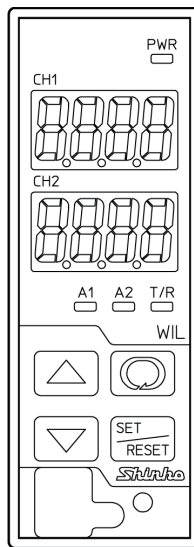


Plug-in Type Digital Indicating DO Meter **WIL-102-DO**

Instruction Manual



Shinko

Preface

Thank you for purchasing our WIL-102-DO, Plug-in Type Digital Indicating DO (Dissolved Oxygen) Meter. This manual contains instructions for the mounting, functions, operations and notes when operating the WIL-102-DO. 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.

Abbreviations used in this manual

Name	Term
DO	Dissolved Oxygen
DO Display	DO Concentration Display
Display Mode	DO Concentration / Temperature Display Mode DO % Saturation / Temperature Display Mode Oxygen Partial Pressure / Temperature Display Mode

Characters Used in This Manual


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

Caution

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

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

The safety precautions are classified into 2 categories: "Warning" and "Caution".

Depending on the circumstances, procedures indicated by  Caution may result in serious consequences, so be sure to follow the directions for usage.

Warning

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

Caution

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



Warning

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



SAFETY PRECAUTIONS

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



Caution with Respect to Export Trade Control Ordinance

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

PRECAUTIONS

1. Installation Precautions



Caution

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

- Overvoltage category II, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:

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

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

2. Wiring Precautions



Caution

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

Note about the DO Sensor Cable

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

- Do not allow terminals and socket of the DO 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 checking/replacement, the DO Sensor cable should be wired with sufficient length.
- Keep the DO Sensor cable and junction cable away from electrical devices, such as motors or their power lines from which inductive interference emanates.

Connection

The DO Sensor cable has the following terminals.

Code	Terminal
RS-485 (SENSOR INPUT)	DO Sensor YB (+) input terminal (Blue)
RS-485 (SENSOR INPUT)	DO Sensor YA (-) input terminal (Green)
POWER FOR SENSOR	External power (+) terminal (Red)
POWER FOR SENSOR	External power (-) terminal (Black) and DO Sensor shield

White and brown cables of the DO Sensor are not used, so cut them off, and electrically insulate them. If they come in contact with other terminals, a malfunction will occur.

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.

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1. Model

1.1 Model

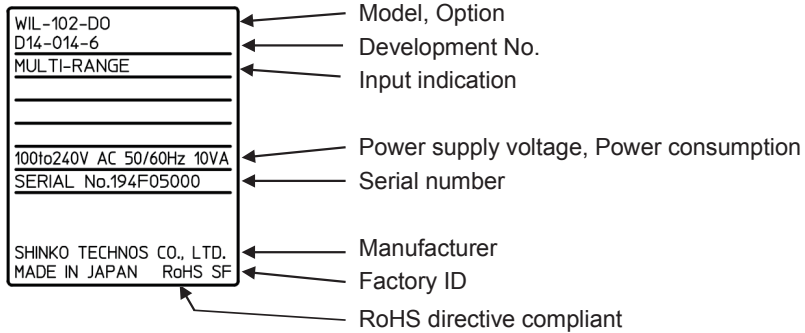
WIL-10	2	-DO		, □□□	
Input Points	2				2 points
Input		DO			Optical DO Sensor
Power supply voltage					100 to 240 V AC (standard)
		1			24 V AC/DC (*)
Option			EVT	EVT□ output (EVT3, EVT4, EVT5, EVT 6)	

(*) Power supply voltage 100 to 240 V AC is standard.

When ordering 24 V AC/DC, enter "1" in Power supply voltage, after 'DO'.

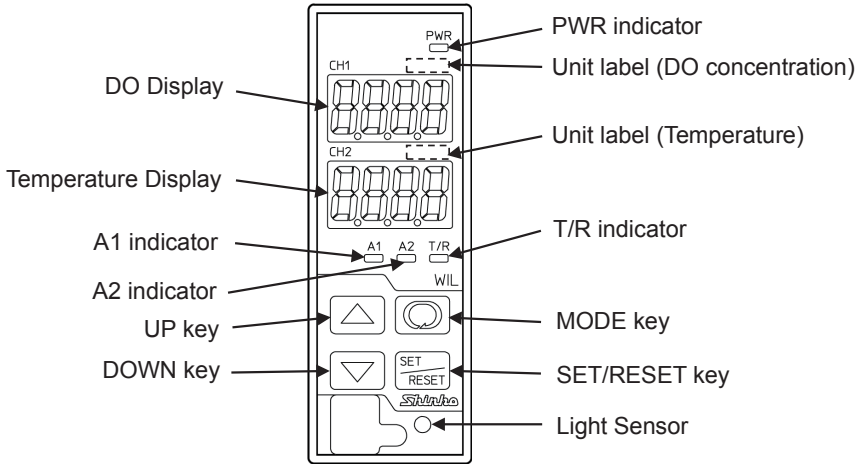
1.2 Model Label

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



(Fig. 1.2-1)

2. Names and Functions of Instrument



(Fig. 2-1)

Displays

DO Display	In Display Mode, DO Concentration, DO % saturation or Oxygen partial pressure is indicated in red. In Setting mode, setting characters are indicated in red.
Temperature Display	In Display Mode, temperature is indicated in red. In Setting mode, set value (selected item) is indicated in red.





Unit Labels

Unit label (DO concentration)	Attach the user's unit of DO concentration from the included unit labels if necessary.
Unit label (Temperature)	Attach the user's unit of temperature from the included unit labels if necessary.

Action Indicators

PWR indicator	When power supply to the instrument is turned ON, the yellow LED lights up.
A1 indicator	When EVT1 output (Contact output 1) is ON, the red LED lights up.
A2 indicator	When EVT2 output (Contact output 2) is ON, the yellow LED lights up.
T/R indicator	The yellow LED lights up during Serial communication TX output (transmitting).

Keys

 UP key	Increases the numeric value, or progresses through the selection items. Switches the Display Mode.
 DOWN key	Decreases the numeric value, or progresses back through the selection items.
 MODE key	Selects a group.
 SET/RESET key	Switches the setting modes, and registers the set value (or selected item).

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

⚠ Notice

When setting the specifications and functions of this instrument, connect mains power cable to terminals 13 and 14 first, then set them referring to “6. Outline of Key Operation and Setting Groups” and “7. Setup (pp. 20 to 40)” before performing “3. Mounting to and Removal from the Control Panel (p.9)” and “5. Wiring (p.16)”.

3. Mounting to and Removal from the Control Panel

3.1 Site Selection

⚠ Caution

Use within the following temperature and humidity ranges.

Temperature: 0 to 50°C (32 to 122°F) (No icing), Humidity: 35 to 85 %RH (Non-condensing)

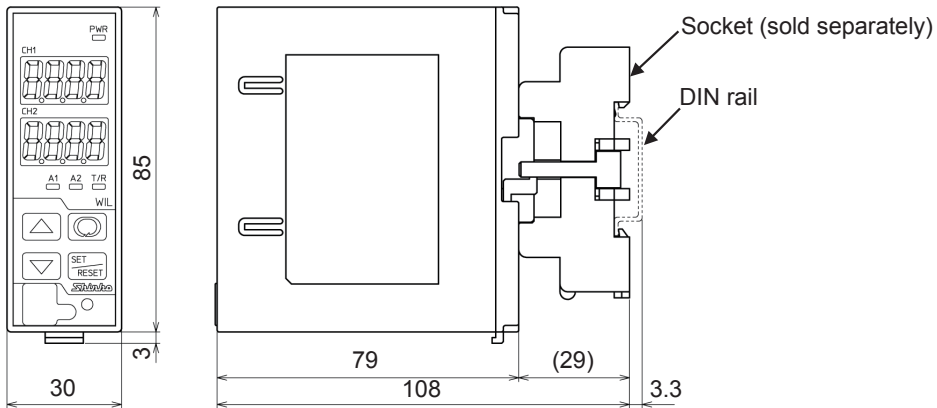
If the WIL-102-DO is installed within a control panel, the ambient temperature of the unit – not the ambient temperature of the control panel – must be kept under 50°C. Otherwise the life of electronic parts (especially electrolytic capacitors) of the unit will be shortened.

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°C (32 to 122°F) that does not change rapidly
- An ambient non-condensing humidity of 35 to 85 %RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil, chemicals or the vapors of these substances can come into direct contact with the unit.

