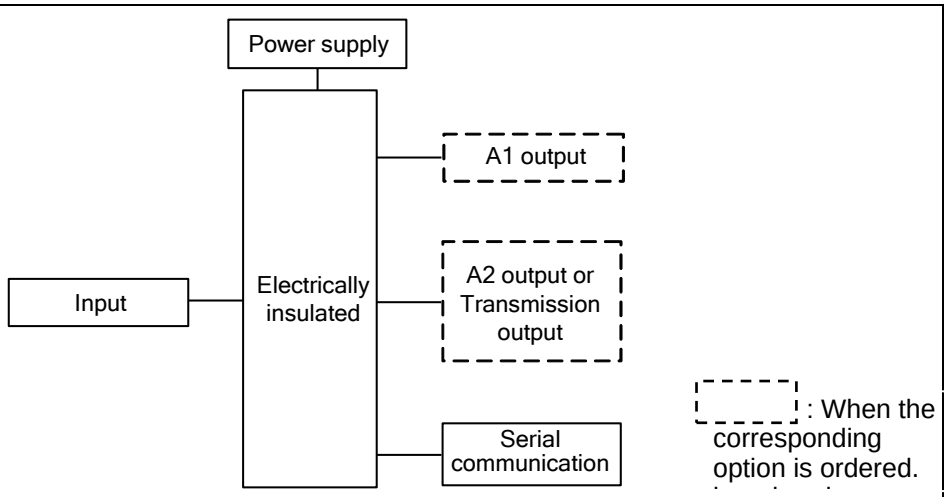
Repeatability	Within ±5 mV (at equivalent input)
Linearity	Within ±5 mV (at equivalent input)
Input sampling period	125 ms
Time accuracy	Within ±1% of setting time

Standard Functions

Adjustment	For successful measurement of ORP, ORP value in the sensor location, electrode performance and standard solution accuracy respectively play an important role for obtaining reliable data. By setting the adjustment value, calibrates ORP value displayed on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).
Span Sensitivity Correction	By setting the span sensitivity correction value in percentage, calibrates ORP value displayed on the WIL-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).

<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 ORP value 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 minimum on both sides.)</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>Start bit</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Data bit</td><td>7</td><td>7 (8) Selectable</td><td>8</td></tr>
<tr><td>Parity</td><td>Even</td><td>Even (No parity, Odd) Selectable</td><td>No parity (Even, Odd) Selectable</td></tr>
<tr><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> 

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>Lock 1: None of the set values can be changed.
Lock 2: Only A11, A12, A21, A22 values can be changed.
Lock 3: All set values – except Adjustment value, Span sensitivity correction value, Transmission output Zero and Span adjustment values – 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>Outside measurement range</td><td>ORP value is outside the measurement range: If the value is less than -1999 mV or exceeds 1999 mV, the following will be indicated.
<table>
<tr><th>ORP Display</th><th>Setting Display</th></tr>
<tr><td>Less than -1999 mV: -1999</td><td>oF is flashing.</td></tr>
<tr><td>Exceeding 1999 mV: 1999</td><td>oF is flashing.</td></tr>
<tr><td colspan="2">However, when ORP value is outside the measurement range, and if the unit proceeds to Adjustment Mode or Span Sensitivity Correction Mode, the ORP Display will be unlit, and the Setting Display will flash oF.</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-101-ORP is switched to warm-up status.</td></tr>
<tr><td>Warm-up Indication</td><td>For approx. 4 seconds after the power is switched ON, orP is indicated on the ORP Display.</td></tr>
<tr><td>Display sleep function</td><td>In ORP Display Mode or Cleansing Output Mode, selects the item to be indicated on the Setting Display.
No indication, A11, A12, A21 or A22 value can be selected in [Setting Display indication (p.28)].
If any item other than ’No indication’ 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 00.00, 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 ORP Display, Setting Display and action indicators.</td></tr>
</table>

Other

Power consumption	Approx. 8 VA
Ambient temperature	0 to 50℃ (32 to 122℉)
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 (Terminal screw fall prevention, finger-safe structure)
Environmental specification	RoHS directive compliant

12.2 Optional Specifications

A□□ Output (Option Code: EVT or TA)

