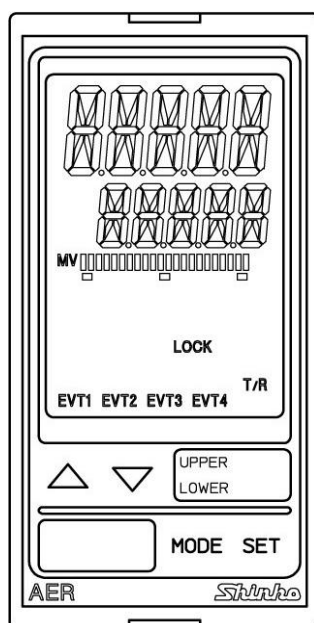# Digital Indicating ORP Meter

AER-101-ORP

Instruction Manual

Preface

Thank you for purchasing our AER-101-ORP, Digital Indicating ORP Meter.

This manual contains instructions for the mounting, functions, operations and notes when operating the AER-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	┥	☐	╵	ᔒ	∃	Ꮞ	⑤	⑥	٦	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	ᔕ	𝑟	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 through 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.

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 AER-101-ORP is mounted through the face of 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 AER-101-ORP.
 • The terminal block of this instrument is designed to be wired from the left side. The
   lead wire must be inserted from the left side of the terminal, and fastened with the
   terminal screw.
 • 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 24V AC/DC power source, do not confuse polarity when using direct current (DC).
 • Be sure to connect the ground terminal to earth for safety (D-class grounding).
   Keep the grounding of this unit separate from other electrical devices, such as motors.
 • 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 AER-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 sensor cable should be wired directly to the terminal block.
- 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

A E R - 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 (*)
Option				C5	Serial communication RS-485
				EVT3	EVT3, EVT4 Outputs (Contact output 3, 4)

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

1.2 How to Read the Model Label

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


```
AER-101-ORP          ◄─────── Model, Option
D12-021-6            ◄─────── Development No.
IN:-2000to2000mV     ◄─────── Input indication range


100to240V AC 50/60Hz 12VA  ◄── Power supply voltage, Power consumption
SERIAL No.194F05000        ◄── Serial number


SHINKO TECHNOS CO., LTD.   ◄── Manufacturer
MADE IN JAPAN  RoHS SF     ◄── Factory ID
                           ◄── RoHS directive compliant
```

(Fig. 1.2-1)

8
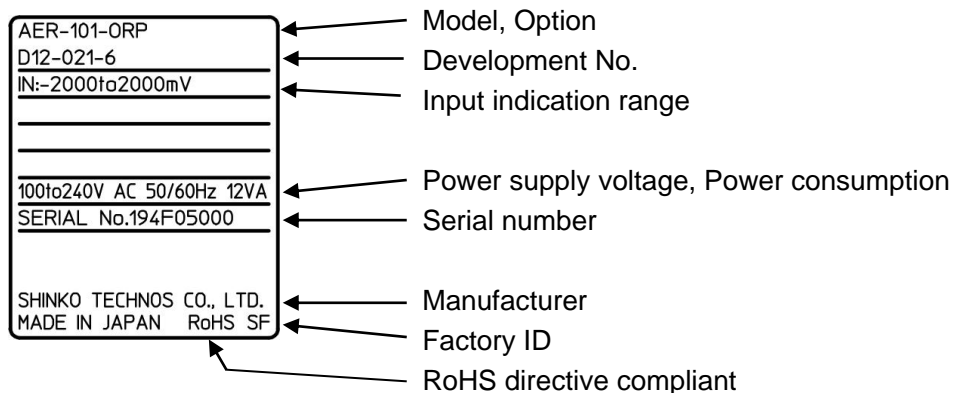
2. Names and Functions of Instrument
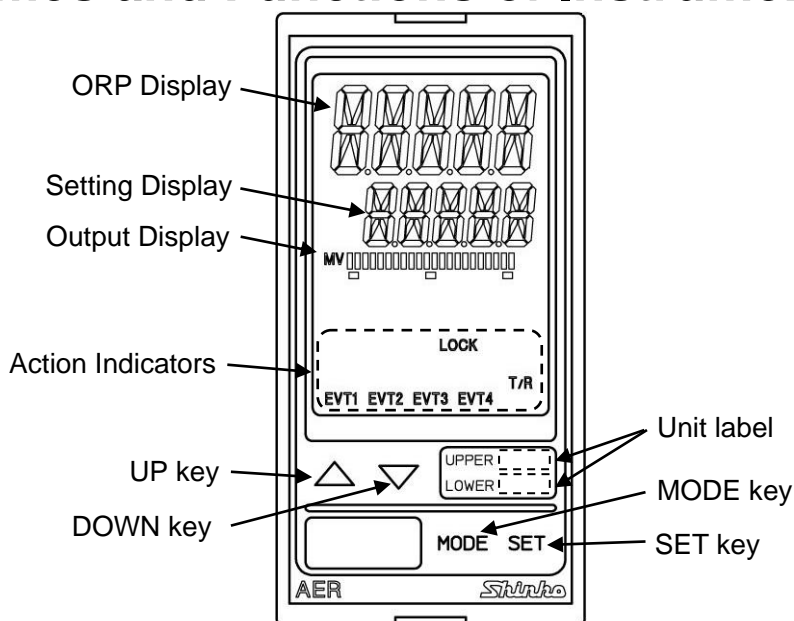
(Fig. 2-1)

Displays

ORP Display	ORP value or characters in setting mode are indicated in red/green/orange. Indications differ depending on the selections in [Backlight selection (p.33)] and [ORP color (p.34)].
Setting Display	Values in setting modes are indicated in green. Indications differ depending on the selections in [Backlight selection (p.33)] and [Setting Display indication (p.35)].
Output Display	Backlight green The bar graph is lit corresponding to the transmission output. Indications differ depending on the selections in [Bar graph indication(p.35)].

Action Indicators: Backlight orange

EVT1	Lights up when EVT1 output (Contact output 1) is ON.
EVT2	Lights up when EVT2 output (Contact output 2) is ON.
EVT3	Lights up when EVT3 output (Contact output 3) (EVT3 option) is ON.
EVT4	Lights up when EVT4 output (Contact output 4) (EVT3 option) is ON.
T/R	Lights up during Serial communication (C5 option) TX output (transmitting).
LOCK	Lights up when Lock 1, 2 or 3 is selected.

Unit label

UPPER	Attach the user's unit of ORP Display from the included unit labels if necessary.
LOWER	Attach the user's unit of Setting Display from the included unit labels if necessary.

Keys

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

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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 AER-101-ORP is mounted through the face of 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)

10
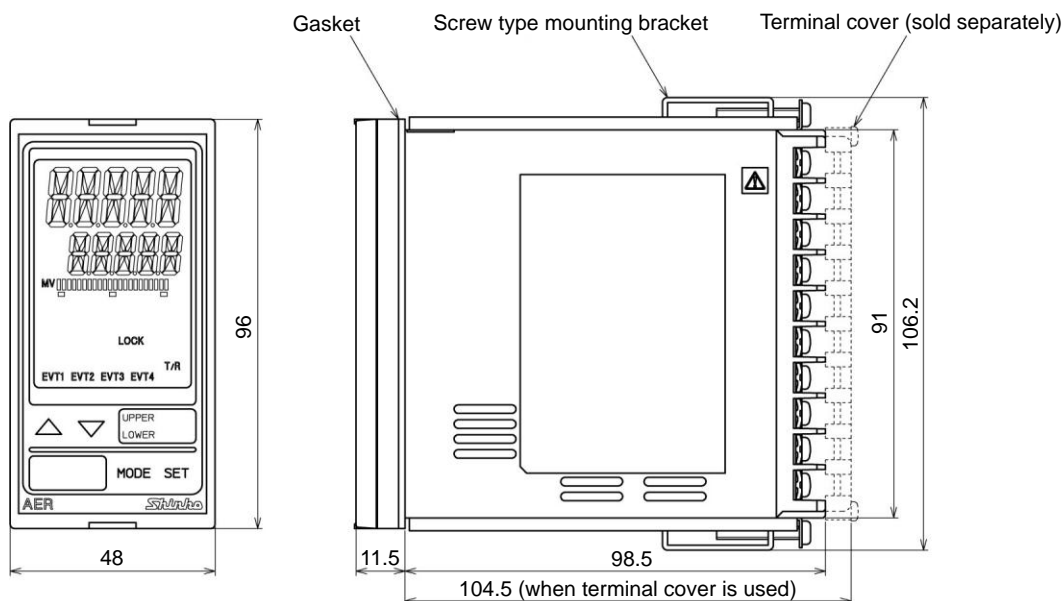
3.3 Panel Cutout (Scale: mm)

> ## ⚠ Caution
>
> If horizontal close mounting is used for the unit, IP66 specification Drip-proof/Dust-proof)
> may be compromised, and all warranties will be invalidated.

130

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

$45^{+0.5}_{0}$

$n{\times}48{-}3\ {}^{+0.5}_{0}$

$92^{+0.8}_{0}$
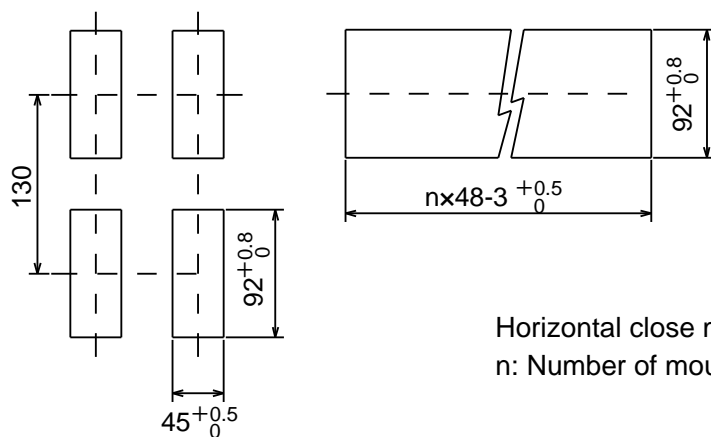
Horizontal close mounting
n: Number of mounted units

(Fig. 3.3-1)

3.4 Mounting and Removal

> ## ⚠ Caution
>
> **As the case is made of resin, do not use excessive force while screwing in the mounting bracket, or the case or mounting brackets could be damaged. The tightening torque should be 0.12 N•m.**

How to mount the unit

Mount the unit vertically to the flat, rigid panel to ensure it adheres to the Drip-proof/ Dust-proof specification (IP66).

Mountable panel thickness: 1 to 8 mm

(1) Insert the unit from the front side of the panel.

(2) Attach the mounting brackets by the holes at the top and bottom of the case, and secure the unit in place with the screws.

How to remove the unit

(1) Turn the power to the unit OFF, and disconnect all wires before removing the unit.

(2) Loosen the screws of the mounting brackets, and remove the mounting brackets.

(3) Pull the unit out from the front of the panel.
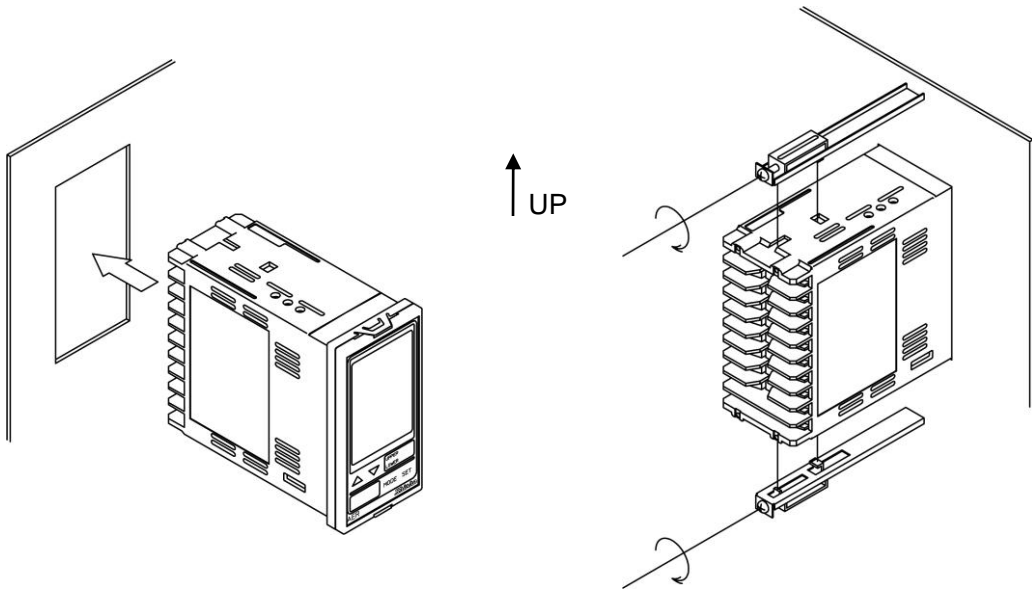
(Fig. 3.4-1)

4. 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 AER-101-ORP.
• The terminal block of this instrument is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
• 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).
• Be sure to connect the ground terminal to earth for safety (D-class grounding). Keep the grounding of this unit separate from other electrical devices, such as motors.
• 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 AER-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 sensor cable should be wired directly to the terminal block.

• 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

4.1 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	Tightening Torque
Y-type	NICHIFU TERMINAL INDUSTRIES CO., LTD.	TMEX1.25Y-3	0.63 N•m
	J.S.T.MFG.CO.,LTD.	VD1.25-B3A	
Ring-type	NICHIFU TERMINAL INDUSTRIES CO., LTD.	TMEX1.25-3	
	J.S.T.MFG.CO.,LTD.	V1.25-3	
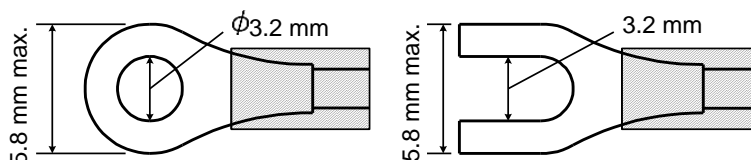
(Fig. 4.1-1)

4.2 Terminal Arrangement
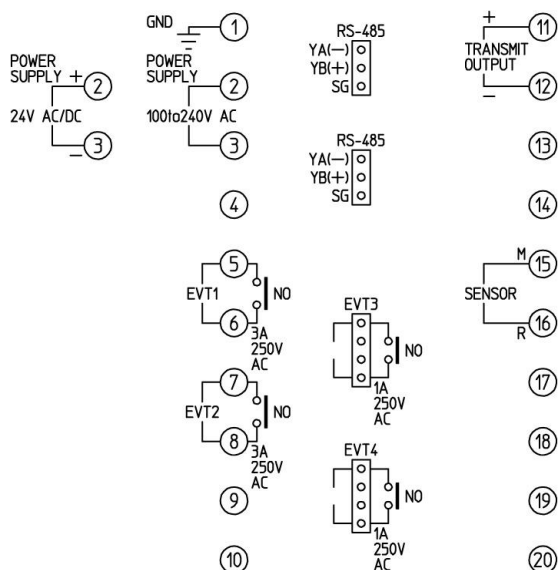
(Fig. 4.2-1)

GND	Ground
POWER SUPPLY	100 to 240 V AC or 24 V AC/DC (when 1 is added after the model) **For 24 V DC, ensure polarity is correct.**
EVT1	EVT1 output (Contact output 1)
EVT2	EVT2 output (Contact output 2)
TRANSMIT OUTPUT	Transmission output
M, R	Electrode sensor
RS-485	Serial communication RS-485 (C5 option) 2 connectors are wired internally. Use the included wire harnesses C5J and C0J.
EVT3	EVT3 output (Contact output 3) (EVT3 option) Use the included wire harness HBJ.
EVT4	EVT4 output (Contact output 4) (EVT3 option) Use the included wire harness HBJ.

5. Outline of Key Operation and Setting Groups

5.1 Outline of Key Operation

There are 2 setting modes: Simple Setting mode, and Group Selection mode in which setting items are divided into groups.

To enter Simple Setting mode, press the SET key in ORP Display Mode or Cleansing Output Mode.