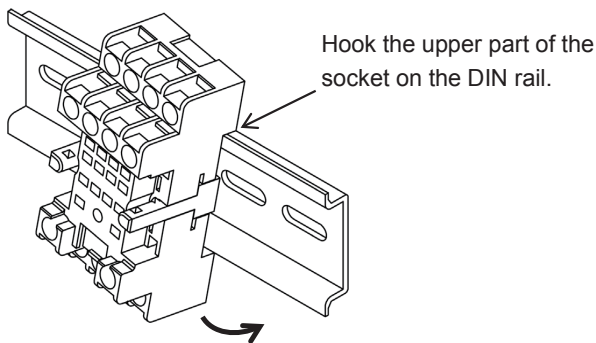
3.2 External Dimensions (Scale: mm)



(Fig. 3.2-1)

3.3 Mounting

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

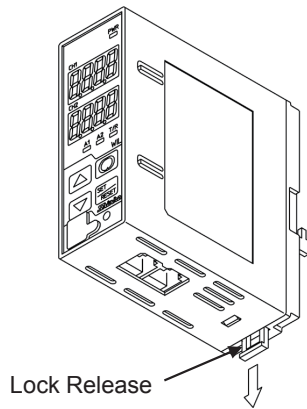


(Fig. 3.3-1)

Caution

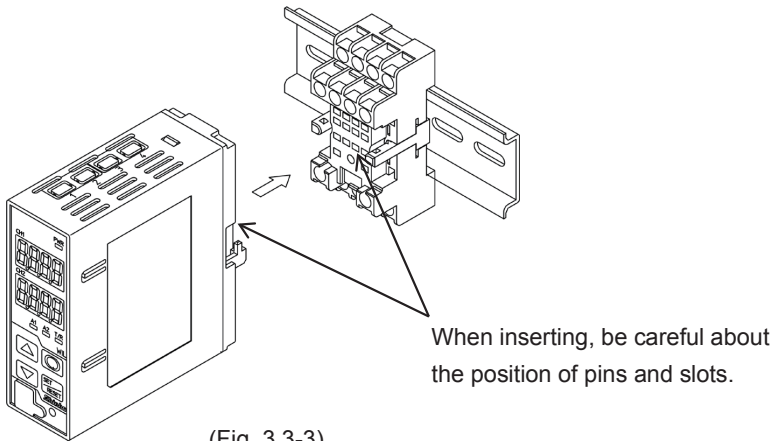
Before inserting the WIL-102-DO into the socket, wire the unit while referring to Section “5. Wiring” (p.16).

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



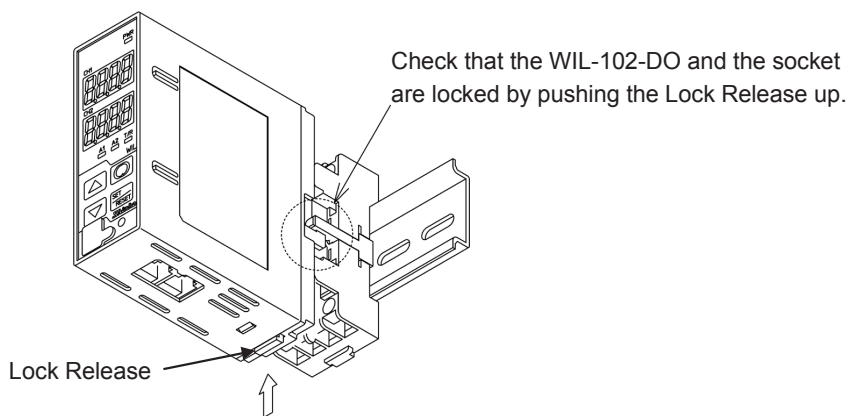
(Fig. 3.3-2)

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



(Fig. 3.3-3)

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

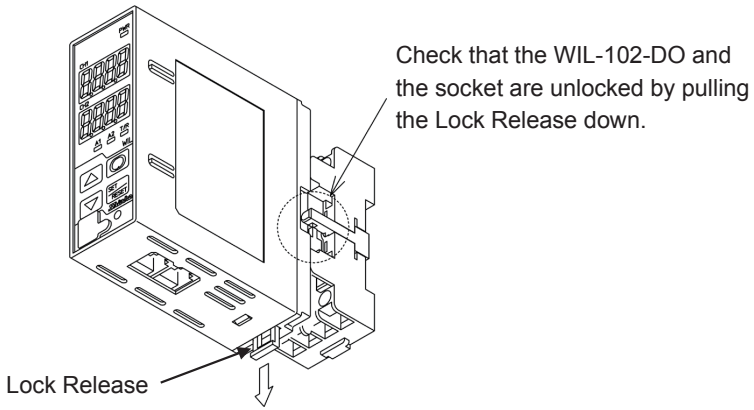


(Fig. 3.3-4)

3.4 Removal

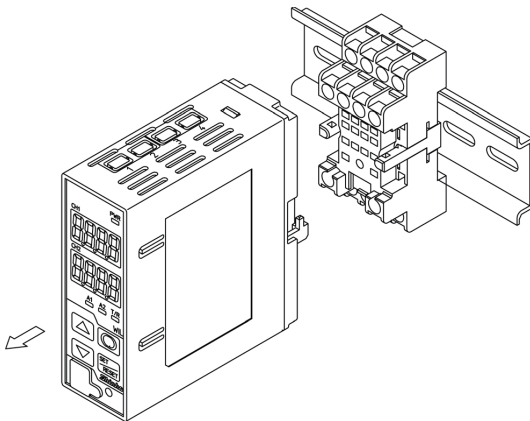
(1) Turn the power supply to the unit OFF.

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



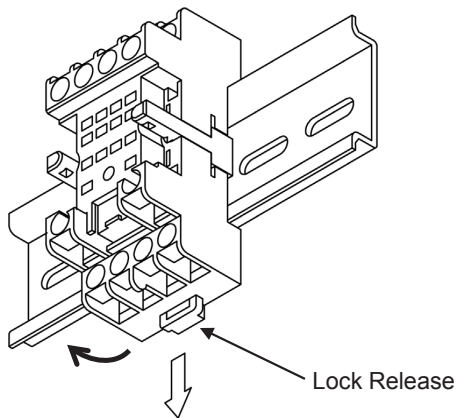
(Fig. 3.4-1)

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



(Fig. 3.4-2)

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



(Fig. 3.4-3)

4. DO Sensor

4.1 Contents of Package

The following items are contained in the DO Sensor package.



DO Sensor (DOS-20)



Sensor cap (DOS-CP)
(Fig. 4.1-1)



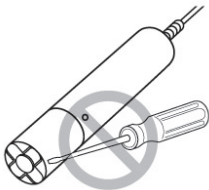
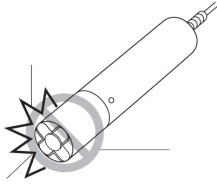
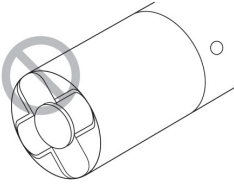
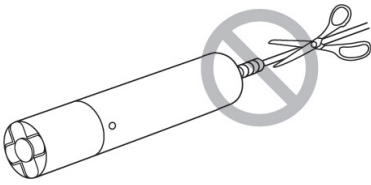
Calibration container

4.2 Caution when Using DO Sensor

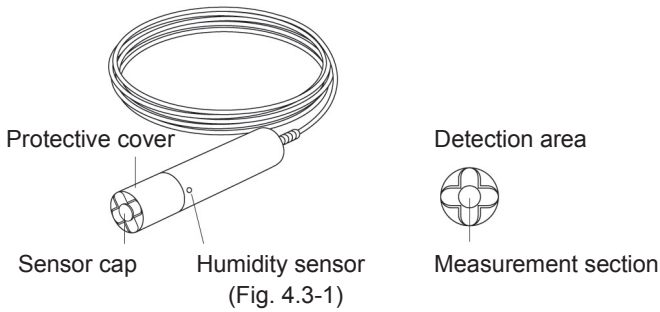


Caution

Do not use the DO Sensor for any purposes other than water quality measurement.

 <p>(Fig. 4.2-1)</p>	<p>Do not disassemble or modify. The sensor contains a high voltage component which may cause fire or electrical shock. For internal inspection, maintenance or repair, please consult us or our agency.</p>
 <p>(Fig. 4.2-2)</p>	<p>Do not subject the sensor to any rough treatment. Do not drop the unit. Handle with care.</p>
 <p>(Fig. 4.2-3)</p>	<p>Do not touch the measurement section. If it is not clean, wipe it with a clean, soft cloth.</p>
 <p>(Fig. 4.2-4)</p>	<p>Be careful not to damage the cable. Ensure that the cable is not tangled, nor caught or trapped in any way when installing and using the sensor. Use a spiral cable wrap to protect the cable. If the cable is damaged, it may malfunction when immersed, and fire or electrical shock will occur.</p>

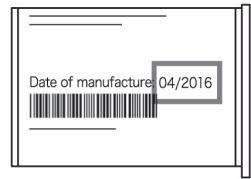
4.3 Name of Sections



4.4 Attaching the Sensor Cap

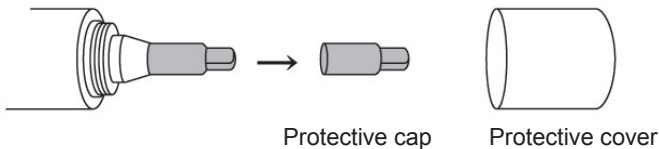
⚠ Caution

- Before attaching, make sure that the O-ring of the sensor is not crooked or is in the right position in the groove.
- Take the sensor cap out from the package just before mounting, and mount it immediately.
- When mounting the sensor cap, keep the dust or water from entering into the cap. Otherwise correct measurement will not be performed.
- Date of manufacture is written on the storage case of sensor cap as the right diagram.