A□□ output	If ORP value exceeds the A□□ value, the A□□ output will be turned ON for each A□□ output type. Regardless of options being ordered, A□□ output status can be read via Status flag 2 (A11, A12, A21, A22 output flag bit) in Serial communication. A□□ output status, when input errors occur, differs depending on the selections in [A□□ output when input errors occur (p.20)] 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.	
Setting range	-1999 to 1999 mV	
Action	ON/OFF action	
A□□ ON side A□□ OFF side	0 to 200 mV	
A□□ type	One type can be selected from the following with the keypad. • No action • ORP input low limit action • ORP input high limit action • Cleansing output • ORP fluctuation alarm output • ORP 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	For A1 or A2 output, A11 type, A12 type, A21 type and/or A22 type are allocated. Output is OR output. However, if cLEG (Cleansing output) is selected in any of [A11, A12, A21, A22 type (pp.21, 22)], the cleansing output will be given top 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.	
ORP input error alarm	Detects actuator trouble. Even if ORP input error alarm time has elapsed, and if ORP input does not become higher than ORP input error alarm band, the unit assumes that actuator trouble has occurred, and sets Status flag 2 (A1, A2 ORP input error alarm output flag bit). In Serial communication, status can be read by reading Status flag 2 (A1, A2 ORP input error alarm output flag bit). ORP input error alarm is disabled in the following cases. • During Adjustment Mode or Span Sensitivity Correction Mode • When cLEG (Cleansing output) is selected in any 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 ORP input error alarm time is set to 0 seconds, or ORP input error alarm band is set to 0 mV.	

Transmission Output (Option Code: TA)

Transmission output		Converting ORP value to analog signal every input sampling period, and outputs the value in current. If Transmission output high limit and low limit are set to the same value, the transmission output 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 span
	Transmission output adjustment	Fine adjustment of Transmission output is performed via Transmission output Zero adjustment and Span adjustment.	
	Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode	Transmission output status can be selected in Adjustment Mode or Span Sensitivity Correction Mode. Last value HOLD: Retains the last value before Adjustment or Span Sensitivity Correction, and outputs it. Set value HOLD: Outputs the value set in [Transmission output value HOLD in Adjustment Mode / Span Sensitivity Correction Mode]. Measured value: Outputs the measured value in Adjustment Mode or Span Sensitivity Correction Mode.	

13. Troubleshooting

If any malfunction occurs, refer to the following items after checking that power is being supplied to the WIL-101-ORP.

13.1 Indication

Problem	Possible Cause	Solution
The ORP Display is unlit.	The time set in [Indication time (p.28)] 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 ORP Display is dark.	U5E□ (Enabled) is selected in [Auto-light function (p.28)].	Select ---- (Disabled).
Indication of the ORP Display is unstable or irregular.	Calibration may not have finished.	Perform calibration.
	Specification of ORP Combined Electrode Sensor may not be suitable.	Replace the sensor with a suitable one.
	Electrode sensor terminal screws have become loose.	Tighten the screws securely.
	Electrical insulation of electrode sensor terminals has deteriorated.	Clean the terminals with alcohol, and dry completely.
	The electrode is not clean.	Clean the electrode.
	Air bubbles are attached to the electrode.	Make sure there are no bubbles in the measurement solution.
	The electrode has not been placed in the measurement solution.	Install the electrode in the measurement solution, maintaining a consistent volume.
	There may be equipment that interferes with or makes noise near the WIL-101-ORP.	Keep WIL-101-ORP clear of any potentially disruptive equipment.
Setting Display is unlit.	nonE (No indication) is selected in [Setting Display indication (p.28)].	Select any other item except nonE (No indication). Select A11, A12, A21 or A22 value.
[□□oF] is flashing on the Setting Display.	This indicates that the ORP value is outside the measurement range (less than -1999 mV or exceeding 1999 mV).	Check the measuring environment.
[Err 1] is indicating on the ORP 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 △ or ▽ key.	Loc 1 (Lock 1) is selected in [Set value lock (p.27)].	Select ---- (Unlock).
Only A□□ value can be set. Other settings are impossible. The values do not change by △ or ▽ key.	Loc2 (Lock 2) is selected in [Set value lock (p.27)].	Select ---- (Unlock).

Problem	Possible Cause	Solution
Unable to enter Manual Cleansing Mode.	cLEn (Cleansing output) is not selected in any of [A11, A12, A21 or A22 type (pp.21, 22)].	Select cLEn (Cleansing output) in any 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 calibration mode (Adjustment Mode or Span Sensitivity Correction Mode).	Loc 1 (Lock 1), Loc2 (Lock 2) or Loc3 (Lock 3) has been selected in [Set value lock (p.27)].	Select ---- (Unlock).
	cLEn (Cleansing output) has been selected in any 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 complete.

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 communi-cation 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-101-ORP cannot be set while in Adjustment Mode or Span Sensitivity Correction Mode.	Check the slave status.
	The WIL-101-ORP is in the front keypad operation setting mode.	Return the unit to ORP Display Mode or Cleansing Output Mode.