To enter Group Selection mode, press the MODE key in ORP Display Mode or Cleansing Output Mode.

Select a group with the MODE key, and press the SET key. The unit enters each setting item.

To set each item, use the △ or ▽ key, and register the set value with the SET key.

5.2 Setting Groups

Abbreviations: Sensi.: Sensitivity   Correct: Correction
Trans.: Transmission   Adjust: Adjustment

POWER ON

Simple Setting Mode
EVT1 value — SET → EVT4 value (*4) — SET →

ORP Display Mode or Cleansing Output Mode (*1)

△ + ▽ (3 sec) (*2) → **Manual Cleansing Mode** (*2)

△ + MODE (3 sec) (*3) → **Adjustment Mode** — SET →

▽ + MODE (3 sec) (*3) → **Span Sensi. Correct. mode** — SET →

△ + SET (3 sec) → **Trans. output Zero adjust mode** — SET → **Trans. output Span adjust mode** — SET →

Group Selection Mode | **Setting Item Selection**

ORP Input Group — SET → ORP inputs for moving average — SET → ORP input filter time constant — SET →

EVT1 Action Group — SET → EVT1 type — SET → EVT1 hysteresis — SET →

EVT2 Action Group — SET → EVT2 type — SET → EVT2 hysteresis — SET →

EVT3 Action Group (*4) — SET → EVT3 type (*4) — SET → EVT3 hysteresis (*4) — SET →

EVT4 Action Group (*4) — SET → EVT4 type (*4) — SET → EVT4 hysteresis (*4) — SET →

Basic Function Group — SET → Set value lock — SET → ORP input error alarm time unit — SET →

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[About each mode and setting items]

(*1) In ORP Display Mode or Cleansing Output Mode, measurement starts, indicating the item selected in [Backlight selection (p.33)], [ORP color (p.34)], [Bar graph indication (p.35)] and [Setting Display indication (p.35)] in Basic Function Group.
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 ⌐ᒾ Ɛ⌶ (Cleansing output) is selected in [EVT1 type to EVT4 type] in the EVT1 to EVT4 Action Groups, the unit can 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 ᒪ⍛⌐╏ ¦ (Lock 1), ᒪ⍛⌐╏𝟸 (Lock 2) or ᒪ⍛⌐╏∃ (Lock 3) is selected in [Set value lock (p.31)].
 • When ⌐ᒾ Ɛ⌶ (Cleansing output) is selected in any of [EVT1 type to EVT4 type (pp. 23, 24)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.

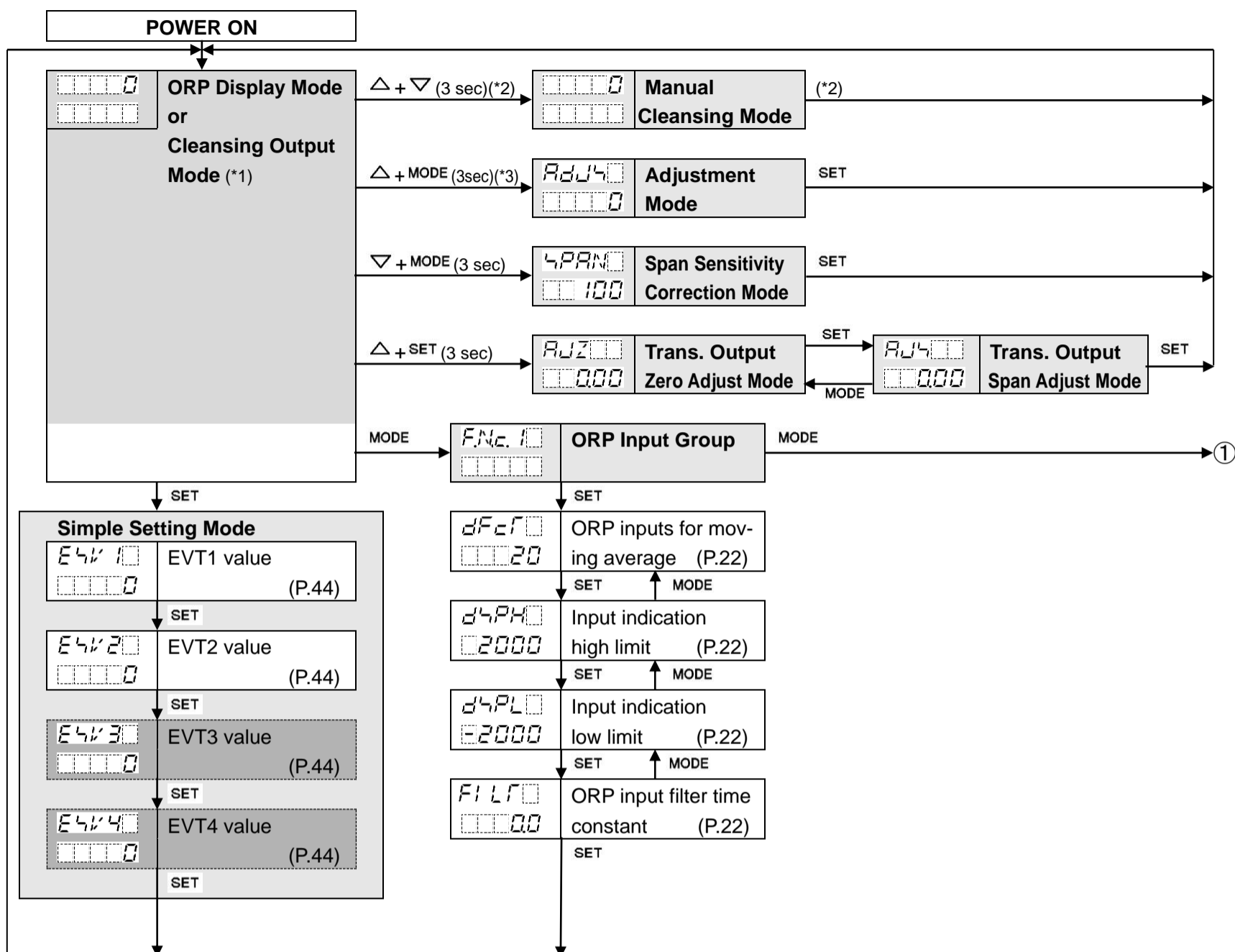(*4) Setting groups and items with dotted lines are indicated only when the EVT3 option is ordered.

[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.

• △ + MODE (3 sec): Press and hold the △ key and MODE key (in that order) together for 3 seconds. The unit will proceed to Adjustment mode.

• ▽ + MODE (3 sec): Press and hold the ▽ key and MODE key (in that order) together for 3 seconds. The unit will proceed to Span sensitivity correction mode.

• △ + SET (3 sec): Press and hold the △ key and SET key (in that order) together for 3 seconds. The unit will proceed to Transmission output Zero adjustment mode.

• MODE , SET : Press the MODE or SET key. The unit will proceed to the next setting item, illustrated by an arrow.

• SET , MODE : Press the SET or MODE key until the desired setting mode appears.

• To revert to ORP Display Mode or Cleansing Output Mode, press and hold the MODE key for 3 seconds while in any mode.

6. Key Operation Flowchart

POWER ON

`□□□□0` `□□□□□`	**ORP Display Mode** or **Cleansing Output Mode** (*1)

△ + ▽ (3 sec)(*2) →

`□□□□0` `□□□□□`	**Manual Cleansing Mode**

(*2) →

△ + MODE (3sec)(*3) →

`AdJ4□` `□□□□0`	**Adjustment Mode**

SET →

▽ + MODE (3 sec) →

`5PAN□` `□□100`	**Span Sensitivity Correction Mode**

SET →

△ + SET (3 sec) →

`AJZ□□` `□□0.00`	**Trans. Output Zero Adjust Mode**

SET →

`AJ4□□` `□□0.00`	**Trans. Output Span Adjust Mode**

SET →

MODE →

`F.Nc. 1□` `□□□□□`	**ORP Input Group**

MODE → ①

SET ↓

Simple Setting Mode

`E5V 1□` `□□□□0`	EVT1 value (P.44)

SET ↓

`E5V2□` `□□□□0`	EVT2 value (P.44)

SET ↓

`E5V3□` `□□□0`	EVT3 value (P.44)

SET ↓

`E5V4□` `□□□□0`	EVT4 value (P.44)

SET ↓

SET ↓

`dFcr□` `□□□20`	ORP inputs for moving average (P.22)

SET ↓ / MODE ↑

`d5PH□` `□2000`	Input indication high limit (P.22)

SET ↓ / MODE ↑

`d5PL□` `-2000`	Input indication low limit (P.22)

SET ↓ / MODE ↑

`FILr□` `□□□0.0`	ORP input filter time constant (P.22)

SET ↓

[About Setting Items]

`E5V 1□` `□□□□0`	EVT1 value (P.44)	• **Upper left:** ORP Display: Indicates the setting item characters. • **Lower left:** Setting Display: Indicates the factory default. • **Right side:** Indicates the setting item and reference page.

`E5V3□` `□□□0`	EVT3 value (P.44)	Setting item in shaded section will be indicated only when the corresponding option is ordered.

[About Each Mode and Setting Item]

(*1) In ORP Display Mode or Cleansing Output Mode, measurement starts, indicating the item selected in [Backlight selection (p.33)], [ORP color (p.34)], [Bar graph indication (p.35)] and [Setting Display indication (p.35)] in Basic Function Group. If power is turned ON again, the last mode (ORP Display Mode or Cleansing Output Mode) from when power was turned OFF will resume.
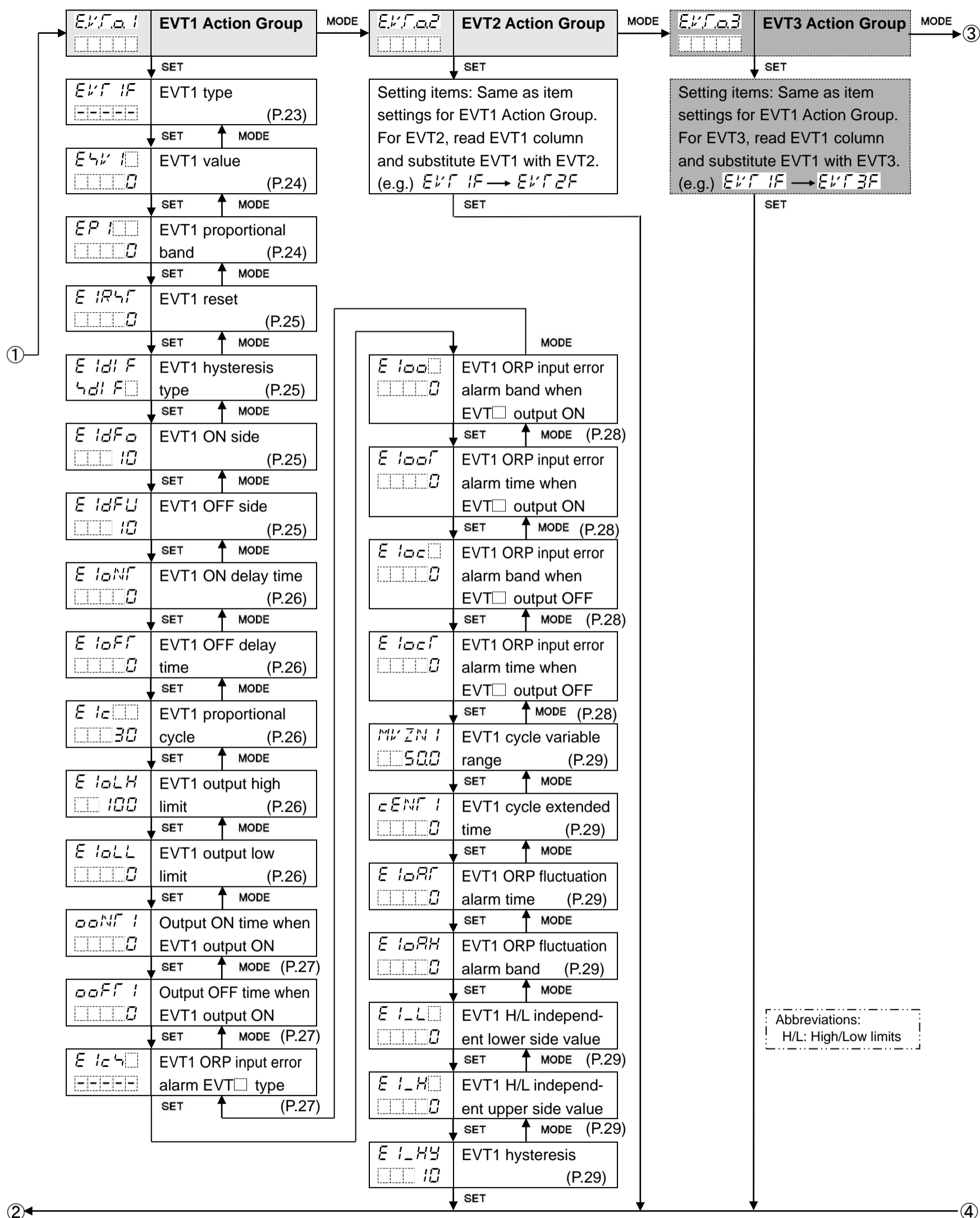
(*2) If `cLEG□` (Cleansing output) is selected in [EVT1 type to EVT4 type] in the EVT1 to EVT4 Action Groups, the unit can enter Manual cleansing mode. After cleansing action is complete, the unit automatically reverts to Cleansing Output Mode.

(*3) The unit cannot enter Adjustment mode or Span sensitivity correction mode in the following cases:
  • When `Lock 1` (Lock 1), `Lock2` (Lock 2) or `Lock3` (Lock 3) is selected in [Set value lock (p.31)] in the Basic Function Group.
  • When `cLEG□` (Cleansing output) is selected in any of [EVT1 type to EVT4 type (pp. 23, 24)], and cleansing action is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.
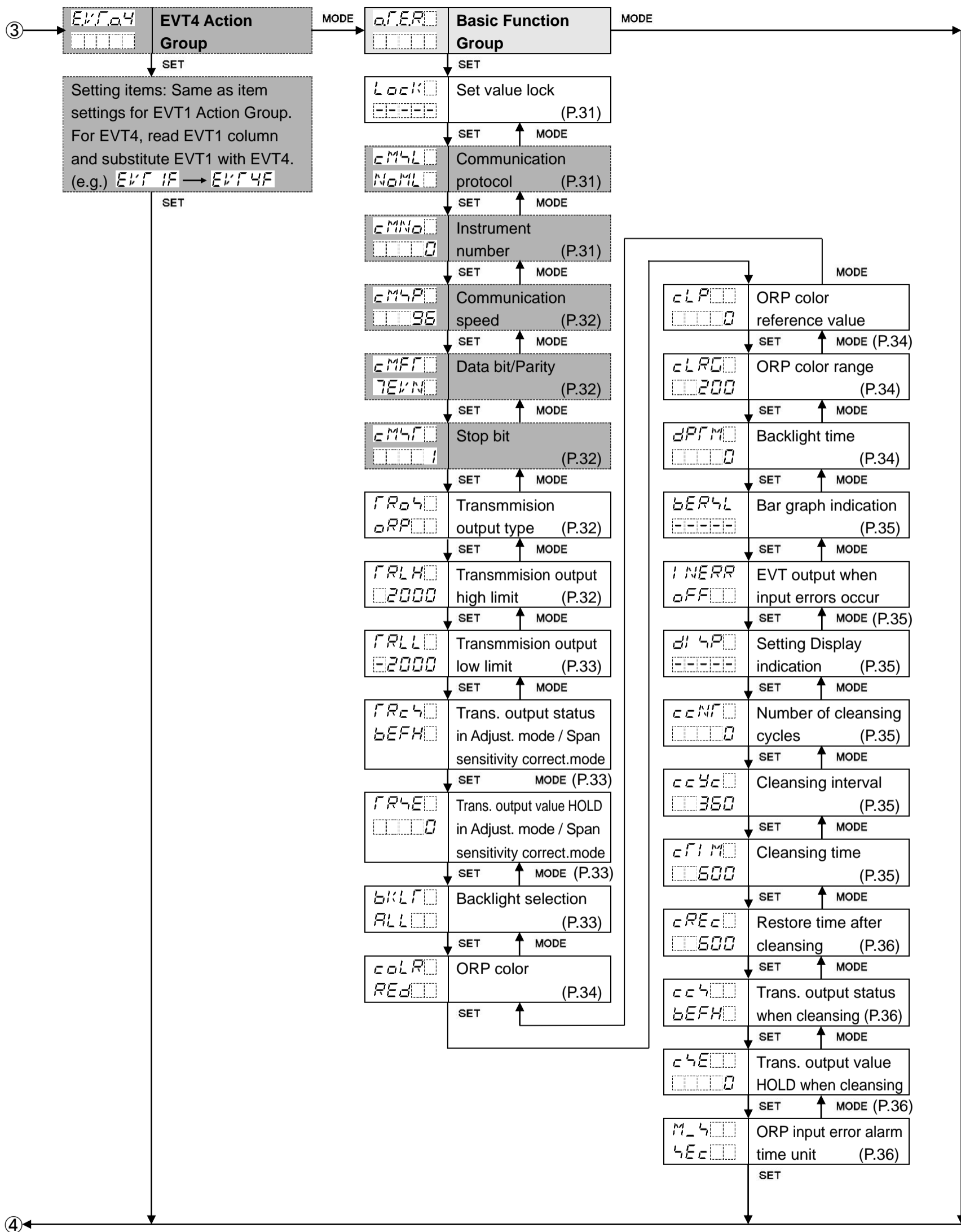
[About Key Operation]

  • △ + ▽ (3 sec): Press and hold the △ and ▽ keys (in that order) together for 3 sec. The unit will enter Manual Cleansing mode.
  • △ + MODE (3 sec): Press and hold the △ and MODE keys (in that order) together for 3 sec. The unit will enter Adjustment mode.
  • ▽ + MODE (3 sec): Press and hold the ▽ and MODE keys (in that order) together for 3 sec. The unit will enter Span sensitivity correction mode.
  • △ + SET (3 sec): Press and hold the △ and SET keys (in that order) together for 3 sec. The unit will enter Transmission output Zero adjustment mode.
  • MODE , SET : Press the MODE or SET key. The unit will proceed to the next setting item, illustrated by an arrow.
  • To revert to ORP Display Mode or Cleansing Output Mode, press and hold the MODE key for 3 seconds while in any mode.