(Fig. 4.4-1)

- (1) Remove the protective cover from the sensor by rotating it, then remove the red protective cap. Please carefully set aside the protective cap.



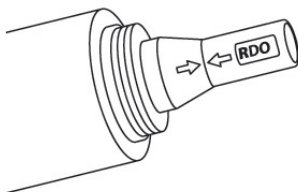
(Fig. 4.4-2)

- (2) Take the provided sensor cap out from the storage case.



(Fig. 4.4-3)

- (3) Match the arrows on the sensor cap and on the sensor, then push the sensor cap straight onto it until no gap is visible.



(Fig. 4.4-4)

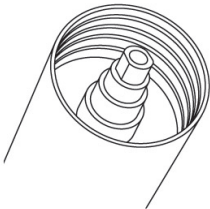
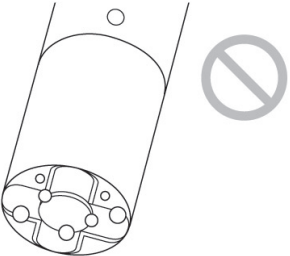
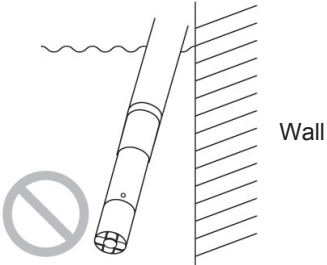
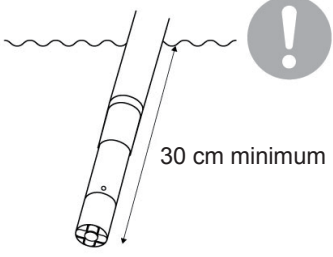
- (4) Reattach the protective cover.

4.5 Installing the DO Sensor



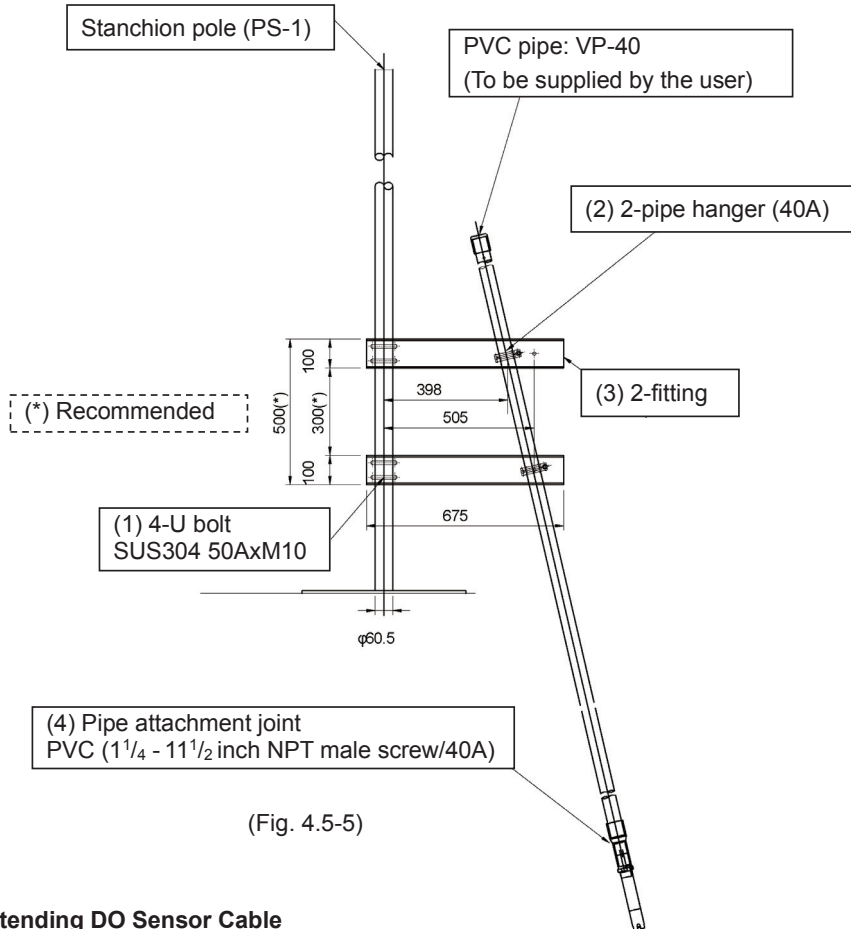
Caution

Before installation, remove the power supply cable from the power source.
After completion, wire the power supply cable.

 <p>(Fig. 4.5-1)</p>	<p>The end of DO Sensor cable is equipped with a female screw (1¼-11 ½NPT) to enable a male screw to be attached to a severed pipe.</p> <p>NPT stands for National Pipe Thread Taper (which is a U.S. standard for tapered threads used on threaded pipes and fittings).</p>
 <p>(Fig. 4.5-2)</p>	<p>When installing the DO Sensor, make sure that air bubbles are not present on and near the detection surface.</p> <p>If air bubbles accumulate in the measurement section area, correct measurement cannot be obtained.</p>
 <p>(Fig. 4.5-3)</p>	<p>Do not install the DO Sensor near to any walls or where water collects.</p> <p>Correct dissolved oxygen in the tank (for measurement) cannot be measured.</p>
 <p>(Fig. 4.5-4)</p>	<p>Install the DO Sensor at a minimum of about 30 cm below the lowest water surface, taking water level changes into consideration.</p>

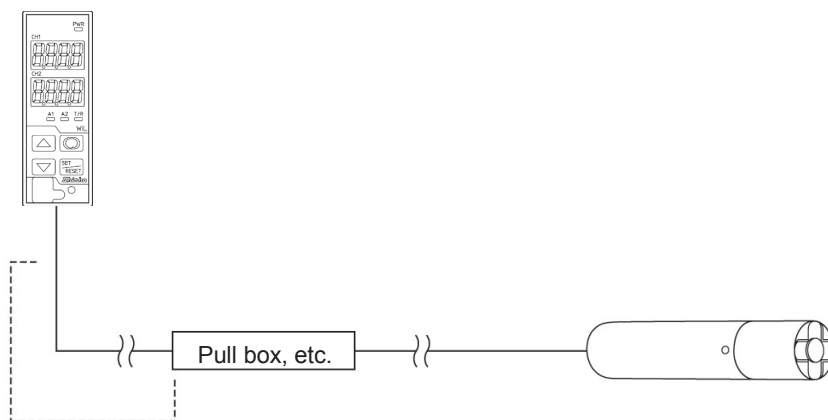
Recommendations

- As an accessory, the attachment (DA-1), sold separately, is recommended to use in a place where water currents are fast.
- The following (1) to (4) are included in the immersion holder.
- The Polyvinyl chloride (PVC) pipe (VP-40) is to be supplied by the user.



4.6 Extending DO Sensor Cable

DO Sensor cable standard length is 10 m.
To extend the cable, refer to the following diagram.
Use a device such as a pull box if necessary.



Extendable cable length: 1200 m (Nominal cross-section area: 0.2 to 1.25 mm²)

(Fig. 4.6-1)

5. Wiring



Warning

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



Caution

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

Note about the DO Sensor Cable

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

- Do not allow terminals and socket of the DO 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 checking/replacement, the DO Sensor cable should be wired with sufficient length.
- Keep the DO Sensor cable and junction cable away from electrical devices, such as motors or their power lines from which inductive interference emanates.

Connection

The DO Sensor cable has the following terminals.

Code	Terminal
RS-485 (SENSOR INPUT)	DO Sensor YB (+) input terminal (Blue)
RS-485 (SENSOR INPUT)	DO Sensor YA (-) input terminal (Green)
POWER FOR SENSOR	External power (+) terminal (Red)
POWER FOR SENSOR	External power (-) terminal (Black) and DO Sensor shield

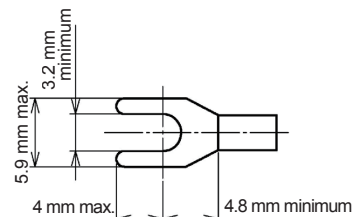
White and brown cables of the DO Sensor are not used, so cut them off, and electrically insulate them. If they come in contact with other terminals, a malfunction will occur.