14. Character Tables

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

Setting Groups

Character	Setting Group
F.nc. 1	ORP Input Function Group
F.nc.2	Output Function Group
a.C.E.r	Basic Function Group

Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AdJ5(*) □□□0	**Adjustment value** -200 to 200 mV	0 mV	

(*) AdJ5 and ORP value are displayed alternately.

Span Sensitivity Correction Mode

Character	Setting Item, Setting Range	Factory Default	Data
SPAn(*) □ 100	**Span sensitivity correction value** Setting range: 50 to 150%	100%	

(*) SPAn and ORP value are displayed alternately.

Transmission Output Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AJ3□ □0.00	**Transmission output Zero adjustment value** Setting range: ±5.00% of Transmission output span	0.00%	
AJ5□ □0.00	**Transmission output Span adjustment value** Setting range: ±5.00% of Transmission output span	0.00%	

ORP Input Function Group

Character	Setting Item, Setting Range	Factory Default	Data
dFcT □□20	**ORP inputs for moving average** Setting range: 1 to 120	20	
d5PH 1999	**Input indication high limit** Setting range: Input indication low limit to 1999 mV	1999 mV	
d5PL -999	**Input indication low limit** Setting range: -1999 mV to Input indication high limit	-1999 mV	
FILT □□0.0	**ORP input filter time constant** Setting range: 0.0 to 60.0 seconds	0.0 seconds	
I Err oFF□	**A□□ output when input errors occur** on□□: Enabled oFF□: Disabled	Disabled	

Output Function Group

Character	Setting Item, Setting Range	Factory Default	Data
A 1 1F -----	**A11 type** -----: No action orPL : ORP input low limit action orPH : ORP input high limit action cLEG : Cleansing output EobA : ORP fluctuation alarm output orHL : ORP input High/Low limits independent action	No action	
A 12F -----	**A12 type** Selection item: Same as those of A11 type	No action	
A2 1F -----	**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	
A 1 1□ □□□0	**A11 value** Setting range: -1999 to 1999 mV	0 mV	
A 12□ □□□0	**A12 value** Setting range: -1999 to 1999 mV	0 mV	
A2 1□ □□□0	**A21 value** Setting range: -1999 to 1999 mV	0 mV	
A22□ □□□0	**A22 value** Setting range: -1999 to 1999 mV	0 mV	
A 1 1d hdI F	**A11 hysteresis type** cdI F : Medium Value hdI F : Reference Value	Reference Value	
A 1 1U □□ 10	**A11 ON side** Setting range: 0 to 200 mV	10 mV	
A 1 1L □□ 10	**A11 OFF side** Setting range: 0 to 200 mV	10 mV	
A 12d hdI F	**A12 hysteresis type** cdI F : Medium Value hdI F : Reference Value	Reference Value	
A 12U □□ 10	**A12 ON side** Setting range: 0 to 200 mV	10 mV	
A 12L □□ 10	**A12 OFF side** Setting range: 0 to 200 mV	10 mV	
A2 1d hdI F	**A21 hysteresis type** cdI F : Medium Value hdI F : Reference Value	Reference Value	
A2 1U □□ 10	**A21 ON side** Setting range: 0 to 200 mV	10 mV	
A2 1L □□ 10	**A21 OFF side** Setting range: 0 to 200 mV	10 mV	
A22d hdI F	**A22 hysteresis type** cdI F : Medium Value hdI F : Reference Value	Reference Value	
A22U □□ 10	**A22 ON side** Setting range: 0 to 200 mV	10 mV	
A22L □□ 10	**A22 OFF side** Setting range: 0 to 200 mV	10 mV	

Character	Setting Item, Setting Range	Factory Default	Data
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	
A11r □□□0	**A11 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A12r □□□0	**A12 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A21r □□□0	**A21 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A22r □□□0	**A22 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
A11h □□□0	**A11 ORP fluctuation alarm band** Setting range: 0 to 3998 mV	0 mV	
A12h □□□0	**A12 ORP fluctuation alarm band** Setting range: 0 to 3998 mV	0 mV	
A21h □□□0	**A21 ORP fluctuation alarm band** Setting range: 0 to 3998 mV	0 mV	
A22h □□□0	**A22 ORP fluctuation alarm band** Setting range: 0 to 3998 mV	0 mV	
A11n □□□0	**A11 High/Low limits independent lower side value** Setting range: 0 to 3998 mV	0 mV	
A12n □□□0	**A12 High/Low limits independent lower side value** Setting range: 0 to 3998 mV	0 mV	
A21n □□□0	**A21 High/Low limits independent lower side value** Setting range: 0 to 3998 mV	0 mV	
A22n □□□0	**A22 High/Low limits independent lower side value** Setting range: 0 to 3998 mV	0 mV	