②

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EVT1 Action Group		EVT2 Action Group		EVT3 Action Group	
$EVTo1$ **EVT1 Action Group**	MODE →	$EVTo2$ **EVT2 Action Group**	MODE →	$EVTo3$ **EVT3 Action Group**	MODE → ③

① →

EVT1 Action Group (SET ↓)

Display	Description
$EVT 1F$	EVT1 type (P.23)
$E4V 1$	EVT1 value (P.24)
$EP 1$	EVT1 proportional band (P.24)
$E1R5T$	EVT1 reset (P.25)
$E1d1F$ $5d1F$	EVT1 hysteresis type (P.25)
$E1dFo$ 10	EVT1 ON side (P.25)
$E1dFU$ 10	EVT1 OFF side (P.25)
$E1oNT$	EVT1 ON delay time (P.26)
$E1oFT$	EVT1 OFF delay time (P.26)
$E1c$ 30	EVT1 proportional cycle (P.26)
$E1oLH$ 100	EVT1 output high limit (P.26)
$E1oLL$	EVT1 output low limit (P.26)
$ooNT 1$	Output ON time when EVT1 output ON (P.27)
$ooFT 1$	Output OFF time when EVT1 output ON (P.27)
$E1c5$	EVT1 ORP input error alarm EVT□ type (P.27)

EVT2 Action Group (SET ↓)

Setting items: Same as item settings for EVT1 Action Group. For EVT2, read EVT1 column and substitute EVT1 with EVT2. (e.g.) $EVT 1F → EVT 2F$

Display	Description
$E1oo$	EVT1 ORP input error alarm band when EVT□ output ON (P.28)
$E1ooT$	EVT1 ORP input error alarm time when EVT□ output ON (P.28)
$E1oc$	EVT1 ORP input error alarm band when EVT□ output OFF (P.28)
$E1ocT$	EVT1 ORP input error alarm time when EVT□ output OFF (P.28)
$MVZN 1$ 50.0	EVT1 cycle variable range (P.29)
$cENT 1$	EVT1 cycle extended time (P.29)
$E1oRT$	EVT1 ORP fluctuation alarm time (P.29)
$E1oRH$	EVT1 ORP fluctuation alarm band (P.29)
$E1_L$	EVT1 H/L independent lower side value (P.29)
$E1_H$	EVT1 H/L independent upper side value (P.29)
$E1_HY$ 10	EVT1 hysteresis (P.29)

EVT3 Action Group (SET ↓)

Setting items: Same as item settings for EVT1 Action Group. For EVT3, read EVT1 column and substitute EVT1 with EVT3. (e.g.) $EVT 1F → EVT 3F$

Abbreviations:
H/L: High/Low limits

② ← ④

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③ → | EVT4 Action Group | MODE → | Basic Function Group | MODE →

SET

Setting items: Same as item settings for EVT1 Action Group. For EVT4, read EVT1 column and substitute EVT1 with EVT4. (e.g.) EVT 1F → EVT 4F

SET

Item	Description	Page
Lock	Set value lock	(P.31)
cMㄴL NoML	Communication protocol	(P.31)
cMNo 0	Instrument number	(P.31)
cM�५P 96	Communication speed	(P.32)
cMFr 7EVN	Data bit/Parity	(P.32)
cM�५r 1	Stop bit	(P.32)
rRoᴴ oRP	Transmmision output type	(P.32)
rRLH 2000	Transmmision output high limit	(P.32)
rRLL -2000	Transmmision output low limit	(P.33)
rRcᴴ bEFH	Trans. output status in Adjust. mode / Span sensitivity correct.mode	(P.33)
rR�५E 0	Trans. output value HOLD in Adjust. mode / Span sensitivity correct.mode	(P.33)
bKLr ALL	Backlight selection	(P.33)
coLR REd	ORP color	(P.34)

(right column)

Item	Description	Page
cLP 0	ORP color reference value	(P.34)
cLRG 200	ORP color range	(P.34)
dPrM 0	Backlight time	(P.34)
bER५L	Bar graph indication	(P.35)
INERR oFF	EVT output when input errors occur	(P.35)
di ५P	Setting Display indication	(P.35)
ccNr 0	Number of cleansing cycles	(P.35)
cc५c 360	Cleansing interval	(P.35)
cri M 600	Cleansing time	(P.35)
cREc 600	Restore time after cleansing	(P.36)
ccᴴ bEFH	Trans. output status when cleansing	(P.36)
c�५E 0	Trans. output value HOLD when cleansing	(P.36)
M_ᴴ ५Ec	ORP input error alarm time unit	(P.36)

④ ←

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7. 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), EVT1, EVT2, EVT3 (EVT3 option) and EVT4 (EVT3 option) types, Communication (C5 option), Transmission output, Indication settings (Backlight selection, ORP color, etc.), Cleansing action, etc.

Setup can be conducted in the ORP Input Group, EVT1, EVT2, EVT3, EVT4 Action Groups and Basic Function Group.

If user's specification is the same as the factory default of the AER-101-ORP, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to Section "8. Calibration (p.37)".

7.1 Turn the Power Supply to the AER-101-ORP ON.

For approx. 4 seconds after the power is switched ON, the following characters are indicated on the ORP Display and Setting Display.

ORP Display	Setting Display
oRP	Unlit

During this time, all outputs are in OFF status, and action indicators turn off.
After that, measurement starts, indicating the item selected in [Backlight selection (p.33)], [ORP color (p.34)], [Bar graph indication (p.35)] and [Setting Display indication (p.35)] in the Basic Function Group.
This status is called ORP Display Mode or Cleansing Output Mode.

7.2 ORP Input Group

To enter the ORP Input Group, follow the procedure below.

① $F.Nc.$ I Press the MODE key in ORP Display Mode or Cleansing Output Mode.

② $dFcr$ Press the SET key.

The unit proceeds to the ORP Input Group, and "ORP inputs for moving average" will appear.

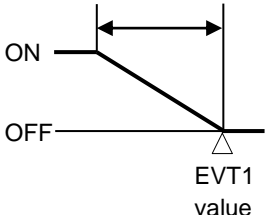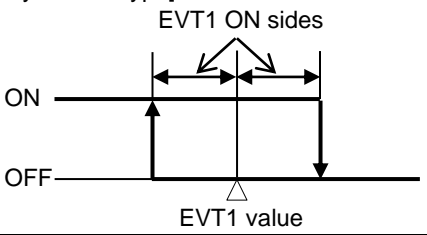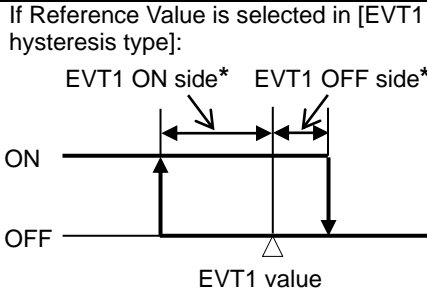| Character	Setting Item, Function, Setting Range	Factory Default
$dFcr$ 20	**ORP inputs for moving average** • Sets the number of ORP inputs used to obtain moving average. • Setting range: 1 to 120	20
$d4PH$ 2000	**Input indication high limit** • Sets the high limit value for ORP input indication. • Setting range: Input indication low limit to 2000 mV	2000 mV
$d4PL$ -2000	**Input indication low limit** • Sets the low limit value for ORP input indication. • Setting range: -2000 mV to Input indication high limit	-2000 mV
$FILr$ 0.0	**ORP input filter time constant** • Sets ORP input filter time constant. Even when ORP value before filter process changes as shown in (Fig. 7.2-1), if the filter time constant "T" is set, the ORP value changes as shown in (Fig. 7.2-2) so that ORP value after finishing filter process can reach 63% (of the desired ORP value) after T seconds have passed. If the filter time constant is set too large, it affects EVT action due to the delay of response. (e.g.) If the LSD (least significant digit) of the ORP value prior to filter process is fluctuating, it can be suppressed by using the filter time constant. (Fig. 7.2-1) (Fig. 7.2-2) • Setting range: 0.0 to 60.0 seconds	0.0 seconds
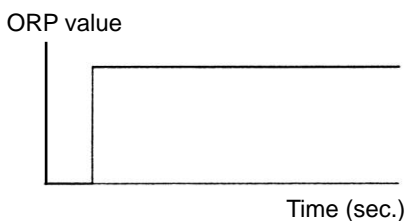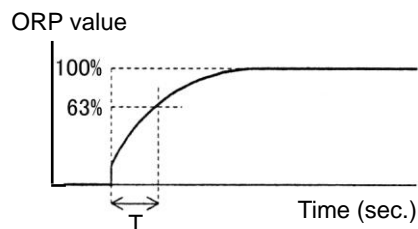
7.3 EVT1 Action Group

To enter the EVT1 Action Group, follow the procedure below.

① EVT_o1 Press the **MODE** key twice in ORP Display Mode or Cleansing Output Mode.

② $EVT 1F$ Press the **SET** key.

The unit proceeds to the EVT1 Action Group, and "EVT1 type" will appear.

Character	Setting Item, Function, Setting Range	Factory Default
$EVT 1F$ ⊡⊡⊡⊡⊡	**EVT1 type**	No action

	• Selects an EVT1 output (Contact output 1) type. (Fig 7.3-1, pp.23, 24)
	 Note: If EVT1 type is changed, EVT1 value defaults to 0.
	 • ⊡⊡⊡⊡⊡ : No action
	   oRP_L : ORP input low limit action
	   oRP_H : ORP input high limit action
	   $cLEG$: Cleansing output
	   $EoUL$: ORP input error alarm output
	   $EoVR$: ORP fluctuation alarm output
	   $oRPHL$: ORP input High/Low limits independent action	

• **EVT1 Action**

EVT1 Type	P Control Action	ON/OFF Control Action
ORP input low limit action (Activated based on the indication value)	EVT1 proportional band ON ──── OFF ──── EVT1 value	If Medium Value is selected in [EVT1 hysteresis type]: EVT1 ON sides ON ──── OFF ──── EVT1 value If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side* ON ──── OFF ──── EVT1 value

* (on pp. 23, 24) Setting Example:

If [EVT1 ON side ($E 1dFo$)] is set to 0.0, EVT1 output can be turned ON at the value set in [EVT1 value ($EVT 1$)].

If [EVT1 OFF side ($E 1dFU$)] is set to 0.0, EVT1 output can be turned OFF at the value set in [EVT1 value ($EVT 1$)].

Character	Setting Item, Function, Setting Range	Factory Default

EVT1 Type	P Control Action	ON/OFF Control Action
ORP input high limit action (Activated based on the indication value)	EVT1 proportional band 	If Medium Value is selected in [EVT1 hysteresis type]: If Reference Value is selected in [EVT1 hysteresis type]:

EVT1 Type	ON/OFF Control Action
ORP input High/Low limits independent action (Activated based on the indication value)	

(Fig. 7.3-1)

$E5\mskip1mu$ 1 0	**EVT1 value**	0 mV
	• Sets EVT1 value. • Available when oRP_L (ORP input low limit action), oRP_H (ORP input high limit action), $Eo\mskip1mu R$ (ORP fluctuation alarm output) or $oRPHL$ (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: Input indication low limit to Input indication high limit	

$EP\mskip1mu 1$ 0	**EVT1 proportional band**	0 mV
	• Sets EVT1 proportional band. ON/OFF control action when set to 0. • Available when oRP_L (ORP input low limit action), oRP_H (ORP input high limit action), $Eo\mskip1mu R$ (ORP fluctuation alarm output) or $oRPHL$ (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV	

Character	Setting Item, Function, Setting Range	Factory Default
$E\ IR5\Gamma$ $\square\square\square\square O$	**EVT1 reset**	0 mV
	• Sets EVT1 reset value. • Available when $\mathit{oRP\_L}$ (ORP input low limit action), $\mathit{oRP\_H}$ (ORP input high limit action), $E\mathit{ol'R}\square$ (ORP fluctuation alarm output) or oRPHL (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: ±200 mV	
$E\ \mathit{ldl}\ F$ $\mathit{5dl}\ F\square$	**EVT1 hysteresis type**	Reference Value
	• Selects EVT1 output hysteresis type (Medium or Reference Value). (Fig. 7.3-1, p.23, 24) • Available when $\mathit{oRP\_L}$ (ORP input low limit action), $\mathit{oRP\_H}$ (ORP input high limit action), $E\mathit{ol'R}\square$ (ORP fluctuation alarm output) or oRPHL (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the P control action. • $\mathit{cdl}\ F\square$: Medium Value Sets the same value for both ON and OFF sides in relation to EVT1 value. Only ON side needs to be set. $\mathit{5dl}\ F\square$: Reference Value Sets individual values for ON and OFF sides in relation to EVT1 value. Both ON and OFF sides need to be set individually.	
$E\ \mathit{ldFo}$ $\square\square\square\ \mathit{lO}$	**EVT1 ON side**	10 mV
	• Sets the span of EVT1 ON side. (Fig. 7.3-1) (pp.23, 24) If $\mathit{cdl}\ F\square$ (Medium Value) is selected in [EVT1 hysteresis type], the span of ON/OFF side will be the same value. • Available when $\mathit{oRP\_L}$ (ORP input low limit action), $\mathit{oRP\_H}$ (ORP input high limit action), $E\mathit{ol'R}\square$ (ORP fluctuation alarm output) or oRPHL (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the P control action. • Setting range: 0 to 200 mV	
$E\ \mathit{ldFU}$ $\square\square\square\ \mathit{lO}$	**EVT1 OFF side**	10 mV
	• Sets the span of EVT1 OFF side. (Fig. 7.3-1) (pp.23, 24) • Available when $\mathit{oRP\_L}$ (ORP input low limit action), $\mathit{oRP\_H}$ (ORP input high limit action), $E\mathit{ol'R}\square$ (ORP fluctuation alarm output) or oRPHL (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the P control action, or if $\mathit{cdl}\ F\square$ (Medium Value) is selected in [EVT1 hysteresis type]. • Setting range: 0 to 200 mV	