5.1 Lead Wire Solderless Terminal

Use a solderless terminal with an insulation sleeve in which an M3 screw fits as follows.

The tightening torque should be 0.63 N•m.

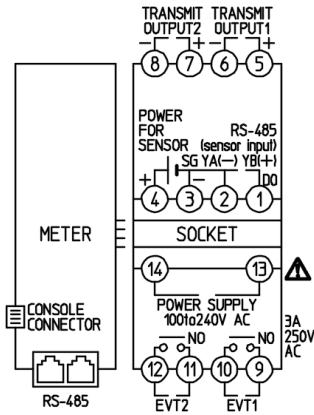
Solderless Terminal	Manufacturer	Model
Y-type	Nichifu Terminal	TMEV1.25Y-3S



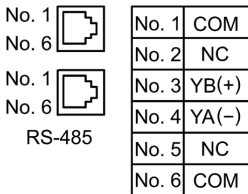
(Fig. 5.1-1)

5.2 Terminal Arrangement

Standard specifications

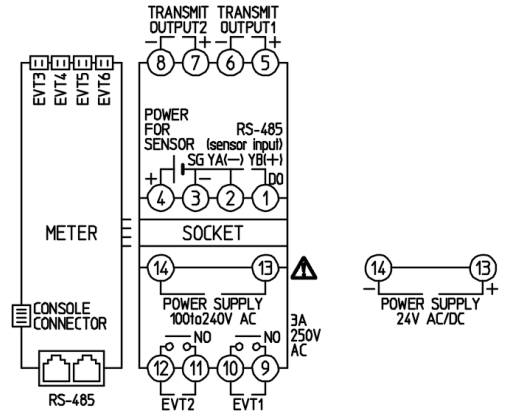


Modular Jack Pin (WIL-102-DO side arrangement)

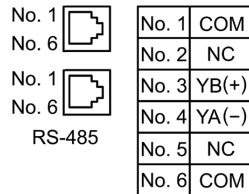


(Fig. 5.2-1)

EVT option



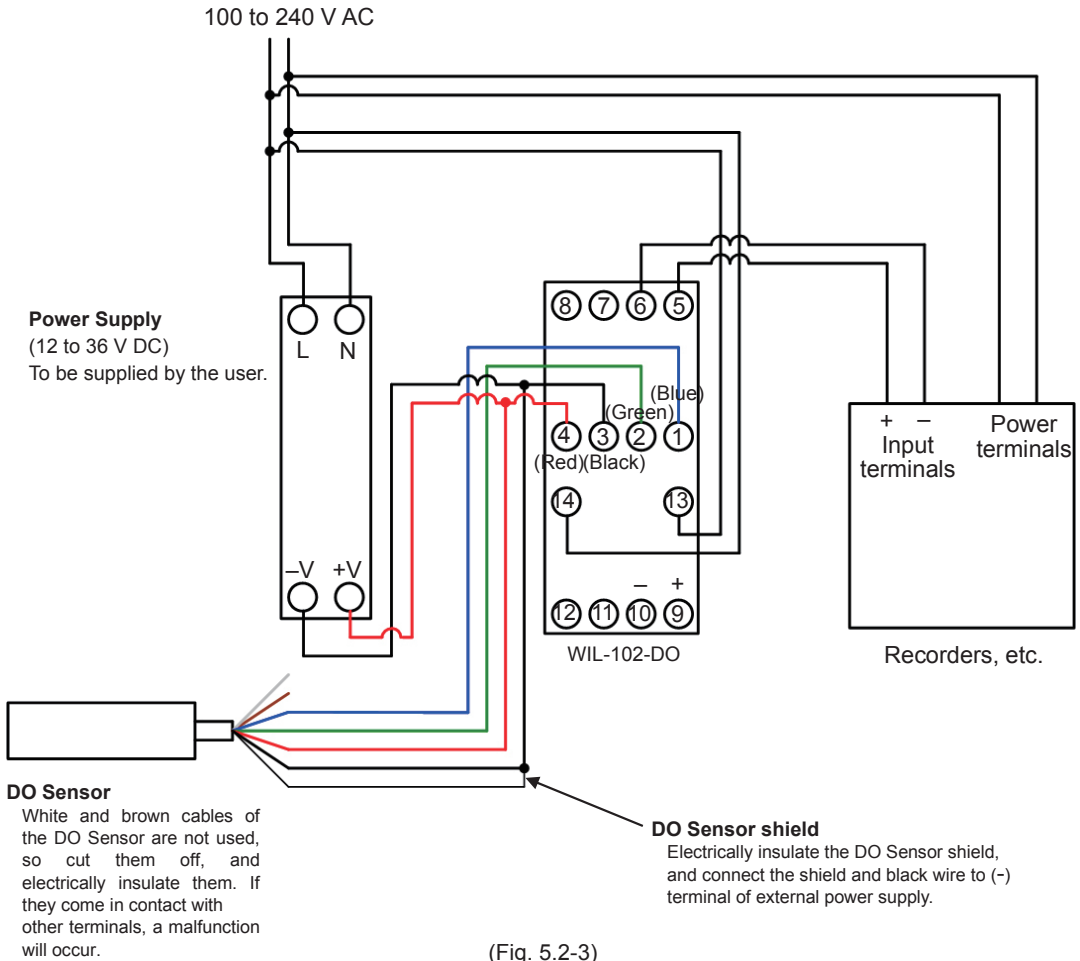
Modular Jack Pin (WIL-102-DO side arrangement)



(Fig. 5.2-2)

Code	Description
DO RS-485 (sensor input)	DO Sensor YB(+) input terminal (Blue)
DO RS-485 (sensor input)	DO Sensor YA(-) input terminal (Green)
DO POWER FOR SENSOR	External power supply (-) terminal (Black) and DO Sensor shield
DO POWER FOR SENSOR	External power supply (+) terminal (Red)
TRANSMIT OUTPUT1	Transmission output 1
TRANSMIT OUTPUT2	Transmission output 2
EVT1	EVT1 output (Contact output 1)
EVT2	EVT2 output (Contact output 2)
EVT3	EVT3 output (Open collector output 3) (EVT option) Use the included wire harnesses WJ.
EVT4	EVT4 output (Open collector output 4) (EVT option) Use the included wire harnesses WJ.
EVT5	EVT5 output (Open collector output 5) (EVT option) Use the included wire harnesses WJ.
EVT6	EVT6 output (Open collector output 6) (EVT option) Use the included wire harnesses WJ.
POWER SUPPLY	Power supply voltage 100 to 240 V AC or 24 V AC/DC (when "1" is added after the model name "DO") 24 V DC: Ensure polarity is correct.
RS-485	Serial Communication modular jack

Wiring Example



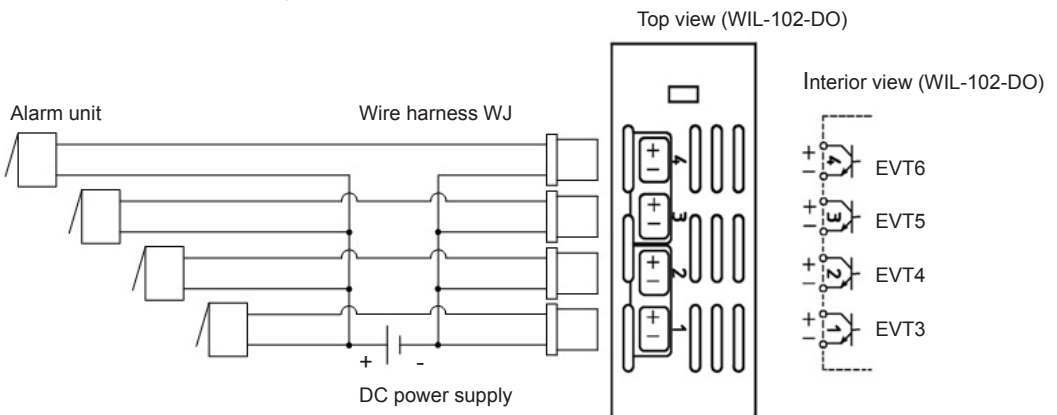
(Fig. 5.2-3)

Wiring Example of EVT3 to EVT6

If EVT output (EVT option) is ordered, EVT3 to EVT6 output connectors are equipped on the top of this instrument. Use the included wire harnesses WJ.

Output specifications are shown below.