Character	Setting Item, Setting Range	Factory Default	Data
A 1 1P □□□0	**A11 High/Low limits independent upper side value** Setting range: 0 to 3998 mV	0 mV	
A 12P □□□0	**A12 High/Low limits independent upper side value** Setting range: 0 to 3998 mV	0 mV	
A2 1P □□□0	**A21 High/Low limits independent upper side value** Setting range: 0 to 3998 mV	0 mV	
A22P □□□0	**A22 High/Low limits independent upper side value** Setting range: 0 to 3998 mV	0 mV	
A 1 1H □□ 10	**A11 hysteresis** Setting range: 1 to 200 mV	10 mV	
A 12H □□ 10	**A12 hysteresis** Setting range: 1 to 200 mV	10 mV	
A2 1H □□ 10	**A21 hysteresis** Setting range: 1 to 200 mV	10 mV	
A22H □□ 10	**A22 hysteresis** Setting range: 1 to 200 mV	10 mV	

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	
cnnL nonL	**Communication protocol** nonL : Shinko protocol nodA : MODBUS ASCII mode nodr : MODBUS RTU mode	Shinko protocol	
cnno □□0	**Instrument number** Setting range: 0 to 95	0	
cnnP □□96	**Communication speed** □□96 : 9600 bps □ 192 : 19200 bps □384 : 38400 bps	9600 bps	
cnFr 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	
cnnr □□□ 1	**Stop bit** □□□ 1 : 1 bit □□□2 : 2 bits	1 bit	
rrLH 1999	**Transmission output high limit** Setting range: Transmission output low limit to 1999 mV	1999 mV	
rrLL -999	**Transmission output low limit** Setting range: -1999 mV to Transmission output high limit	-1999 mV	
rrc5 bEFH	**Transmission output status in Adjustment Mode / Span Sensitivity Correction Mode** bEFH : Last value HOLD 5Erh : Set value HOLD PVH□ : Measured value	Last value HOLD	
rr5E □□□0	**Transmission output value HOLD in Adjustment Mode / Span Sensitivity Correction Mode** Setting range: -1999 to 1999 mV	0 mV	
LI Cr ----	**Auto-light function** ---- : Disabled US E□ : Enabled	Disabled	
dI SP nonE	**Setting Display indication** nonE : No indication dA 11 : A11 value dA 12 : A12 value dA21 : A21 value dA22 : A22 value	No indication	
rI nE 00.00	**Indication time** 00.00 (Remains lit) 00.01 to 60.00 (Minutes.Seconds)	00.00 (Remains lit)	

Character	Setting Item, Setting Range	Factory Default	Data
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** 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	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	
A1o□ -----	**A1 ORP input error alarm A□□ type** ----- : No action A11□ : A11 type A12□ : A12 type A21□ : A21 type A22□ : A22 type	No action	
A2o□ -----	**A2 ORP input error alarm A□□ type** ----- : No action A11□ : A11 type A12□ : A12 type A21□ : A21 type A22□ : A22 type	No action	
A1oo □□□0	**A1 ORP input error alarm band when A□□ output ON** Setting range: 0 to 1999 mV	0 mV	
A1oF □□□0	**A1 ORP input error alarm time when A□□ output ON** Setting range: 0 to 9999 seconds or minutes	0 seconds	

Character	Setting Item, Setting Range	Factory Default	Data
A1oc □□□0	**A1 ORP input error alarm band when A□□ output OFF** Setting range: 0 to 1999 mV	0 mV	
A1cT □□□0	**A1 ORP input error alarm time when A□□ output OFF** Setting range: 0 to 9999 seconds or minutes	0 seconds	
A2oo □□□0	**A2 ORP input error alarm band when A□□ output ON** Setting range: 0 to 1999 mV	0 mV	
A2oT □□□0	**A2 ORP input error alarm time when A□□ output ON** Setting range: 0 to 9999 seconds or minutes	0 seconds	
A2oc □□□0	**A2 ORP input error alarm band when A□□ output OFF** Setting range: 0 to 1999 mV	0 mV	
A2cT □□□0	**A2 ORP input error alarm time when A□□ output OFF** Setting range: 0 to 9999 seconds or minutes	0 seconds	
n_tU tEc□	**ORP input error alarm time unit** tEc□ : Second(s) nI n□ : Minute(s)	Second(s)	
ccnT □□□0	**Number of cleansing cycles** Setting range: 0 to 10 (When set to 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	
cctU bEFH	**Transmission output status when cleansing** bEFH : Last value HOLD tEnH : Set value HOLD PVH□ : Measured value	Last value HOLD	
ctE□ □□□0	**Transmission output value HOLD when cleansing** Setting range: -1999 to 1999 mV	0 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-101-ORP
- Serial number ---------- No. 194F05000

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

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