Character	Setting Item, Function, Setting Range	Factory Default
E 1oNⲄ 　　　　0	**EVT1 ON delay time** • Sets EVT1 delay time. 　The EVT1 output does not turn ON after the input value exceeds the 　EVT1 value until the time set in [EVT1 ON delay time] elapses. • Available when oRP_L (ORP input low limit action), oRP_H 　(ORP input high limit action), EoⱯR (ORP fluctuation alarm 　output) or oRPHL (ORP input High/Low limits independent action) 　is selected in [EVT1 type]. • Not available for the P control action. • Setting range: 0 to 10000 seconds	0 seconds
E 1oFⲄ 　　　　0	**EVT1 OFF delay time** • Sets EVT1 delay time. 　The EVT1 output does not turn OFF after the input value exceeds the 　EVT1 value until the time set in [EVT1 OFF delay time] elapses. • Available when oRP_L (ORP input low limit action), oRP_H 　(ORP input high limit action), EoⱯR (ORP fluctuation alarm 　output) or oRPHL (ORP input High/Low limits independent action) 　is selected in [EVT1 type]. • Not available for the P control action. • Setting range: 0 to 10000 seconds	0 seconds
E 1c 　　　30	**EVT1 proportional cycle** • Sets EVT1 proportional cycle. • Available when oRP_L (ORP input low limit action), oRP_H 　(ORP input high limit action), EoⱯR (ORP fluctuation alarm 　output) or oRPHL (ORP input High/Low limits independent action) 　is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: 1 to 300 seconds	30 seconds
E 1oLH 　　100	**EVT1 output high limit** • Sets EVT1 output high limit value. • Available when oRP_L (ORP input low limit action), oRP_H 　(ORP input high limit action), EoⱯR (ORP fluctuation alarm 　output) or oRPHL (ORP input High/Low limits independent action) 　is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: EVT1 output low limit to 100%	100%
E 1oLL 　　　　0	**EVT1 output low limit** • Sets EVT1 output low limit value. • Available when oRP_L (ORP input low limit action), oRP_H 　(ORP input high limit action), EoⱯR (ORP fluctuation alarm 　output) or oRPHL (ORP input High/Low limits independent action) 　is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: 0% to EVT1 output high limit	0%

Character	Setting Item, Function, Setting Range	Factory Default
$ooN\Gamma\ l$ 0	**Output ON time when EVT1 output ON**	0 seconds

	• Sets Output ON time when EVT1 output is ON.
	   If ON time and OFF time are set, EVT1 output can be turned ON/OFF
	   in a configured cycle when EVT1 output is turned ON.(Fig. 7.3-2) (p.27)
	 • Available when oRP_L (ORP input low limit action), oRP_H
	   (ORP input high limit action), $Eo\nu R$ (ORP fluctuation alarm
	   output) or $oRPHL$ (ORP input High/Low limits independent action)
	   is selected in [EVT1 type].
	 • Not available for P control action.
	 • Setting range: 0 to 10000 seconds	

$ooF\Gamma\ l$ 0	**Output OFF time when EVT1 output ON**	0 seconds

	• Sets Output OFF time when EVT1 output is ON.
	   If ON time and OFF time are set, EVT1 output can be turned ON/OFF
	   in a configured cycle when EVT1 output is turned ON. (Fig. 7.3-2) (p.27)
	 • Available when oRP_L (ORP input low limit action), oRP_H
	   (ORP input high limit action), $Eo\nu R$ (ORP fluctuation alarm
	   output) or $oRPHL$ (ORP input High/Low limits independent action)
	   is selected in [EVT1 type].
	 • Not available for P control action.
	 • Setting range: 0 to 10000 seconds	

• **Timing chart (EVT1 output ON time and OFF time when EVT1 output is ON)**

(Fig. 7.3-2)

Character	Setting Item, Function, Setting Range	Factory Default
$E\ lc4$	**EVT1 ORP input error alarm EVT□ type**	No action

	• Selects EVT□ output type (except EVT1 type) in order to assess
	   EVT1 ORP input error alarm.
	 • Available only when $EoUL$ (ORP input error alarm output) is
	   selected in [EVT1 type].
	 • : No action
	    $EV\Gamma 2$: EVT2 action
	    $EV\Gamma 3$: EVT3 action
	    $EV\Gamma 4$: EVT4 action	

Character	Setting Item, Function, Setting Range	Factory Default
$E\ loo\square$ $\square\square\square\square 0$	**EVT1 ORP input error alarm band when EVT□ output ON**	0 mV
	• Sets the band to assess EVT1 ORP input error alarm when EVT□ output (selected in [EVT1 ORP input error alarm EVT□ type]) is ON. • Available only when $E\sigma UL\square$ (ORP input error alarm output) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV When set to 0 (zero), ORP input error alarm is disabled.	
$E\ loo\Gamma$ $\square\square\square\square 0$	**EVT1 ORP input error alarm time when EVT□ output ON**	0 seconds
	• Sets time to assess EVT1 ORP input error alarm when EVT□ output (selected in [EVT1 ORP input error alarm EVT□ type]) is ON. • Available only when $E\sigma UL\square$ (ORP input error alarm output) is selected in [EVT1 type]. • Setting range: 0 to 10000 seconds or minutes (*) When set to 0 (zero), ORP input error alarm is disabled.	
$E\ loc\square$ $\square\square\square\square 0$	**EVT1 ORP input error alarm band when EVT□ output OFF**	0 mV
	• Sets the band to assess EVT1 ORP input error alarm when EVT□ output (selected in [EVT1 ORP input error alarm EVT□ type]) is OFF. • Available only when $E\sigma UL\square$ (ORP input error alarm output) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV When set to 0 (zero), ORP input error alarm is disabled.	
$E\ loc\Gamma$ $\square\square\square\square 0$	**EVT1 ORP input error alarm time when EVT□ output OFF**	0 seconds
	• Sets time to assess EVT1 ORP input error alarm when EVT□ output (selected in [EVT1 ORP input error alarm EVT□ type]) is OFF. • Available only when $E\sigma UL\square$ (ORP input error alarm output) is selected in [EVT1 type]. • Setting range: 0 to 10000 seconds or minutes (*) When set to 0 (zero), ORP input error alarm is disabled.	

(*) Time unit follows the selection in [ORP input error alarm time unit].

Character	Setting Item, Function, Setting Range	Factory Default
MVZN1 □□50.0	**EVT1 cycle variable range**	50.0%
	• Sets EVT1 cycle variable range. • Available when *oRP_L* (ORP input low limit action), *oRP_H* (ORP input high limit action), *EoVA* (ORP fluctuation alarm output) or *oRPHL* (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: 1.0 to 100.0%	
cENF1 □□□□0	**EVT1 cycle extended time**	0 seconds
	• Sets EVT1 cycle extended time. • Available when *oRP_L* (ORP input low limit action), *oRP_H* (ORP input high limit action), *EoVA* (ORP fluctuation alarm output) or *oRPHL* (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Not available for the ON/OFF control action. • Setting range: 0 to 300 seconds	
E1oAF □□□□0	**EVT1 ORP fluctuation alarm time**	0 hours
	• Sets time to assess EVT1 ORP fluctuation alarm. Disabled when set to 0 (zero) hours. • Available only when *EoVA* (ORP fluctuation alarm output) is selected in [EVT1 type]. • Setting range: 0 to 72 hours	
E1oAH □□□□0	**EVT1 ORP fluctuation alarm band**	0 mV
	• Sets the band to assess EVT1 ORP fluctuation alarm. Disabled when set to 0 mV. • Available only when *EoVA* (ORP fluctuation alarm output) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV	
E1_L □□□□0	**EVT1 High/Low limits independent lower side value**	0 mV
	• Sets the lower side value of EVT1 High/Low limits independent action. (Fig. 7.3-1) (p.24). Disabled when set to 0 mV. • Available only when *oRPHL* (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV	
E1_H □□□□0	**EVT1 High/Low limits independent upper side value**	0 mV
	• Sets the upper side value of EVT1 High/Low limits independent action. (Fig. 7.3-1) (p.24). Disabled when set to 0 mV. • Available only when *oRPHL* (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: 0 to 4000 mV	
E1_HY □□□10	**EVT1 hysteresis**	10 mV
	• Sets the hysteresis of EVT1 High/Low limits independent action. • Available only when *oRPHL* (ORP input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: 1 to 200 mV	

7.4 EVT2 Action Group

To enter the EVT2 Action Group, follow the procedure below.

① $EVT_{o}2$ Press the **MODE** key 3 times in ORP Display Mode/Cleansing Output Mode.

② $EVT2F$ Press the **SET** key.
       The unit proceeds to the EVT2 Action Group, and "EVT2 type" appears.

Action, indication condition and setting range of the EVT2 Action Group are the same as those of EVT1 Action Group.

Substitute EVT1 with EVT2, and refer to the EVT1 Action Group (pp. 23 to 29).

(e.g.) $EVT\ 1F \longrightarrow EVT2F$
       $E4V\ 1\square \longrightarrow E4V2\square$

7.5 EVT3 Action Group

EVT3 Action Group is indicated only when EVT3, EVT4 outputs (EVT3 option) are/is ordered.

To enter the EVT3 Action Group, follow the procedure below.

① $EVT_{o}3$ Press the **MODE** key 4 times in ORP Display Mode/Cleansing Output Mode.

② $EVT3F$ Press the **SET** key.
       The unit proceeds to the EVT3 Action Group, and "EVT3 type" appears.

Action, indication condition and setting range of the EVT3 Action Group are the same as those of EVT1 Action Group.

Substitute EVT1 with EVT3, and refer to the EVT1 Action Group (pp. 23 to 29).

(e.g.) $EVT\ 1F \longrightarrow EVT3F$
       $E4V\ 1\square \longrightarrow E4V3\square$

7.6 EVT4 Action Group

EVT4 Action Group is indicated only when EVT3, EVT4 outputs (EVT3 option) are/is ordered.

To enter the EVT4 Action Group, follow the procedure below.

① $EVT_{o}4$ Press the **MODE** key 5 times in ORP Display Mode or Cleansing Output Mode.

② $EVT4F$ Press the **SET** key.
       The unit proceeds to the EVT4 Action Group, and "EVT4 type" appears.

Action, indication condition and setting range of the EVT4 Action Group are the same as those of EVT1 Action Group.

Substitute EVT1 with EVT4, and refer to the EVT1 Action Group (pp. 23 to 29).

(e.g.) $EVT\ 1F \longrightarrow EVT4F$
       $E4V\ 1\square \longrightarrow E4V4\square$

7.7 Basic Function Group

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

① $o\overline{r}.E.R$ Press the **MODE** key 4 times in ORP Display Mode/Cleansing Output Mode.
   If EVT3, EVT4 Outputs (EVT3 option) are/is ordered, press the **MODE** key 6 times in ORP Display Mode/Cleansing Output Mode.
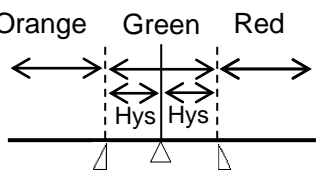
② $LocK$ Press the **SET** key.

The unit enters the Basic Function Group, and the "Set Value Lock" will appear.

Character	Setting Item, Function, Setting Range	Factory Default
$LocK$	**Set value lock**	Unlock

$-----$	• Locks the set values to prevent setting errors.
	• $-----$ (Unlock): All set values can be changed.
	  $LocK\ I$ (Lock 1) : None of the set values can be changed.
	  $LocK2$ (Lock 2) : Only EVT1, EVT2, EVT3, EVT4 values can be changed.
	  $LocK3$ (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.
	  Do not change setting items (EVT1, EVT2, EVT3, EVT4 types). If they are changed, they will affect other setting items.
	  Be sure to select Lock 3 when changing the set value frequently via software communication. (If a value set via software communication is the same as the value before the setting, the value will not be written in non-volatile IC memory.)	

$cM5L$ $NoML$	**Communication protocol**	Shinko protocol

	• Selects communication protocol.
	• Available when the Serial communication (C5 option) is ordered.
	• $NoML$: Shinko protocol
	  $ModR$: MODBUS ASCII mode
	  $ModR$: MODBUS RTU mode	

$cMNo$ $\qquad 0$	**Instrument number**	0
	• Sets the instrument number of this unit. (The instrument numbers should be set one by one when multiple instruments are connected, otherwise communication is impossible.) • Available when the Serial communication (C5 option) is ordered. • Setting range: 0 to 95	

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Character	Setting Item, Function, Setting Range	Factory Default
`cM5P` `96`	**Communication speed**	9600 bps

	• Selects a communication speed equal to that of the host computer.
	• Available when the Serial communication (C5 option) is ordered.
	• `96` : 9600 bps
	   `192` : 19200 bps
	   `384` : 38400 bps	

`cMFr` `7EVN`	**Data bit/Parity**	7 bits/Even

	• Selects data bit and parity.
	• Available when the Serial communication (C5 option) is ordered.
	• `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	

`cM5r` `1`	**Stop bit**	1 bit
	• Selects the stop bit. • Available when the Serial communication (C5 option) is ordered. • `1`: 1 bit `2`: 2 bits	
`rRo5` `oRP`	**Transmission output type**	ORP transmission

	• Selects the transmission output type.
	• `oRP` : ORP transmission
	  `MV 1` : EVT1 MV transmission
	  `MV 2` : EVT2 MV transmission
	  `MV 3` : EVT3 MV transmission (*)
	  `MV 4` : EVT4 MV transmission (*)	

`rRLH` `2000`	**Transmission output high limit**	ORP transmission: 2000 mV
		MV transmission: 100.0%
	• 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, transmission output will be fixed at 4 mA DC. • Setting range: ORP transmission: Transmission output low limit to 2000 mV MV transmission: Transmission output low limit to 100.0%	

(*) Available when EVT3, EVT4 outputs (EVT3 option) are/is ordered.

Character	Setting Item, Function, Setting Range	Factory Default
⌐RLL□ ⊟2000	**Transmission output low limit**	ORP transmission: -2000 mV
		MV transmission: 0.0%
	• 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, transmission output will be fixed at 4 mA DC. • Setting range: ORP transmission: -2000 mV to Transmission output high limit MV transmission: 0.0% to Transmission output high limit	
⌐Rc5□ bEFH□	**Transmission output status in Adjustment mode / Span sensitivity correction mode**	Last value HOLD

	• Selects Transmission output status in Adjustment mode or Span
	 sensitivity correction mode.
	 • Selection range
	 bEFH□: Last value HOLD (Retains the last value before adjustment
	             or span sensitivity correction, and outputs it.)
	 5EⰜH□: 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 / Span sensitivity correction mode.)	

⌐R5E□ □□□□0	**Transmission output value HOLD in Adjustment mode / Span sensitivity correction mode**	ORP transmission: 0 mV
		MV transmission: 0.0%
	• Sets the Transmission output value HOLD in Adjustment mode or Span sensitivity correction mode. • Available only when 5EⰜH□ (Set value HOLD) is selected in [Transmission output status in Adjustment mode / Span sensitivity correction mode]. • Setting range: ORP transmission: -2000 to 2000 mV MV transmission: 0.0 to 100.0%	
bKLⰜ□ ALL□□	**Backlight selection**	All are backlit.