Open collector control capacity: 0.1 A 24 V DC

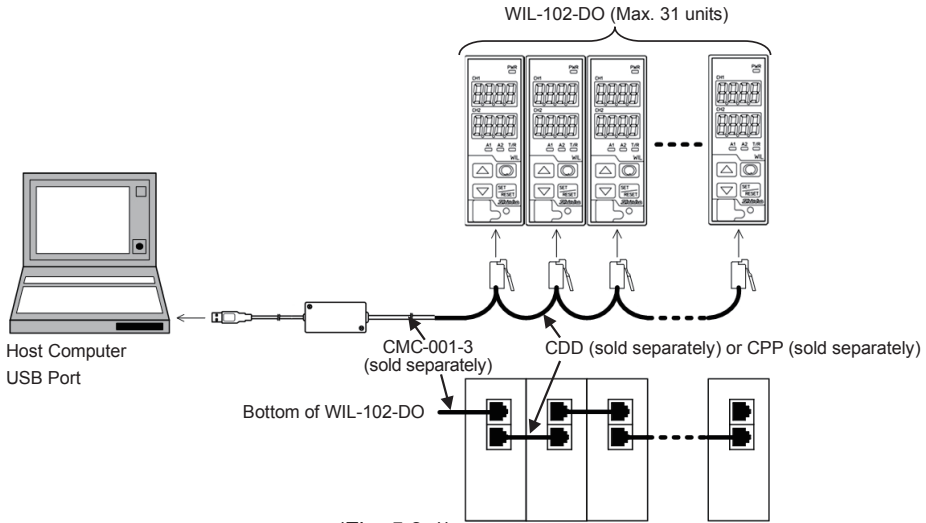


(Fig. 5.2-4)

5.3 Wire the Communication Cable

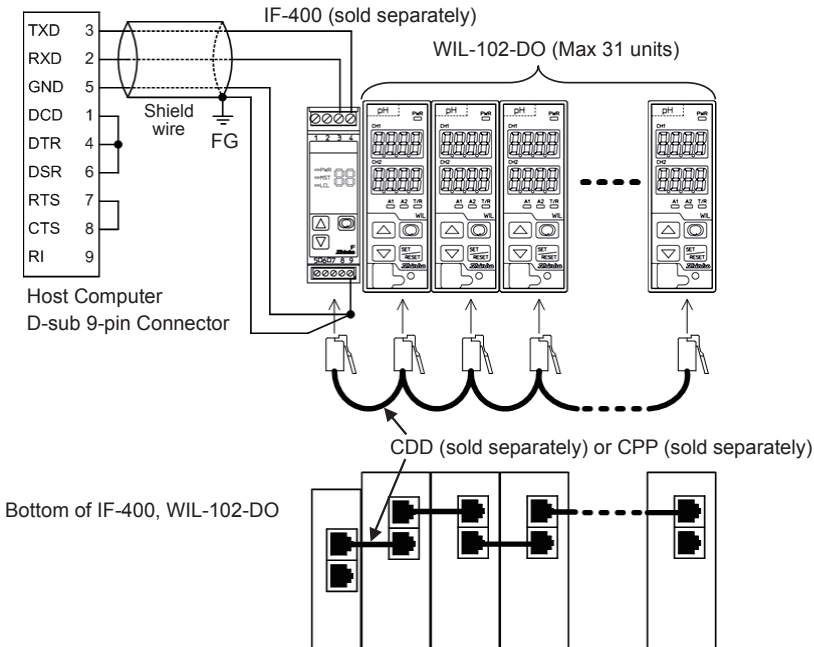
Connect to the modular jack at the bottom of the instrument, using CDD (sold separately) or CPP (sold separately).

- **Wiring Example Using the USB Communication Cable CMC-001-3 (sold separately)**



(Fig. 5.3-1)

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



(Fig. 5.3-2)

Shield Wire

Be sure to ground only one end of the shield wire so that current cannot flow to the shield wire. If both ends of the shield wire are grounded, the circuit will be closed, resulting in a ground loop. This may cause noise. Be sure to ground the FG.

Recommended cable: OTSC-VB 2PX0.5SQ (made by Onamba Co., Ltd.) or equivalent
(Use a twisted pair cable.)

Terminator (Terminal Resistor)

The terminator is mounted at the end of the wire when connecting multiple peripheral devices to a personal computer. The terminator prevents signal reflection and disturbance.

Do not connect a terminator with the communication line because each WIL-102-DO has built-in pull-up and pull-down resistors.


Communication converter IF-400 (sold separately) has a built-in terminal resistor.




6. Outline of Key Operation and Setting Groups


6.1 Outline of Key Operation

Setting items are divided into groups, and group selection has to be made with keypads.

Press the  key in Display Mode or Cleansing Output Mode. The unit enters Group Selection Mode.

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

To set each setting item, use the  or  key, and register the set value with the  key.

If the  key is held down for 3 seconds at any setting item, the unit will revert to Display Mode or Cleansing Output Mode.

6.2 Setting Groups



Setting groups are indicated on p.21.

[About setting items]



Setting group or setting item in shaded section will be displayed only when the corresponding option is ordered.







(*1) In Cleansing Output Mode, the measured value (DO concentration, DO % saturation, Oxygen partial pressure, Temperature) will be held during cleansing action (Cleansing time, Standby after cleansing).





(*2) If errors occur during 1st-point calibration (100% saturation calibration) while in 2-point calibration mode, press the  or  key. The unit will revert to Display Mode or Cleansing Output Mode.

















(*3) Depending on the selection in [Data clear Stop/Perform], the unit operates as follows.

- If 'Data clear Stop' is selected, data will not be cleared. The unit will revert to the mode prior to Data clear Stop (either Display Mode or Cleansing Output Mode).
- If 'Data clear Perform' is selected, data will be cleared. The unit will revert to the mode prior to Data clear Perform (either Display Mode or Cleansing Output Mode). (While data is being cleared, all indications are momentarily unlit.)

About Key Operation

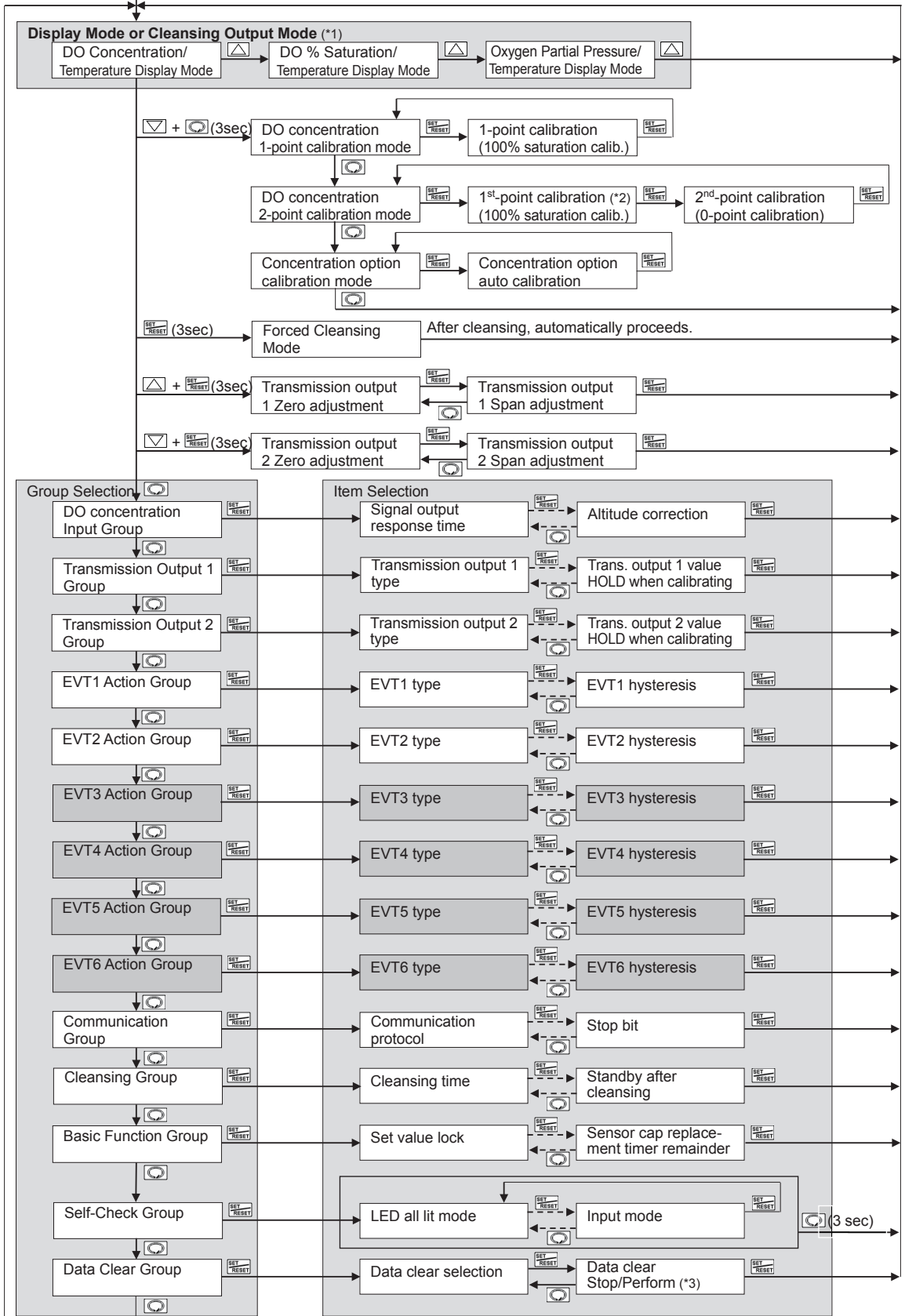
- , , : Press the ,  or  key. The unit will proceed to the next setting item, illustrated by an arrow.

 or : Press the  or  key until the desired setting mode appears.