	• Selects the display to backlight.
	 • ALL□□ : All are backlit.
	   ₒRP□□ : ORP Display is backlit.
	   5EⰜ□□ : Setting Display is backlit.
	   Ac□□□ : Action indicators are backlit.
	   ₒRP5Ⰼ : ORP Display + Setting Display are backlit.
	   ₒRPAc : ORP Display + Action indicators are backlit.
	   5EⰜAc : Setting Display + Action indicators are backlit.	

| Character	Setting Item, Function, Setting Range	Factory Default
$coLR$ REd	**ORP color**	Red
	• Selects a color for the ORP Display. • GRN : Green 　REd : Red 　oRG : Orange 　$oRPGR$: ORP color changes continuously. 　　　　The ORP Display color changes according to [ORP color reference value] and [ORP color range] settings. 　　　　• When ORP is lower than [ORP color reference value] – [ORP color range]: Orange 　　　　• When ORP is within [ORP color reference value] $\pm$ [ORP color range]: Green 　　　　• When ORP is higher than [ORP color reference value] + [ORP color range]: Red 　　Orange　Green　Red △ : ORP color reference value Hys : ORP color range (Fig. 7.7-1)	
cLP 0	**ORP color reference value**	0 mV
	• Sets a reference value for ORP color to be green when $oRPGR$ (ORP color changes continuously) is selected in [ORP color]. • Setting range: $\pm$2000 mV	
$cLRG$ 200	**ORP color range**	200 mV
	• Sets a range for ORP color to be green when $oRPGR$ (ORP color changes continuously) is selected in [ORP color]. • Setting range: 1 to 4000 mV	
$dPTM$ 0	**Backlight time**	0 minutes
	• Sets time to backlight from no operation status until backlight is switched off. 　When set to 0 (zero), the backlight remains ON. 　Backlight relights by pressing any key while backlight is OFF. • Setting range: 0 to 99 minutes	

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Character	Setting Item, Function, Setting Range	Factory Default

bER⅄L ⊟⊟⊟⊟⊟	**Bar graph indication**
	• Selects bar graph indication.
	• ⊟⊟⊟⊟⊟ : No indication
	  ΓRoΓ : Transmission output
	     Segments will light in accordance with the output.
	     Scale is -5 to 105%.
	     Segments will light from left to right in accordance
	     with the output.
	
	     [When output is 50%]
	
	    -5% 50% 105%
	     Lights from left to right according to the output.
	(Fig. 7.7-2)
		No indication

I NERR *oFF*	**EVT output when input errors occur** • If input errors occur, such as ORP Combined Electrode Sensor is dis- connected or short-circuited, EVT output can be Enabled or Disabled. If "Enabled" is selected, EVT output will be maintained when input errors occur. If "Disabled" is selected, EVT output will be turned OFF when input errors occur. • Available when *oRP_L* (ORP input low limit action) or *oRP_H* (ORP input high limit action) is selected in [EVT☐ type]. • *oN* : Enabled *oFF* : Disabled	Disabled

dI ⅄P ⊟⊟⊟⊟⊟	**Setting Display indication**
	• Selects an item to be indicated on the Setting Display.
	• ⊟⊟⊟⊟⊟ : No indication
	  E⅄V I : EVT1 value
	  E⅄V 2 : EVT2 value
	  E⅄V 3 : EVT3 value (*)
	  E⅄V 4 : EVT4 value (*)
		No indication

ccNΓ ☐☐☐☐☐ *0*	**Number of cleansing cycles** • Sets the number of cleansing outputs. (Fig. 7.7-3) (p.36) • Available for this setting item and all subsequent items when *cLEC* (Cleansing output) is selected in any of [EVT1 to EVT4 types (pp. 23, 24)]. • Setting range: 0 to 10 (0: Continuous cleansing)	0 (Continuous cleansing)
cc⅄c ☐*360*	**Cleansing interval** • Sets an interval between cleansings. (Fig. 7.7-3) (p.36) • Setting range: 60 to 3000 minutes	360 minutes
cΓI M ☐*600*	**Cleansing time** • Sets the cleansing time in cleansing interval.(Fig. 7.7-3) (p.36) • Setting range: 1 to 1800 seconds	600 seconds

(*) Available when EVT3, EVT4 outputs (EVT3 option) are/is ordered.

Character	Setting Item, Function, Setting Range	Factory Default
$cREc\square$ $\square\square 600$	**Restore time after cleansing**	600 seconds
	• Sets the time to restore units to normal operation after cleansing output. (Fig. 7.7-3) (p.36) • Setting range: 1 to 1800 seconds	
$cc4\square\square$ $bEFH\square$	**Transmission output status when cleansing**	Last value HOLD
	• Selects Transmission output status when cleansing action is performing. • Available when Transmission output (TA option) is ordered. • $bEFH\square$: Last value HOLD (Retains the last value before cleansing, and outputs it.) $\quad 4EFH\square$: Set value HOLD (Outputs the value set in [Transmission output value HOLD when cleansing].) $\quad PVH\square$: Measured value (Outputs the measured value when cleaning.)	
$c4E\square\square$ $\square\square\square\square 0$	**Transmission output value HOLD when cleansing**	ORP transmission: 0 mV MV transmission: 0.0%
	• Sets the Transmission output value HOLD when cleansing. • Available only when $4EFH\square$ (Set value HOLD) is selected in [Transmission output status when cleansing]. • Setting range ORP transmission: -2000 to 2000 mV MV transmission: 0.0 to 100.0%	
$M\_4\square\square$ $4Ec\square\square$	**ORP input error alarm time unit**	Second(s)
	• Selects ORP input error alarm time unit. • Selection item $4Ec\square\square$: Second(s) $MIN\square\square$: Minute(s)	

• **Cleansing Output Action**
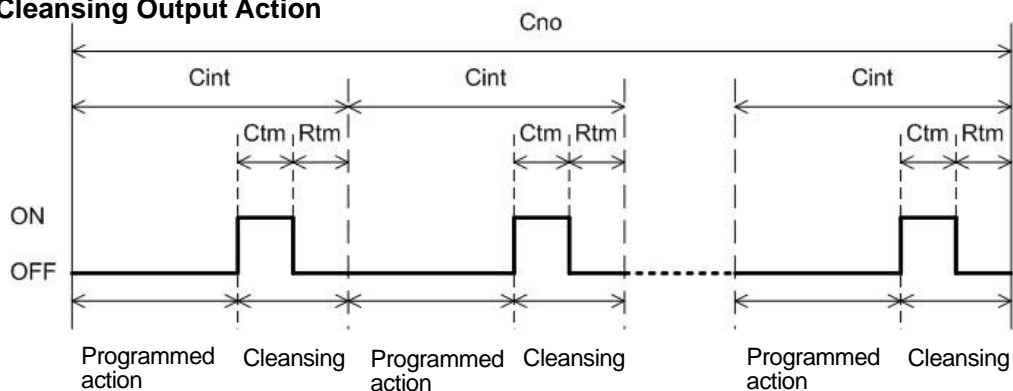
Cno: Number of cleansing cycles
Cint: Cleansing interval
Ctm: Cleansing time
Rtm: Restore time after cleansing

(Fig. 7.7-3)

8. Calibration

Adjustment Mode and Span Sensitivity Correction Mode are described below.

8.1 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 AER-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 $Lock1$ (Lock 1), $Lock2$ (Lock 2) or $Lock3$ (Lock 3) is selected in [Set value lock (p.31)].
- When $cLEG$ (Cleansing output) is selected in any of [EVT1 to EVT4 type (pp. 23, 24)], 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.33)], select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.
(2) Press and hold the △ key and MODE key (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 displayed alternately.
Setting Display	The adjustment value is displayed.

(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 electric potentials, refer to the temperature characteristics of your standard solution.
Adjustment range: -200 to 200 mV
(5) Press the SET key.
Adjustment mode is complete, and the unit reverts to ORP Display Mode or Cleansing Output Mode.

8.2 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 AER-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 $Lock\ 1$ (Lock 1), $Lock2$ (Lock 2) or $Lock3$ (Lock 3) is selected in [Set value lock (p.31)].
- When $cLEG$ (Cleansing output) is selected in any of [EVT1 to EVT4 types (pp. 23, 24)], 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.33)], select it while the ORP Combined Electrode Sensor is being immersed in the solution currently calibrated.
(2) Press and hold the ▽ key and **MODE** key (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	$5PAN$ and ORP value are displayed alternately.
Setting Display	The Span sensitivity correction value is displayed.

(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 electric potentials, refer to the temperature characteristics of your standard solution.
Setting range: 50 to 150%
(5) Press the **SET** key.
Span sensitivity correction mode is complete, and the unit reverts to ORP Display Mode or Cleansing Output Mode.

8.3 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 instrument.

In this case, perform Transmission output Zero adjustment and Span adjustment.

The unit cannot enter Transmission output Zero adjustment mode in the following cases:
- During Adjustment mode or Span sensitivity correction mode
- When $Lock1$ (Lock 1), $Lock2$ (Lock 2) or $Lock3$ (Lock 3) is selected in [Set value lock (p.31)].
- When $cLEo$ (Cleansing output) is selected in any of EVT1 to EVT4 types (pp. 23, 24) using the 'Cleansing time' and 'Restore time after cleansing' settings.

The following outlines adjustment procedure.

(1) Press and hold the △ and SET 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 Contents
ORP Display	AJZ
Setting Display	Transmission output Zero adjustment value

(2) Set Transmission output Zero adjustment value with the △, ▽ keys, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: ±5.00% of Transmission output span

(3) Press the SET key.

The unit enters Transmission output Span adjustment mode, and indicates the following:

Display	Indication Contents
ORP Display	$AJ5$
Setting Display	Transmission output Span adjustment value

(4) Set Transmission output Span adjustment value with the △, ▽ keys, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: ±5.00% of Transmission output span

(5) Press the MODE 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 key in Transmission output Span adjustment mode.

The unit reverts to ORP Display Mode or Cleansing Output Mode.

9. Measurement

9.1 Starting Measurement

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

For approx. 4 seconds after the power is switched ON, the following characters are indicated on the ORP Display and Setting Display.

ORP Display	Setting Display
оRP	Unlit

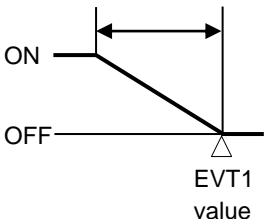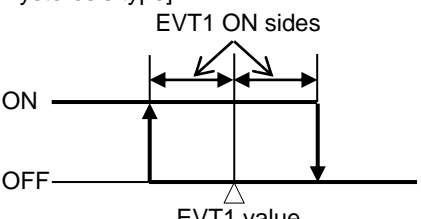During this time, all outputs are in OFF status, and action indicators go off.
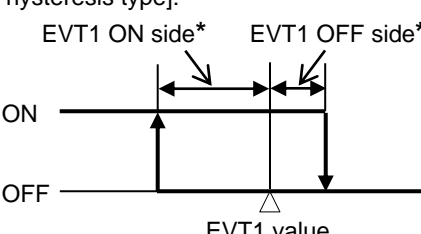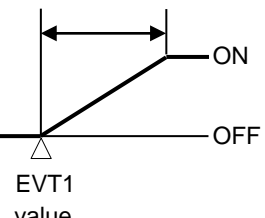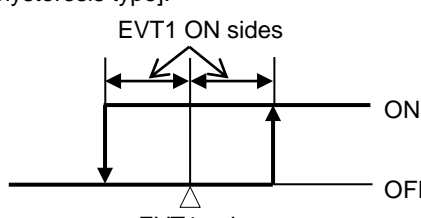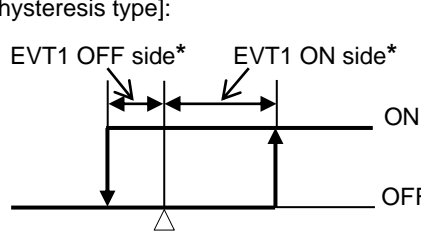
After that, measurement starts, indicating the item selected in [Backlight selection (p.33)], [ORP color (p.34)], [Bar graph indication (p.35)] and [Setting Display indication (p.35] in the Basic Function Group.

9.2 EVT1 to EVT4 Outputs

If oRP_L (ORP input low limit action), oRP_H (ORP input high limit action) or $oRPHL$ (ORP input High/Low limits independent action) is selected in [EVT1 type (p.23)], the following action is activated. (Fig. 9.2-1)
The same applies to EVT2, EVT3 and EVT4.

• **EVT1 Action**

EVT1 Type	P Control Action	ON/OFF Control Action
ORP input low limit action (Activated based on the indication value)	EVT1 proportional band ON OFF EVT1 value	If Medium Value is selected in [EVT1 hysteresis type]: EVT1 ON sides ON OFF EVT1 value If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side* ON OFF EVT1 value
ORP input high limit action (Activated based on the indication value)	EVT1 proportional band ON OFF EVT1 value	If Medium Value is selected in [EVT1 hysteresis type]: EVT1 ON sides ON OFF EVT1 value If Reference Value is selected in [EVT1 hysteresis type]: EVT1 OFF side* EVT1 ON side* ON OFF EVT1 value

* Setting Example:

If [EVT1 ON side ($E\ ldFo$)] is set to 0.0, EVT1 output can be turned ON at the value set in [EVT1 value ($E\, 5\nu\ l$)].

If [EVT1 OFF side ($E\ ldFU$)] is set to 0.0, EVT1 output can be turned OFF at the value set in [EVT1 value ($E\, 5\nu\ l$)].

EVT1 Type	ON/OFF Control Action
ORP input High/Low limits independent action (Activated based on the indication value)	EVT1 hysteresis · EVT1 hysteresis · ON · OFF · EVT1 High/Low limits independent lower side value · EVT1 value · EVT1 High/Low limits independent upper side value

(Fig. 9.2-1)

• **P Control Action**

Within the proportional band, the manipulated variable is output in proportion to the deviation between the EVT1 value and ORP value.

EVT1 Type	Description
ORP input low limit action	If ORP value is lower than [EVT1 value – EVT1 proportional band], EVT1 output is turned ON. If ORP value enters within the proportional band, EVT1 output is turned ON/OFF in EVT1 proportional cycles. If ORP value exceeds the EVT1 value, EVT1 output is turned OFF.
ORP input high limit action	If ORP value is higher than [EVT1 value + EVT1 proportional band], EVT1 output is turned ON. If ORP value enters within the proportional band, EVT1 output is turned ON/OFF in EVT1 proportional cycles. If ORP value drops below the EVT1 value, EVT1 output is turned OFF.

• **ON/OFF Control Action**

EVT1 Type	Description
ORP input low limit action	If ORP value is lower than EVT1 value, EVT1 output is turned ON. If ORP value exceeds the EVT1 value, EVT1 output is turned OFF.
ORP input high limit action	If ORP value is higher than EVT1 value, EVT1 output is turned ON. If ORP value drops below the EVT1 value, EVT1 output is turned OFF.

If ON and OFF time are set in [Output ON/OFF Time when EVT1 Output ON (p.27)], and when EVT1 output is turned ON, EVT1 output is turned ON/OFF in a configured cycle.

Timing chart (Output ON time and OFF time when EVT1 output is ON)
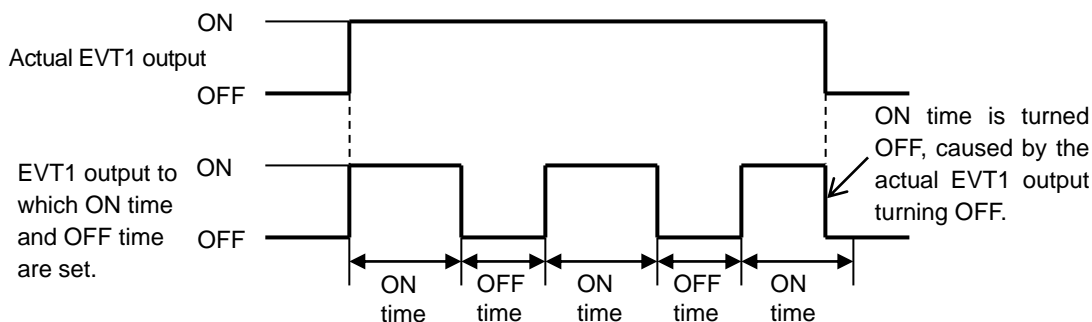
(Fig. 9.2-2)

EVT output status can be read by reading the status flag (EVT1, EVT2, EVT3, EVT4 output flag bit) in Serial communication (C5 option).

EVT output status, when input errors occur, differs depending on the selection in [EVT output when input errors occur (p.35)].

• If oFF(Disabled) is selected, EVT output is turned OFF when input errors occur.
• If oN(Enabled) is selected, EVT output is maintained when input errors occur.

9.3 Setting EVT1 to EVT4 Values

EVT1 to EVT4 values are set in Simple Setting mode.

These setting items are the same as those in EVT1 to EVT4 Action Groups.

To enter Simple Setting mode, follow the procedure below.

① $E5\nu I$ Press the **SET** key in ORP Display Mode or Cleansing Output Mode. "EVT1 value" will appear.

② Set each setting item with the △ or ▽ key, and register the value with the **SET** key.

Character	Setting Item, Function, Setting Range	Factory Default
$E5\nu I$ 0	**EVT1 value** • Sets EVT1 value. • Available when σRP_L (ORP input low limit action), σRP_H (ORP input high limit action), $E\sigma\nu R$ (ORP fluctuation alarm output) or $\sigma RPHL$ (ORP input High/Low limits independent action) is selected in [EVT1 type (p.23)]. • Setting range: Input indication low limit to Input indication high limit	0 mV
$E5\nu 2$ 0	**EVT2 value** • Sets EVT2 value. • Available when σRP_L (ORP input low limit action), σRP_H (ORP input high limit action), $E\sigma\nu R$ (ORP fluctuation alarm output) or $\sigma RPHL$ (ORP input High/Low limits independent action) is selected in [EVT2 type (p.23)]. • Setting range: Input indication low limit to Input indication high limit	0 mV
$E5\nu 3$ 0	**EVT3 value** • Sets EVT3 value. • Available when σRP_L (ORP input low limit action), σRP_H (ORP input high limit action), $E\sigma\nu R$ (ORP fluctuation alarm output) or $\sigma RPHL$ (ORP input High/Low limits independent action) is selected in [EVT3 type (p.23)]. Available when EVT3, EVT4 Outputs (EVT3 option) are/is ordered. • Setting range: Input indication low limit to Input indication high limit	0 mV
$E5\nu 4$ 0	**EVT4 value** • Sets EVT4 value. • Available when σRP_L (ORP input low limit action), σRP_H (ORP input high limit action), $E\sigma\nu R$ (ORP fluctuation alarm output) or $\sigma RPHL$ (ORP input High/Low limits independent action) is selected in [EVT4 type (p.23)]. Available when EVT3, EVT4 Outputs (EVT3 option) are/is ordered. • Setting range: Input indication low limit to Input indication high limit	0 mV

③ Press the **SET** key. The unit reverts to ORP Display Mode or Cleansing Output Mode.

9.4 Cleansing Output

If $cLEC\square$ (Cleansing output) is selected in any of [EVT1 to EVT4 type (pp. 23, 24)], the unit will enter Cleansing Output mode.

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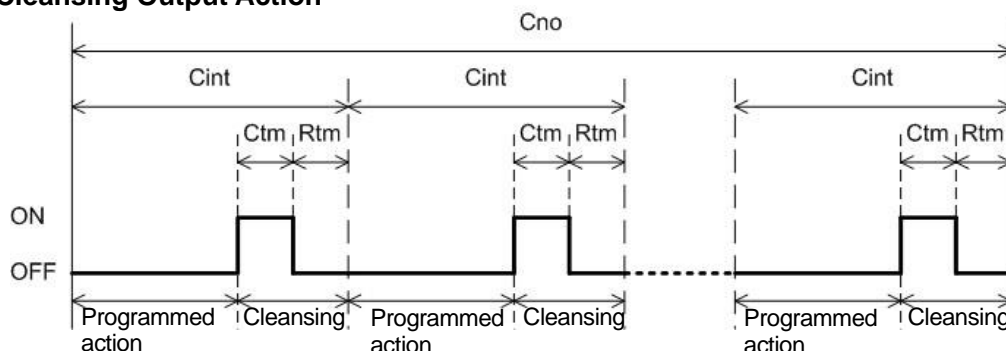
Cno: Number of cleansing cycles
Cint: Cleansing interval
Ctm: Cleansing time
Rtm: Restore time after cleansing

(Fig. 9.4-1)

• If $cLEC\square$ (Cleansing output) is selected in any other [EVT type] during cleansing action, the current setting values (Number of cleansing cycles, Cleansing interval, Cleansing time, and Restore time after cleansing) will be used for the selected cleansing output.

• During Adjustment mode or Span sensitivity correction mode, 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 $cLEC\square$ (Cleansing output) is selected in [EVT1 to EVT4 type (pp. 23, 24)], the unit will revert to ORP Display Mode.

9.5 Manual Cleansing Mode

By pressing the $\triangle$ and $\triangledown$ keys simultaneously for 3 seconds, the unit enters Manual cleansing mode.

In Manual cleansing mode, cleansing action is performed using "Cleansing time" and "Restore time after cleansing".

After cleansing is completed, the unit automatically reverts to Cleansing Output mode.
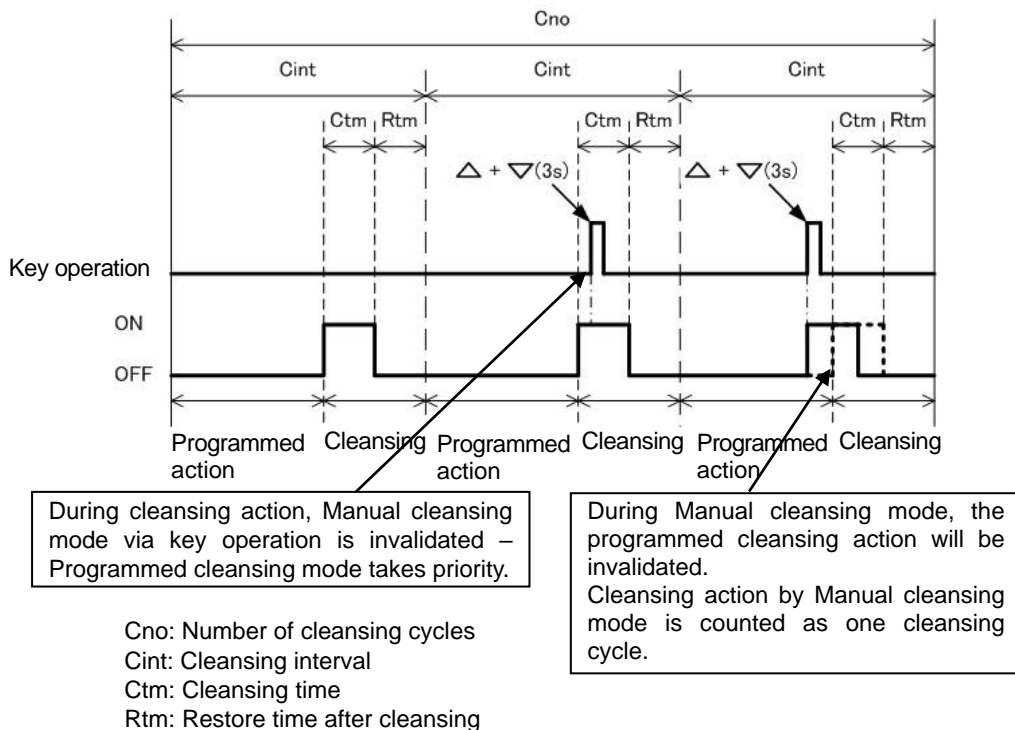
Manual cleansing mode will not be accessible in the following cases.
 • When $\llcorner \boxminus \boxminus \kappa \; l$ (Lock 1), $\llcorner \boxminus \boxminus \kappa \boxminus$ (Lock 2) or $\llcorner \boxminus \boxminus \kappa \boxminus$ (Lock 3) is selected in [Set value lock (p.31)].
 • While cleansing action is performing.

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 one cleansing cycle.

Manual Cleansing Mode Action

During cleansing action, Manual cleansing mode via key operation is invalidated – Programmed cleansing mode takes priority.

During Manual cleansing mode, the programmed cleansing action will be invalidated.
Cleansing action by Manual cleansing mode is counted as one cleansing cycle.

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

(Fig. 9.5-1)

9.6 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.

In Serial communication, status can be read by reading Status flag 2 (EVT1, EVT2, EVT3, EVT4 output flag bit).

If $EoUL$ (ORP input error alarm output) is selected in [EVT1 type (p.23)], EVT1 output will be turned ON.

The same applies to EVT2, EVT3 and EVT4.

ORP input error alarm is disabled in the following cases:
  • During Adjustment mode or Span sensitivity correction mode
  • When $cLEC$ (Cleansing output) is selected in any of EVT1 to EVT4 type (p. 23, 24), and cleansing is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.
  • When ORP input error alarm time is set to 0 seconds (or minutes) or ORP input error alarm band is set to 0 mV.

9.7 Cycle Automatic Variable Function

If deviation between EVT☐ value and measured value enters EVT☐ cycle variable range, the proportional cycle will be automatically extended in accordance with the deviation.
Proportional action OFF time will be extended, and ON / OFF ratio will be adjusted.
However, if EVT☐ cycle extended time is set to 0 (zero) seconds, this function will be disabled.

C: EVTx proportional cycle
tf1, tf2: Extended OFF time
Ctf1, Ctf2: Cycle delay time

(Fig. 9.7-1)

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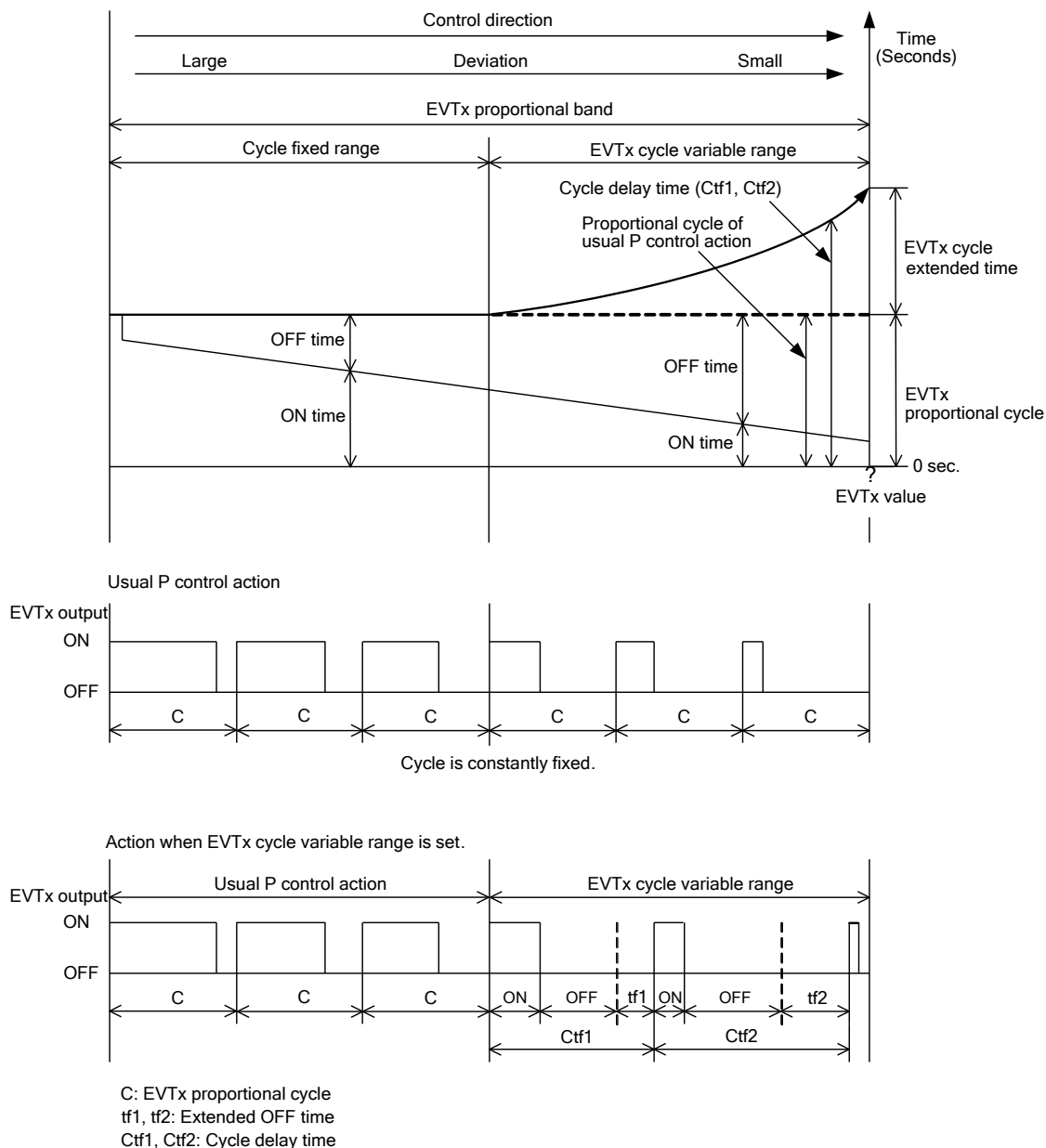
9.8 Transmission Output

Converting ORP or MV 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

9.9 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 (EVT1, EVT2, EVT3, EVT4 output flag bit).

In Serial communication, status can be read by reading Status flag 2 (EVT1, EVT2, EVT3, EVT4 output flag bit).

If $EoVA$ (ORP fluctuation alarm output) is selected in [EVT1 type (pp.23, 24)], the selected EVT1 output will be turned ON.

The same applies to EVT2, EVT3 and EVT4.

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.

10. Specifications

10.1 Standard Specifications

Rating

Rated Scale	**Input**	**Input Range**	**Resolution**
	ORP Combined Electrode Sensor	-2000 to 2000 mV	1 mV
Input	ORP Combined Electrode Sensor		
Power Supply Voltage	Model	**AER-101-ORP**	**AER-101-ORP 1**
	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	48 x 96 x 98.5 mm (W x H x D)	
Mounting	Flush (Applicable panel thickness: 1 to 8 mm)	
Case	Material: Flame-resistant resin, Color: Black	
Front Panel	Membrane sheet	
Drip-proof/Dust-proof	IP66 (for front panel only)	
Indication Structure	Display	
	ORP Display	11-segment LCD display 5-digits Backlight: Red/Green/Orange Character size: 14.0 x 5.4 mm (H x W)
	Setting Display	11-segment LCD display 5-digits Backlight: Green Character size: 10.0 x 4.6 mm (H x W)
	Output Display	22-segment LCD display Bar graph Backlight: Green
	Action indicators: Backlight: Orange color	
	EVT1	EVT1 output (Contact output 1) ON: Lit
	EVT2	EVT2 output (Contact output 2) ON: Lit
	EVT3	EVT3 output (Contact output 3) ON: Lit
	EVT4	EVT4 output (Contact output 4) ON: Lit
	T/R	Serial communication TX output (transmitting): Lit
	LOCK	Lock 1, Lock 2, Lock 3 selected: Lit
Setting Structure	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 indicated on the AER-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 indicated on the AER-101-ORP to read 260 mV (at 20℃) when immersing the ORP Combined Electrode Sensor in the standard solution (Quinhydrone potential difference 260 mV).	
EVT Output		
Output Action	P control: When setting proportional band to any value other than 0. ON/OFF control: When setting proportional band to 0.	
	EVT☐ proportional band	0 to 4000 mV
	EVT☐ proportional cycle	1 to 300 seconds
	EVT☐ ON side, OFF side	0 to 200 mV
	EVT☐ output high, low limit	0 to 100%
	EVT☐ High/Low limits independent upper side, lower side value	0 to 4000 mV
	EVT☐ hysteresis	1 to 200 mV
Type	Selectable by the keypad from the following. • No action • ORP input low limit action • ORP input high limit action • Cleansing output • ORP input error alarm 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
EVT ON Delay Time	0 to 10000 seconds	
EVT OFF Delay Time	0 to 10000 seconds	
Output ON Time/ OFF Time when EVT Output ON	If ON time and OFF time are set, the output will be turned ON/OFF at constant intervals when EVT output is ON.	

Cleansing Output

Cleansing Output Mode

If $cLEG\square$ (Cleansing output) is selected in any of [EVT1 to EVT4 type (pp. 23, 24)], the unit will enter Cleansing Output mode.