-  +  (3 sec): Press and hold the  key and  key (in that order) together for approx. 3 seconds.
The unit will proceed to DO concentration 1-point Calibration mode.
-  (3 sec),  (3 sec): Press the  key or  key for approx. 3 seconds.
The unit will proceed to the next setting mode, illustrated by an arrow.
-  +  (3 sec): Press and hold the  key and  key (in that order) together for approx. 3 seconds. The unit will proceed to Transmission output 1 Zero adjustment.
-  +  (3 sec): Press and hold the  key and  key (in that order) together for approx. 3 seconds. The unit will proceed to Transmission output 2 Zero adjustment.

POWER ON

Abbreviations:
Calib.: Calibration Trans.: Transmission



7. Setup

Setup should be done before using this instrument according to the user's conditions:

Setting the DO concentration input, Transmission output 1, Transmission output 2, EVT1, EVT2, EVT3 to EVT6 (EVT option) types, Communication, Cleansing and Indication settings, etc.

Setup can be conducted in the groups below:

DO Concentration Input Group, Transmission Output 1 Group, Transmission Output 2 Group, EVT1 to EVT6 Action Groups, Communication Group, Cleansing Group, Basic Function Group

If the user's specification is the same as the factory default value of the WIL-102-DO, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to "8. Calibration (p.41)".

7.1 Turn the Power Supply to the WIL-102-DO ON.

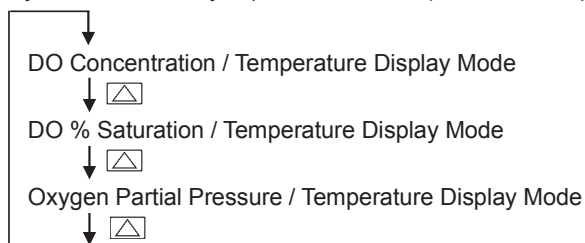
For approx. 8 seconds after the power is switched ON, the following characters are indicated on the DO Display and Temperature Display.

Display	Indication
DO Display	do□□
Temperature Display	□□□□ [Version number (e.g.) 1.00]

During this time, all outputs are in OFF status, and action indicators except the PWR indicator turn off. After that, measurement starts, indicating DO concentration, DO % saturation or Oxygen partial pressure on the DO Display, and temperature on the Temperature Display. This status is called Display Mode or Cleansing Output Mode.

Switching Between Modes


Every time the  key is pressed, modes (on the DO Display) progress as follows.






7.2 DO Concentration Input Group

To enter the DO Concentration Input Group, follow the procedure below.

① *Fnci* Press the  key once in Display Mode or Cleansing Output Mode.

② *dFcf* Press the  key.

The unit enters the DO Concentration Input Group, and “Signal output response time” will appear.

Character	Setting Item, Function, Setting Range	Factory Default
<i>dFcf</i> 	Signal output response time <ul style="list-style-type: none"> Sets the signal output response time. Moving average is calculated from the set signal output response time, and the resulting value is updated every Data update cycle (fixed at 5 seconds) as a measurement value. Moving average = Signal output response time ÷ Data update cycle (5 sec.) (e.g.) If signal output response time is set to 50 seconds, the Moving average will be: 50/5 = 10 (times) However, signal output response time setting will be invalidated during DO concentration calibration mode, Transmission output 1 adjustment mode, or Transmission output 2 adjustment mode. Setting range: 5 to 600 seconds 	60 seconds
<i>4ALF</i> 	Salinity correction <ul style="list-style-type: none"> Sets the salinity concentration correction value. Setting range: 0 to 42 PSU 	0 PSU
<i>4EAL</i> 	Altitude correction <ul style="list-style-type: none"> Sets altitude. Setting range: 0 to 5000 m 	0 m





7.3 Transmission Output 1 Group

To enter the Transmission Output 1 Group, follow the procedure below.

① *f r o 1* Press the  key twice in Display Mode or Cleansing Output Mode.


② *f r o 1* Press the  key.

The unit enters Transmission Output 1 Group, and “Transmission output 1 type” will appear.

Character	Setting Item, Function, Setting Range	Factory Default
<i>f r o 1</i> <i>d o</i> 	Transmission output 1 type <ul style="list-style-type: none"> • Selects Transmission output 1 type. • <i>d o</i>  : DO concentration transmission • <i>w t e m p</i> : Water temperature transmission • <i>d o %</i> : DO % saturation transmission • <i>o 2</i> : Oxygen partial pressure transmission 	DO concentration transmission
<i>f r h 1</i> <i>2000</i>	Transmission output 1 high limit <ul style="list-style-type: none"> • Sets Transmission output 1 high limit value. (This value corresponds to 20 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Setting range: Transmission output 1 low limit to Measurement range high limit 	20.00 mg/L
<i>f r l 1</i>  <i>000</i>	Transmission output 1 low limit <ul style="list-style-type: none"> • Sets Transmission output 1 low limit value. (This value corresponds to 4 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Setting range: Measurement range low limit to Transmission output 1 high limit 	0.00 mg/L
<i>f r c 1</i> <i>b e f h</i>	Transmission output 1 status when calibrating <ul style="list-style-type: none"> • Selects Transmission output 1 output status when calibrating DO concentration. • Selection item: <i>b e f h</i>: Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.) <i>s e t</i>: Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when calibrating].) <i>m e a s</i>: Measured value (Outputs the measured value when calibrating DO concentration.) 	Last value HOLD
<i>f r v 1</i>  <i>000</i>	Transmission output 1 value HOLD when calibrating <ul style="list-style-type: none"> • Sets Transmission output 1 value HOLD. • Available only when <i>s e t</i> (Set value HOLD) is selected in [Transmission output 1 status when calibrating]. • Setting range: Measurement range low limit to Measurement range high limit 	0.00 mg/L

7.4 Transmission Output 2 Group

To enter the Transmission Output 2 Group, follow the procedure below.

① *r r a 2* Press the  key 3 times in Display Mode or Cleansing Output Mode.



② *r r a 2* Press the  key.

The unit enters Transmission Output 2 Group, and “Transmission output 2 type” will appear.