An EVT 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.

While cleansing is being performed, other outputs are in OFF status.
ORP measured values are retained.

When cleansing is not being performed, normal 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 EVT 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.

Manual Cleansing Mode

By pressing the $\triangle$ and $\triangledown$ keys simultaneously for 3 seconds, the unit enters Manual cleansing mode.

In Manual cleansing mode, cleansing action is performed using "Cleansing time" and "Restore time after cleansing".

After cleansing action is complete, the unit automatically reverts to Cleansing Output mode.

Manual cleansing mode (by keypad operation) will not be accessible if programmed cleansing is currently being performed. 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.

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.

In Serial communication, status can be read by reading Status flag 2 (EVT1, EVT2, EVT3, EVT4 output flag bit).

If $EoUL\square$ (ORP input error alarm output) is selected in [EVT1 type (pp.23, 24)], EVT1 output is turned ON.

The same applies to EVT2, EVT3 and EVT4.

ORP input error alarm is disabled in the following cases:
• During Adjustment mode or Span sensitivity correction mode
• When $cLEG\square$ (Cleansing output) is selected in any of EVT1 to EVT4 type (pp. 23, 24), and cleansing is performing using the 'Cleansing time' and 'Restore time after cleansing' settings.
• When ORP input error alarm time is set to 0 seconds (or minutes) or ORP input error alarm band is set to 0 mV.

Cycle Automatic Variable Function
If deviation between EVT☐ value and measured value enters EVT☐ cycle variable range, the proportional cycle will be automatically extended in accordance with the deviation. Proportional action OFF time will be extended, and ON / OFF ratio will be adjusted. However, if EVT☐ cycle extended time is set to 0 (zero) seconds, this function will be disabled.

Transmission Output Function
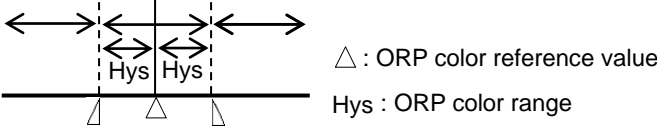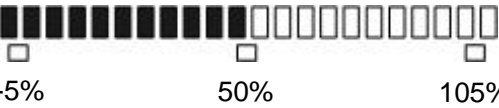
Transmission Output	Converting ORP value or MV to analog signal every input sampling period, outputs in current. If Transmission output high limit and low limit are set to the same value, Transmission output will be fixed at 4 mA DC.	
	Resolution	12000
	Current	4 to 20 mA DC(Load resistance: Max 550 Ω)
	Output accuracy	Within ±0.3% of Transmission output span
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	Selects Transmission output status in Adjustment mode / 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 value measured in Adjustment mode / Span sensitivity correction mode.	

Insulation, Dielectric Strength

Circuit Insulation Configuration	
	Insulation Resistance: 10 MΩ minimum, at 500 V DC
Dielectric Strength	Power terminal - ground (GND): 1.5 kV AC for 1 minute Input terminal - ground (GND): 1.5 kV AC for 1 minute Input terminal - power terminal: 1.5 kV AC for 1 minute

Attached Functions

Set Value Lock	Lock 1: None of the set values can be changed. Lock 2: Only EVT1, EVT2, EVT3, EVT4 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.
Outside Measurement Range	ORP value is outside the measurement range: If the value is less than -2000 mV or exceeds 2000 mV, the following will be indicated. 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 $oF\square\square\square$.

ORP Display	Setting Display
Less than -2000 mV: -2000	$oF\square\square\square$ is flashing.
Exceeding 2000 mV: 2000	$oF\square\square\square$ is flashing.

Power Failure Countermeasure	The setting data is backed up in the non-volatile IC memory.
Self-diagnosis	The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the AER-101-ORP is switched to warm-up status.
Warm-up Indication	For approx. 4 seconds after the power is switched ON, the characters below are indicated on the ORP Display. The Setting Display is unlit.

ORP Display	Setting Display
$oRP\square\square$	Unlit

ORP Color	Selects ORP Display color.	
	Selection Item in [ORP Color (p.34)]	**ORP Display Color**
	GRN	Green
	REd	Red
	oRG	Orange
	$oRPGR$	ORP color changes continuously.

Within the same cell, below the table:

ORP color changes continuously:
ORP Display color changes according to [ORP color reference value (p.34)] and [ORP color range (p. 34)] settings.
• When ORP is lower than [ORP color reference value] – [ORP color range]: Orange
• When ORP is within [ORP color reference value] ± [ORP color range]: Green
• When ORP is higher than [ORP color reference value] + [ORP color range]: Red

Orange   Green   Red

Hys Hys
△ : ORP color reference value
Hys : ORP color range

Bar Graph Indication	When $TRoT$ (Transmission output) is selected in [Bar graph indication (p.35)], segments light in accordance with the output. Scale is -5 to 105%. Segments light from left to right in accordance with the output.

(e.g.) When output is 50%

■■■■■■■■■■□□□□□□□□□□
□   □   □
-5%   50%   105%

Lights from left to right in accordance with the output.

Other

Power Consumption	Approx. 12 VA
Ambient Temperature	0 to 50℃
Ambient Humidity	35 to 85 %RH (Non-condensing)
Weight	Approx. 280 g
Accessories Included	Unit label: 1 sheet Mounting brackets: 1 set Instruction manual: 1 copy When Serial communication (C5 option) is ordered: 　Wire harness C5J (0.2 m): 1 length 　Wire harness C0J (3 m):　1 length When EVT3, EVT4 Outputs (Contact output 3, 4) (EVT3 option) is ordered: 　Wire harness HBJ (3 m):　2 lengths
Accessories Sold Separately	Terminal cover

10.2 Optional Specifications

Serial Communication (Option code: C5)

Serial Communication	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			
	Cable Length	1.2 km (Max), Cable resistance value: Within 50 Ω (Terminators are not necessary, but if used, use 120 Ω minimum on both sides.)		
	Communication Line	EIA RS-485		
	Communication Method	Half-duplex communication		
	Communication Speed	9600, 19200, 38400 bps (Selectable by keypad)		
	Synchronization Method	Start-stop synchronization		
	Code Form	ASCII, Binary		
	Communication Protocol	Shinko protocol, MODBUS ASCII, MODBUS RTU (Selectable by keypad)		
	Data Bit/Parity	8 bits/No parity, 7 bits/No parity, 8 bits/Even, 7 bits/Even, 8 bits/Odd, 7 bits/Odd (Selectable by keypad)		
	Stop Bit	1, 2 (Selectable by keypad)		
	Error Correction	Command request repeat system		
	Error Detection	Parity check, Checksum (Shinko protocol), LRC (MODBUS protocol ASCII), CRC-16 (MODBUS protocol RTU)		
	Data Format	Communication Protocol	**Shinko Protocol**	**MODBUS ASCII**	**MODBUS RTU**
		Start bit	1	1	1
		Data bit	7	7 (8) Selectable	8
		Parity	Even	Even (No parity, Odd) Selectable	No parity (Even, Odd) Selectable
		Stop bit	1	1 (2) Selectable	1 (2) Selectable

EVT3, EVT4 Outputs (Contact output 3, 4) (Option code: EVT3)

EVT3, EVT4 Outputs (Contact output 3, 4)	Same as EVT output (pp. 51, 52)

11. Troubleshooting

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

11.1 Indication

Problem	Possible Cause	Solution
The ORP Display is unlit.	The time set in [Backlight time (p.34)] has passed.	If any key is pressed while displays are unlit, it will re-light. Set the backlight time to a suitable time-frame.
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 AER-101-ORP.	Keep AER-101-ORP clear of any potentially disruptive equipment.
The Setting Display is unlit.	⊟⊟⊟⊟ (No indication) is selected in [Setting Display indication (p.35)].	Select any other item except ⊟⊟⊟⊟ (No indication).
[𝑜𝐹] is flashing on the Setting Display.	This indicates that the ORP value is outside the measurement range (less than -2000 mV or exceeding 2000 mV).	Check the measuring environment.
[𝐸𝑅𝑅 𝟣] is indicating on the ORP Display.	Internal memory is defective.	Contact our agency or us.

11.2 Key Operation

Problem	Possible Cause	Solution
Unable to set values. The values do not change by the △ or ▽ key.	$Lock\ 1$ (Lock 1) is selected in [Set value lock (p.31)]. (The LOCK indicator lights up when Lock 1 is selected.)	Select ⁻⁻⁻⁻⁻ (Unlock).
Only EVT1 to EVT4 values can be set. Other settings are impossible. The values do not change by △ or ▽ key.	$Lock2$ (Lock 2) is selected In [Set value lock (p.31)]. (The LOCK indicator lights up when Lock 2 is selected.)	Select ⁻⁻⁻⁻⁻ (Unlock).
Unable to enter Manual Cleansing Mode.	$cLEG$ (Cleansing output) is not selected in any of [EVT1 type to EVT4 type (pp. 23, 24)].	Select $cLEG$ (Cleansing output) in any of [EVT1 type to EVT4 type (pp. 23, 24)].
	Cleansing action is performing using the 'Cleansing Time' and 'Restore Time after Cleansing' settings.	Execute Manual cleansing after cleansing action is complete.
Unable to enter a calibration mode (Adjustment mode or Span sensitivity correction mode).	$Lock\ 1$ (Lock 1), $Lock2$ (Lock 2) or $Lock3$ (Lock 3) has been selected in [Set value lock (p.31)]. (The LOCK indicator lights up when Lock 1, Lock 2 or Lock 3 is selected.)	Select ⁻⁻⁻⁻⁻ (Unlock).
	$cLEG$ (Cleansing output) has been selected in any of [EVT1 type to EVT4 type (pp. 23, 24)], and cleansing action is performing using the 'Cleansing Time' and 'Restore Time after Cleansing' settings.	Perform calibration after cleansing action is complete.

12. Character Tables

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

12.1 Setting Group List

Character	Setting Group	Reference Section
FNc. 1	ORP Input Group	Section 12.6 (p.61)
EVTo 1	EVT1 Action Group	Section 12.7 (p.61, 62)
EVTo2	EVT2 Action Group	Section 12.8 (p.63, 64)
EVTo3	EVT3 Action Group	Section 12.9 (p.65, 66)
EVTo4	EVT4 Action Group	Section 12.10 (p.67, 68)
oTER	Basic Function Group	Section 12.11 (pp.69 to 71)

12.2 Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AdJ4(*)	**Adjustment value**	0 mV	
_0_	Setting range: -200 to 200 mV		

(*) _AdJ4_ and ORP value are displayed alternately.

12.3 Span Sensitivity Correction Mode

Character	Setting Item, Setting Range	Factory Default	Data
SPAN(*)	**Span sensitivity correction value**	100%	
_100_	Setting range: 50 to 150%		

(*) _SPAN_ and ORP value are displayed alternately.

12.4 Transmission Output Adjustment Mode

Character	Setting Item, Setting Range	Factory Default	Data
AJZ _0.00_	**Transmission output Zero adjustment value**	0.00%	
	Setting range: ±5.00% of Transmission output span		
_AJ4_ _0.00_	**Transmission output Span adjustment value**	0.00%	
	Setting range: ±5.00% of Transmission output span		

12.5 Simple Setting Mode

Character	Setting Item, Setting Range	Factory Default	Data
_EV 1_ _0_	**EVT1 value**	0 mV	
	Setting range: Input indication low limit to Input indication high limit		
_EV 2_ _0_	**EVT2 value**	0 mV	
	Setting range: Input indication low limit to Input indication high limit		
_EV 3_ _0_	**EVT3 value**	0 mV	
	Setting range: Input indication low limit to Input indication high limit		
_EV 4_ _0_	**EVT4 value**	0 mV	
	Setting range: Input indication low limit to Input indication high limit		

12.6 ORP Input Group

Character	Setting Item, Setting Range	Factory Default	Data
dFcⴓ 20	**ORP inputs for moving average** Setting range: 1 to 120	20	
d4PH 2000	**Input indication high limit** Setting range: Input indication low limit to 2000 mV	2000 mV	
d4PL -2000	**Input indication low limit** Setting range: -2000 mV to Input indication high limit	-2000 mV	
FILⴓ 0.0	**ORP input filter time constant** Setting range: 0.0 to 60.0 seconds	0.0 seconds	

12.7 EVT1 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
EVⴓ IF -----	**EVT1 type** -----: No action oRP_L : ORP input low limit action oRP_H : ORP input high limit action cLEC : Cleansing output EoUL : ORP input error alarm output EoVA : ORP fluctuation alarm output oRPHL : ORP input High/Low limits independent action	No action	
E4V 1 0	**EVT1 value** Setting range: Input indication low limit to Input indication high limit	0 mV	
EP 1 0	**EVT1 proportional band** Setting range: 0 to 4000 mV	0 mV	
E 1R4ⴓ 0	**EVT1 reset** Setting range: ±200 mV	0 mV	
E 1d1 F 4d1 F	**EVT1 hysteresis type** cd1 F : Medium Value 4d1 F : Reference Value	Reference Value	
E 1dFo 10	**EVT1 ON side** Setting range: 0 to 200 mV	10 mV	
E 1dFU 10	**EVT1 OFF side** Setting range: 0 to 200 mV	10 mV	
E 1oNⴓ 0	**EVT1 ON delay time** Setting range: 0 to 10000 seconds	0 seconds	
E 1oFⴓ 0	**EVT1 OFF delay time** Setting range: 0 to 10000 seconds	0 seconds	
E 1c 30	**EVT1 proportional cycle** Setting range: 1 to 300 seconds	30 seconds	
E 1oLH 100	**EVT1 output high limit** Setting range: EVT1 output low limit to 100%	100%	
E 1oLL 0	**EVT1 output low limit** Setting range: 0% to EVT1 output high limit	0%	

Character	Setting Item, Setting Range	Factory Default	Data
ᴏᴏNᴦ ı ‾‾‾‾‾0	**Output ON time when EVT1 output ON** Setting range: 0 to 10000 seconds	0 seconds	
ᴏᴏFᴦ ı ‾‾‾‾‾0	**Output OFF time when EVT1 output ON** Setting range: 0 to 10000 seconds	0 seconds	
E ıc4⬜ ⬚⬚⬚⬚⬚	**EVT1 ORP input error alarm EVT⬜ type** ⬚⬚⬚⬚⬚ : No action EVᴦ2⬜ : EVT2 type EVᴦ3⬜ : EVT3 type EVᴦ4⬜ : EVT4 type	No action	
E ıᴏᴏ⬜ ‾‾‾‾‾0	**EVT1 ORP input error alarm band when EVT⬜ output ON** Setting range: 0 to 4000 mV	0 mV	
E ıᴏᴏᴦ ‾‾‾‾‾0	**EVT1 ORP input error alarm time when EVT⬜ output ON** Setting range: 0 to 10000 seconds or minutes	0 seconds	
E ıᴏc⬜ ‾‾‾‾‾0	**EVT1 ORP input error alarm band when EVT⬜ output OFF** Setting range: 0 to 4000 mV	0 mV	
E ıᴏcᴦ ‾‾‾‾‾0	**EVT1 ORP input error alarm time when EVT⬜ output OFF** Setting range: 0 to 10000 seconds or minutes	0 seconds	
MVZN ı ‾‾50.0	**EVT1 cycle variable range** Setting range: 1.0 to 100.0%	50.0%	
cENᴦ ı ‾‾‾‾‾0	**EVT1 cycle extended time** Setting range: 0 to 300 seconds	0 seconds	
E ıᴏᴚᴦ ‾‾‾‾‾0	**EVT1 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
E ıᴏᴚH ‾‾‾‾‾0	**EVT1 ORP fluctuation alarm band** Setting range: 0 to 4000 mV	0 mV	
E ı_L⬜ ‾‾‾‾‾0	**EVT1 High/Low limits independent lower side value** Setting range: 0 to 4000 mV	0 mV	
E ı_H⬜ ‾‾‾‾‾0	**EVT1 High/Low limits independent upper side value** Setting range: 0 to 4000 mV	0 mV	
E ı_HY ‾‾‾ ı0	**EVT1 hysteresis** Setting range: 1 to 200 mV	10 mV	