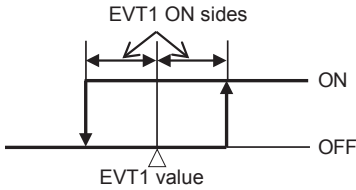
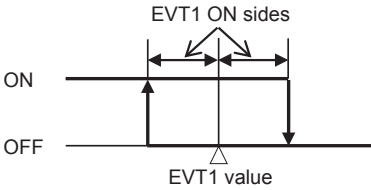
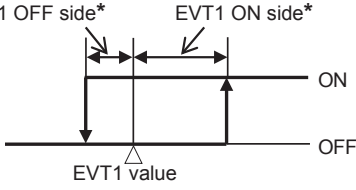
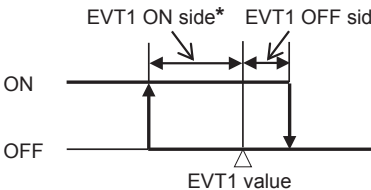
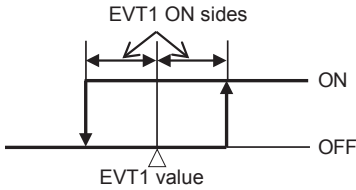
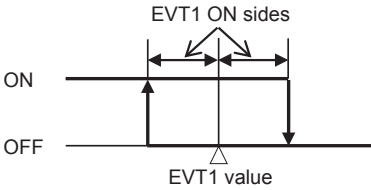
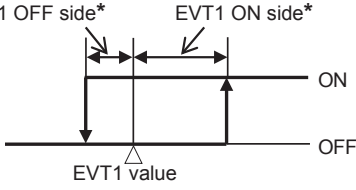
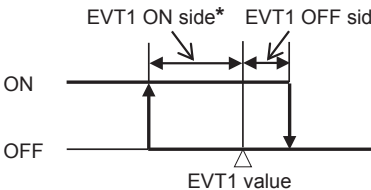
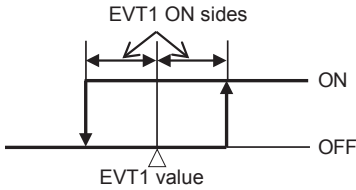
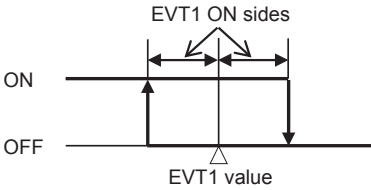
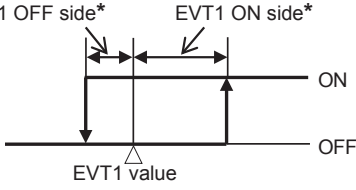
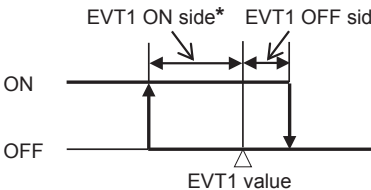
Character	Setting Item, Function, Setting Range	Factory Default
<i>r r a 2</i> <i>d o</i>	Transmission output 2 type <ul style="list-style-type: none"> • Selects Transmission output 2 type. • <i>d o</i> : DO concentration transmission • <i>w t</i> : Water temperature transmission • <i>d o %</i> : DO % saturation transmission • <i>o p p</i> : Oxygen partial pressure transmission 	DO concentration transmission
<i>r r h 2</i> <i>2 0 0 0</i>	Transmission output 2 high limit <ul style="list-style-type: none"> • Sets Transmission output 2 high limit value. (This value corresponds to 20 mA DC output.) • If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Setting range: Transmission output 2 low limit to Measurement range high limit 	20.00 mg/L
<i>r r l 2</i> <i>0 0 0</i>	Transmission output 2 low limit <ul style="list-style-type: none"> • Sets Transmission output 2 low limit value. (This value corresponds to 4 mA DC output.) • If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Setting range: Measurement range low limit to Transmission output 2 high limit 	0.00 mg/L
<i>r r c 2</i> <i>b e f h</i>	Transmission output 2 status when calibrating <ul style="list-style-type: none"> • Selects Transmission output 2 output status when calibrating DO concentration. • Selection item: <i>b e f h</i>: Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.) <i>h e f h</i>: Set value HOLD (Outputs the value set in [Transmission output 2 value HOLD when calibrating].) <i>p h</i>: Measured value (Outputs the measured value when calibrating DO concentration.) 	Last value HOLD
<i>r r h 2</i> <i>0 0 0</i>	Transmission output 2 value HOLD when calibrating <ul style="list-style-type: none"> • Sets Transmission output 2 value HOLD. • Available only when <i>h e f h</i> (Set value HOLD) is selected in [Transmission output 2 status when calibrating]. • Setting range: Measurement range low limit to Measurement range high limit 	0.00 mg/L

7.5 EVT1 Action Group

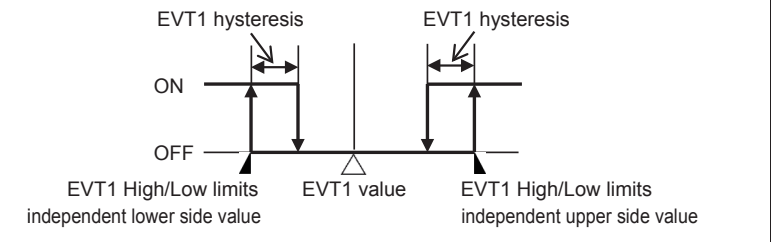
To enter the EVT1 Action Group, follow the procedure below.

- ① *E.H.F. 1* Press the  key 4 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F. 1* Press the  key.

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

Character	Setting Item, Function, Setting Range	Factory Default						
<i>E.F.F. 1</i> [---][---]	EVT1 type • Selects an EVT1 output type. Note: If EVT1 type is changed, EVT1 value defaults to 0.00 or 0.0. • [---][---]: No action <i>do_H</i> : DO concentration input high limit action <i>do_L</i> : DO concentration input low limit action <i>wt_H</i> : Water temperature input high limit action <i>wt_L</i> : Water temperature input low limit action <i>do_H</i> : DO % saturation input high limit action <i>do_L</i> : DO % saturation input low limit action <i>OP_H</i> : Oxygen partial pressure input high limit action <i>OP_L</i> : Oxygen partial pressure input low limit action <i>rcRP</i> : Sensor cap replacement timer (Fig. 7.5-3) (p.27) <i>SELF</i> : Self-Check output (p.27) <i>CLCO</i> : Cleansing output (Fig. 7.5-4) (p.27) <i>doHL</i> : DO concentration input High/Low limits independent action (Fig.7.5-2) (p.27) <i>wtHL</i> : Water temperature input High/Low limits independent action (Fig.7.5-2) (p.27) <i>doHL</i> : DO % saturation input High/Low limits independent action (Fig.7.5-2) (p.27) <i>OPHL</i> : Oxygen partial pressure input High/Low limits independent action (Fig.7.5-2) (p.27)	No action						
<p>• EVT1 Action (Activated based on the indication value.)</p> <table border="1"> <thead> <tr> <th>DO concentration input high limit Water temperature input high limit DO % saturation input high limit Oxygen partial pressure input high limit</th> <th>DO concentration input low limit Water temperature input low limit DO % saturation input low limit Oxygen partial pressure input low limit</th> </tr> </thead> <tbody> <tr> <td> If Medium Value is selected in [EVT1 hysteresis type]:  </td> <td> If Medium Value is selected in [EVT1 hysteresis type]:  </td> </tr> <tr> <td> If Reference Value is selected in [EVT1 hysteresis type]: EVT1 OFF side* EVT1 ON side*  </td> <td> If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side*  </td> </tr> </tbody> </table> <p style="text-align: center;">(Fig. 7.5-1)</p>			DO concentration input high limit Water temperature input high limit DO % saturation input high limit Oxygen partial pressure input high limit	DO concentration input low limit Water temperature input low limit DO % saturation input low limit Oxygen partial pressure input low limit	If Medium Value is selected in [EVT1 hysteresis type]: 	If Medium Value is selected in [EVT1 hysteresis type]: 	If Reference Value is selected in [EVT1 hysteresis type]: EVT1 OFF side* EVT1 ON side* 	If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side* 
DO concentration input high limit Water temperature input high limit DO % saturation input high limit Oxygen partial pressure input high limit	DO concentration input low limit Water temperature input low limit DO % saturation input low limit Oxygen partial pressure input low limit							
If Medium Value is selected in [EVT1 hysteresis type]: 	If Medium Value is selected in [EVT1 hysteresis type]: 							
If Reference Value is selected in [EVT1 hysteresis type]: EVT1 OFF side* EVT1 ON side* 	If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side* 							
<p>* Setting Example: If [EVT1 ON side (<i>dfO 1</i>)] is set to 0, EVT1 output can be turned ON at the value set in [EVT1 value (<i>48 0</i>)]. If [EVT1 OFF side (<i>dfU 1</i>)] is set to 0, EVT1 output can be turned OFF at the value set in [EVT1 value (<i>48 0</i>)].</p>								

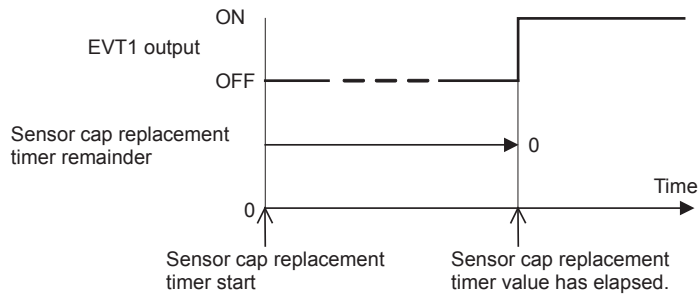
DO concentration input High/Low limits independent action
Water temperature input High/Low limits independent action
DO % saturation input High/Low limits independent action
Oxygen partial pressure input High/Low limits independent action



(Fig. 7.5-2)

• **Sensor Cap Replacement Timer Output**

If the set Sensor cap replacement timer value has elapsed (when sensor cap replacement timer remainder is "0"), EVT1 output will be turned ON.



(Fig. 7.5-3)

• **Self-check Output**

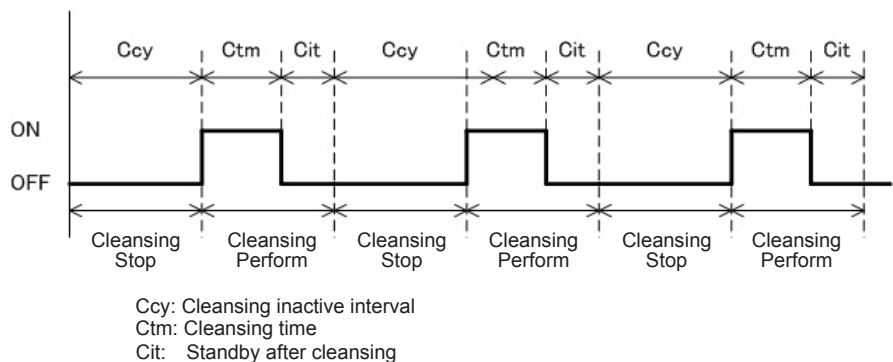
If the following error occurs, EVT1 output will be turned ON.