12.8 EVT2 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
$EVT2F$ $-----$	**EVT2 type** $-----$: No action oRP_L : ORP input low limit action oRP_H : ORP input high limit action $cLEG$: Cleansing output $EoUL$: ORP input error alarm output $EoVR$: ORP fluctuation alarm output $oRPHL$: ORP input High/Low limits independent action	No action	
$ESV2$ 0	**EVT2 value** Setting range: Input indication low limit to Input indication high limit	0 mV	
$EP2$ 0	**EVT2 proportional band** Setting range: 0 to 4000 mV	0 mV	
$E2RSr$ 0	**EVT2 reset** Setting range: ±200 mV	0 mV	
$E2diF$ $SdiF$	**EVT2 hysteresis type** $cdiF$: Medium Value $SdiF$: Reference Value	Reference Value	
$E2dFo$ 10	**EVT2 ON side** Setting range: 0 to 200 mV	10 mV	
$E2dFU$ 10	**EVT2 OFF side** Setting range: 0 to 200 mV	10 mV	
$E2oNr$ 0	**EVT2 ON delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E2oFr$ 0	**EVT2 OFF delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E2c$ 30	**EVT2 proportional cycle** Setting range: 1 to 300 seconds	30 seconds	
$E2oLH$ 100	**EVT2 output high limit** Setting range: EVT2 output low limit to 100%	100%	
$E2oLL$ 0	**EVT2 output low limit** Setting range: 0% to EVT2 output high limit	0%	
$ooNr2$ 0	**Output ON time when EVT2 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$ooFr2$ 0	**Output OFF time when EVT2 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$E2cS$ $-----$	**EVT2 ORP input error alarm EVT□ type** $EVT1$: EVT1 type $-----$: No action $EVT3$: EVT3 type $EVT4$: EVT4 type	No action	

Character	Setting Item, Setting Range	Factory Default	Data
$E2oo\square$ $\square\square\square\square0$	**EVT2 ORP input error alarm band when EVT$\square$ output ON** Setting range: 0 to 4000 mV	0 mV	
$E2oo\Gamma$ $\square\square\square\square0$	**EVT2 ORP input error alarm time when EVT$\square$ output ON** Setting range: 0 to 10000 seconds or minutes	0 seconds	
$E2oc\square$ $\square\square\square\square0$	**EVT2 ORP input error alarm band when EVT$\square$ output OFF** Setting range: 0 to 4000 mV	0 mV	
$E2oc\Gamma$ $\square\square\square\square0$	**EVT2 ORP input error alarm time when EVT$\square$ output OFF** Setting range: 0 to 10000 seconds or minutes	0 seconds	
$MVZN2$ $\square\square50.0$	**EVT2 cycle variable range** Setting range: 1.0 to 100.0%	50.0%	
$cEN\Gamma2$ $\square\square\square\square0$	**EVT2 cycle extended time** Setting range: 0 to 300 seconds	0 seconds	
$E2oA\Gamma$ $\square\square\square\square0$	**EVT2 ORP fluctuation alarm time** Setting range: 0 to 72 hours	0 hours	
$E2oAH$ $\square\square\square\square0$	**EVT2 ORP fluctuation alarm band** Setting range: 0 to 4000 mV	0 mV	
$E2\_L\square$ $\square\square\square\square0$	**EVT2 High/Low limits independent lower side value** Setting range: 0 to 4000 mV	0 mV	
$E2\_H\square$ $\square\square\square\square0$	**EVT2 High/Low limits independent upper side value** Setting range: 0 to 4000 mV	0 mV	
$E2\_HY$ $\square\square\square10$	**EVT2 hysteresis** Setting range: 1 to 200 mV	10 mV	

12.9 EVT3 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
$EVT\ 3F$ ⊟⊟⊟⊟⊟	**EVT3 type** ⊟⊟⊟⊟⊟: No action oRP_L : ORP input low limit action oRP_H: ORP input high limit action $cLEG$: Cleansing output $EoUL$: ORP input error alarm output $EoVR$: ORP fluctuation alarm output $oRPHL$: ORP input High/Low limits independent action	No action	
$E4V3$ 0	**EVT3 value** Setting range: Input indication low limit to Input indication high limit	0 mV	
$EP3$ 0	**EVT3 proportional band** Setting range: 0 to 4000 mV	0 mV	
$E3R4r$ 0	**EVT3 reset** Setting range: ±200 mV	0 mV	
$E3di\ F$ $4di\ F$	**EVT3 hysteresis type** $cdi\ F$: Medium Value $4di\ F$: Reference Value	Reference Value	
$E3dFo$ 10	**EVT3 ON side** Setting range: 0 to 200 mV	10 mV	
$E3dFU$ 10	**EVT3 OFF side** Setting range: 0 to 200 mV	10 mV	
$E3oNr$ 0	**EVT3 ON delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E3oFr$ 0	**EVT3 OFF delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E3c$ 30	**EVT3 proportional cycle** Setting range: 1 to 300 seconds	30 seconds	
$E3oLH$ 100	**EVT3 output high limit** Setting range: EVT3 output low limit to 100%	100%	
$E3oLL$ 0	**EVT3 output low limit** Setting range: 0% to EVT3 output high limit	0%	
$ooNr3$ 0	**Output ON time when EVT3 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$ooFr3$ 0	**Output OFF time when EVT3 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$E3c4$ ⊟⊟⊟⊟⊟	**EVT3 ORP input error alarm EVT☐ type** $EVT\ 1$: EVT1 type $EVT\ 2$: EVT2 type ⊟⊟⊟⊟⊟ : No action $EVT4$: EVT4 type	No action	

Character	Setting Item, Setting Range	Factory Default	Data
ᴱ3ₒₒ☐ ☐	**EVT3 ORP input error alarm band when EVT☐ output ON**	0 mV	
	Setting range: 0 to 4000 mV		
ᴱ3ₒₒᴦ ☐	**EVT3 ORP input error alarm time when EVT☐ output ON**	0 seconds	
	Setting range: 0 to 10000 seconds or minutes		
ᴱ3ₒc☐ ☐	**EVT3 ORP input error alarm band when EVT☐ output OFF**	0 mV	
	Setting range: 0 to 4000 mV		
ᴱ3ₒcᴦ ☐	**EVT3 ORP input error alarm time when EVT☐ output OFF**	0 seconds	
	Setting range: 0 to 10000 seconds or minutes		
MVZN3 50.0	**EVT3 cycle variable range**	50.0%	
	Setting range: 1.0 to 100.0%		
cENᴦ3 ☐	**EVT3 cycle extended time**	0 seconds	
	Setting range: 0 to 300 seconds		
ᴱ3ₒAᴦ ☐	**EVT3 ORP fluctuation alarm time**	0 hours	
	Setting range: 0 to 72 hours		
ᴱ3ₒAH ☐	**EVT3 ORP fluctuation alarm band**	0 mV	
	Setting range: 0 to 4000 mV		
ᴱ3_L☐ ☐	**EVT3 High/Low limits independent lower side value**	0 mV	
	Setting range: 0 to 4000 mV		
ᴱ3_H☐ ☐	**EVT3 High/Low limits independent upper side value**	0 mV	
	Setting range: 0 to 4000 mV		
ᴱ3_HY 10	**EVT3 hysteresis**	10 mV	
	Setting range: 1 to 200 mV		

12.10 EVT4 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
$EVT4F$ $-----$	**EVT4 type** $-----$: No action oRP_L : ORP input low limit action oRP_H : ORP input high limit action $cLEG$: Cleansing output $EoUL$: ORP input error alarm output $EoVA$: ORP fluctuation alarm output $oRPHL$: ORP input High/Low limits independent action	No action	
$E4V4$ 0	**EVT4 value** Setting range: Input indication low limit to Input indication high limit	0 mV	
$EP4$ 0	**EVT4 proportional band** Setting range: 0 to 4000 mV	0 mV	
$E4R4r$ 0	**EVT4 reset** Setting range: ±200 mV	0 mV	
$E4di\ F$ $4di\ F$	**EVT4 hysteresis type** $cdi\ F$: Medium Value $4di\ F$: Reference Value	Reference Value	
$E4dFo$ 10	**EVT4 ON side** Setting range: 0 to 200 mV	10 mV	
$E4dFU$ 10	**EVT4 OFF side** Setting range: 0 to 200 mV	10 mV	
$E4oNr$ 0	**EVT4 ON delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E4oFr$ 0	**EVT4 OFF delay time** Setting range: 0 to 10000 seconds	0 seconds	
$E4c$ 30	**EVT4 proportional cycle** Setting range: 1 to 300 seconds	30 seconds	
$E4oLH$ 100	**EVT4 output high limit** Setting range: EVT4 output low limit to 100%	100%	
$E4oLL$ 0	**EVT4 output low limit** Setting range: 0% to EVT4 output high limit	0%	
$ooNr4$ 0	**Output ON time when EVT4 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$ooFr4$ 0	**Output OFF time when EVT4 output ON** Setting range: 0 to 10000 seconds	0 seconds	
$E4c4$ $-----$	**EVT4 ORP input error alarm EVT☐ type** $EVT1$: EVT1 type $EVT2$: EVT2 type $EVT3$: EVT3 type $-----$: No action	No action	

Character	Setting Item, Setting Range	Factory Default	Data
$E4oo\square$ $\square\square\square\square\square0$	**EVT4 ORP input error alarm band when EVT☐ output ON**	0 mV	
	Setting range: 0 to 4000 mV		
$E4oo\Gamma$ $\square\square\square\square\square0$	**EVT4 ORP input error alarm time when EVT☐ output ON**	0 seconds	
	Setting range: 0 to 10000 seconds or minutes		
$E4oc\square$ $\square\square\square\square\square0$	**EVT4 ORP input error alarm band when EVT☐ output OFF**	0 mV	
	Setting range: 0 to 4000 mV		
$E4oc\Gamma$ $\square\square\square\square\square0$	**EVT4 ORP input error alarm time when EVT☐ output OFF**	0 seconds	
	Setting range: 0 to 10000 seconds or minutes		
$MVZN4$ $\square\square50.0$	**EVT4 cycle variable range**	50.0%	
	Setting range: 1.0 to 100.0%		
$cEN\Gamma4$ $\square\square\square\square\square0$	**EVT4 cycle extended time**	0 seconds	
	Setting range: 0 to 300 seconds		
$E4oA\Gamma$ $\square\square\square\square\square0$	**EVT4 ORP fluctuation alarm time**	0 hours	
	Setting range: 0 to 72 hours		
$E4oAH$ $\square\square\square\square\square0$	**EVT4 ORP fluctuation alarm band**	0 mV	
	Setting range: 0 to 4000 mV		
$E4\_L\square$ $\square\square\square\square\square0$	**EVT4 High/Low limits independent lower side value**	0 mV	
	Setting range: 0 to 4000 mV		
$E4\_H\square$ $\square\square\square\square\square0$	**EVT4 High/Low limits independent upper side value**	0 mV	
	Setting range: 0 to 4000 mV		
$E4\_HY$ $\square\square\square\square10$	**EVT4 hysteresis**	10 mV	
	Setting range: 1 to 200 mV		

12.11 Basic Function Group

Character	Setting Item, Setting Range		Factory Default	Data
$Lock$ $-----$	**Set value lock**		Unlock	
	$-----$: Unlock			
	$Lock1$: Lock 1			
	$Lock2$: Lock 2			
	$Lock3$: Lock 3			
$cM5L$ $NoML$	**Communication protocol**		Shinko protocol	
	$NoML$: Shinko protocol			
	$ModA$: MODBUS ASCII mode			
	$ModR$: MODBUS RTU mode			
$cMNo$ 0	**Instrument number**		0	
	Setting range: 0 to 95			
$cM5P$ 96	**Communication speed**		9600 bps	
	96: 9600 bps			
	192: 19200 bps			
	384: 38400 bps			
$cMFr$ $7EVN$	**Data bit/Parity**		7 bits/Even	
	$8NoN$: 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			
$cM5r$ 1	**Stop bit**		1 bit	
	1: 1 bit			
	2: 2 bits			
$rRob$ oRP	**Transmission output type**		ORP transmission	
	oRP: ORP transmission			
	$MV1$: EVT1 MV transmission			
	$MV2$: EVT2 MV transmission			
	$MV3$: EVT3 MV transmission			
	$MV4$: EVT4 MV transmission			
$rRLH$ 2000	**Transmission output high limit**	ORP transmission: 2000 mV		
		MV transmission: 100.0%		
	ORP transmission: Transmission output low limit to 2000 mV			
	MV transmission: Transmission output low limit to 100.0%			
$rRLL$ -2000	**Transmission output low limit**	ORP transmission: -2000 mV		
		MV transmission: 0.0%		
	ORP transmission: -2000 mV to Transmission output high limit			
	MV transmission: 0.0% to Transmission output high limit			

Character	Setting Item, Setting Range	Factory Default	Data
$\lceil R_c \, \backslash$ $b E F H$	**Transmission output status in Adjustment mode / Span sensitivity correction mode** $\qquad b E F H$: Last value HOLD $\qquad \backslash E \lceil H$: Set value HOLD $\qquad P V H$: Measured value	Last value HOLD	
$\lceil R \backslash E$ 0	**Transmission output value HOLD in Adjustment mode / Span sensitivity correction mode** ORP transmission: -2000 to 2000 mV MV transmission: 0.0 to 100.0%	ORP transmission: 0 mV MV transmission: 0.0%	
$b K L \lceil$ $R L L$	**Backlight selection** $\qquad R L L$: All are backlit. $\qquad o R P$: ORP Display is backlit. $\qquad \backslash E \lceil$: Setting Display is backlit. $\qquad R c$: Action indicators are backlit. $\qquad o R P \backslash \lceil$: ORP Display + Setting Display are backlit. $\qquad o R P R c$: ORP Display + Action indicators are backlit. $\qquad \backslash E \lceil R c$: Setting Display + Action indicators are backlit.	All are backlit	
$c o L R$ $R E d$	**ORP color** $\qquad G R N$: Green $\qquad R E d$: Red $\qquad o R G$: Orange $\qquad o R P G R$: ORP color changes continuously.	Red	
$c L P$ 0	**ORP color reference value** $\quad$ Setting range: ±2000 mV	0 mV	
$c L R G$ 200	**ORP color range** $\quad$ Setting range: 1 to 4000 mV	200 mV	
$d P \lceil M$ 0	**Backlight time** $\quad$ Setting range: 0 to 99 minutes	0 minutes	
$b E R \backslash L$ - - - - -	**Bar graph indication** $\qquad$ - - - - - : No indication $\qquad \lceil R o \lceil$: Transmission output	No indication	
$I N E R R$ $o F F$	**EVT output when input errors occur** $\qquad o N$: Enabled $\qquad o F F$: Disabled	Disabled	
$d I \, \backslash P$ - - - - -	**Setting Display indication** $\qquad$ - - - - - : No indication $\qquad E \backslash V \, I$: EVT1 value $\qquad E \backslash V \, 2$: EVT2 value $\qquad E \backslash V \, 3$: EVT3 value $\qquad E \backslash V \, 4$: EVT4 value	No indication	
$c c N \lceil$ 0	**Number of cleansing cycles** $\quad$ Setting range: 0 to 10 (0: Continuous cleansing)	0 (Continuous cleansing)	

Character	Setting Item, Setting Range	Factory Default	Data
ccYc 360	**Cleansing interval** Setting range: 60 to 3000 minutes	360 minutes	
cΓiM 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	
cch bEFH	**Transmission output status when cleansing** bEFH : Last value HOLD SEΓH : Set value HOLD PVH : Measured value	Last value HOLD	
cSE 0	**Transmission output value HOLD when cleansing** Setting range: ORP transmission: -2000 to 2000 mV MV transmission: 0.0 to 100.0%	ORP transmission: 0 mV MV transmission: 0.0%	
M_S SEc	**ORP input error alarm time unit** SEc : Second(s) MI N : Minute(s)	Second(s)	

***** 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   --------------------------- AER-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.