Error Code	Description
<i>Err 1</i>	DO Sensor communication errors have occurred, or DO sensor is not connected.
<i>Err 2</i>	DO Sensor cap is not attached, or it is incorrectly attached.
<i>Err 3</i>	Calibration error (If input errors have occurred, or if calibration cannot be performed 30 minutes after starting calibration)

• **Cleansing Output**

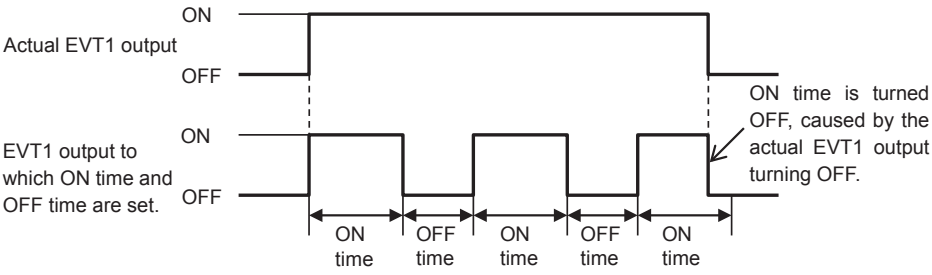
After 'Cleansing inactive interval' has elapsed, EVT1 output is turned ON during the configured 'Cleansing time'.

After 'Standby after Cleansing' has passed, this action is repeated.



(Fig. 7.5-4)



Character	Setting Item, Function, Setting Range	Factory Default
48 000	EVT1 value <ul style="list-style-type: none"> • Sets EVT1 value. • Not available for this setting item and all subsequent items if (No action), <i>Γ cRP</i> (Sensor cap replacement timer), <i>4ELF</i> (Self-check output), or <i>cLEU</i> (Cleansing output) is selected in [EVT1 type]. • Setting range: DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa 	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa
d1 F 1 4d1 F	EVT1 hysteresis type <ul style="list-style-type: none"> • Selects EVT1 output hysteresis type (Medium or Reference Value). • Not available if <i>d0HL</i> (DO concentration input High/Low limits independent action), <i>Γ nHL</i> (Water temperature input High/Low limits independent action), <i>d4HL</i> (DO % saturation input High/Low limits independent action) or <i>ΓPHL</i> (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type]. • <i>c d1 F</i>: Medium Value Sets the same value for both ON and OFF sides in relation to EVT1 value. Only ON side needs to be set. • <i>4d1 F</i>: 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. 	Reference Value
dF0 1 00 1	EVT1 ON side <ul style="list-style-type: none"> • Sets the span of EVT1 ON side. If <i>c d1 F</i> (Medium Value) is selected in [EVT1 hysteresis type], the span of ON/OFF side will be the same value. • Not available if <i>d0HL</i> (DO concentration input High/Low limits independent action), <i>Γ nHL</i> (Water temperature input High/Low limits independent action), <i>d4HL</i> (DO % saturation input High/Low limits independent action) or <i>ΓPHL</i> (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa 	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa
dFU 1 00 1	EVT1 OFF side <ul style="list-style-type: none"> • Sets the span of EVT1 OFF side. • Not available if <i>c d1 F</i> (Medium Value) is selected in [EVT1 hysteresis type]. • Setting range: DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa 	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa

Character	Setting Item, Function, Setting Range	Factory Default
onF 1 □□□□	EVT1 ON delay time • Sets EVT1 ON delay time. The EVT1 output does not turn ON (under the conditions of turning ON) until the time set in [EVT1 ON delay time] elapses. • Setting range: 0 to 9999 seconds	0 seconds
off 1 □□□□	EVT1 OFF delay time • Sets EVT1 OFF delay time. The EVT1 output does not turn OFF (under the conditions of turning OFF) until the time set in [EVT1 OFF delay time] elapses. • Setting range: 0 to 9999 seconds	0 seconds
oon 1 □□□□	Output ON time when EVT1 output ON • 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. 7.5-5) • Setting range: 0 to 9999 seconds	0 seconds
oof 1 □□□□	Output OFF time when EVT1 output ON • 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. 7.5-5) • Setting range: 0 to 9999 seconds • Timing chart (Output ON time and OFF time when EVT1 output is ON)  ON time OFF time ON time OFF time ON time (Fig. 7.5-5)	0 seconds
E_L 1 □□□□	EVT1 High/Low limits independent lower side value • Sets the lower side value of EVT1 High/Low limits independent action. • Available when <i>doHL</i> (DO concentration input High/Low limits independent action), <i>t nHL</i> (Water temperature input High/Low limits independent action), <i>d%HL</i> (DO % saturation input High/Low limits independent action) or <i>oPHL</i> (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type]. • Setting range: DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa

Character	Setting Item, Function, Setting Range	Factory Default
E_H1 0.00	EVT1 High/Low limits independent upper side value	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa
	<ul style="list-style-type: none"> Sets the upper side value of EVT1 High/Low limits independent action. Setting range: DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa 	
E_H1 0.01	EVT1 hysteresis	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa
	<ul style="list-style-type: none"> Sets hysteresis of EVT1 High/Low limits independent action. Setting range: DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa 	

7.6 EVT2 Action Group

To enter EVT2 Action Group, follow the procedure below.

- ① *E.H.F.2* Press the  key 5 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F.2* Press the  key.

The unit proceeds to EVT2 Action Group, and "EVT2 type" appears.

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



Substitute EVT1 with EVT2 (/ with 2), and refer to EVT1 Action Group (pp. 26 to 30).

(e.g.) *E.F.F.1* → *E.F.F.2*
48.1 → *48.2*

7.7 EVT3 Action Group

Available when EVT□ output (EVT option) is ordered.

To enter EVT3 Action Group, follow the procedure below.

- ① *E.H.F.3* Press the  key 6 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F.3* Press the  key.

The unit proceeds to EVT3 Action Group, and "EVT3 type" appears.

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



Substitute EVT1 with EVT3 (/ with 3), and refer to EVT1 Action Group (pp. 26 to 30).

(e.g.) *E.F.F.1* → *E.F.F.3*
48.1 → *48.3*

7.8 EVT4 Action Group

Available when EVT□ output (EVT option) is ordered.

To enter EVT4 Action Group, follow the procedure below.

- ① *E.H.F.4* Press the  key 7 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F.4* Press the  key.

The unit proceeds to EVT4 Action Group, and "EVT4 type" appears.

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



Substitute EVT1 with EVT4 (/ with 4), and refer to EVT1 Action Group (pp. 26 to 30).

(e.g.) *E.F.F.1* → *E.F.F.4*
48.1 → *48.4*

7.9 EVT5 Action Group

Available when EVT□ output (EVT option) is ordered.

To enter the EVT5 Action Group, follow the procedure below.

- ① *E.H.F.5* Press the  key 8 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F.5* Press the  key.

The unit proceeds to EVT5 Action Group, and "EVT5 type" appears.

Action, indication condition and setting range of EVT5 Action Group are the same as those of EVT1 Action Group.



Substitute EVT1 with EVT5 (/ with 5), and refer to EVT1 Action Group (pp. 26 to 30).

(e.g.) *E.F.F.1* → *E.F.F.5*
48.1 → *48.5*

7.10 EVT6 Action Group

Available when EVT□ output (EVT option) is ordered.

To enter the EVT6 Action Group, follow the procedure below.

- ① *E.H.F.6* Press the  key 9 times in Display Mode or Cleansing Output Mode.
- ② *E.F.F.6* Press the  key.

The unit proceeds to EVT6 Action Group, and "EVT6 type" appears.




Action, indication condition and setting range of EVT6 Action Group are the same as those of EVT1 Action Group.

Substitute EVT1 with EVT6 (/ with 6), and refer to EVT1 Action Group (pp. 26 to 30).

(e.g.) *E.F.F.1* → *E.F.F.6*
48.1 → *48.6*

7.11 Communication Group




To enter the Communication Group, follow the procedure below.

- ① $\overline{c0\overline{h\overline{h}}}$ Press the  key 6 times in Display Mode or Cleansing Output Mode.
If EVT \square output (EVT option) is ordered, press the  key 10 times in Display Mode or Cleansing Output Mode.
- ② $\overline{c\overline{h\overline{L}}}$ Press the  key.
The unit enters the Communication Group, and “Communication protocol” will appear.

Character	Setting Item, Function, Setting Range	Factory Default
$\overline{c\overline{h\overline{L}}}$ $\overline{h0\overline{h\overline{L}}}$	Communication protocol • Selects the communication protocol. • $\overline{h0\overline{h\overline{L}}}$: Shinko protocol $\overline{h0dA}$: MODBUS ASCII mode $\overline{h0dR}$: MODBUS RTU mode	Shinko protocol
$\overline{c\overline{h\overline{00}}}$ $\overline{0000}$	Instrument number • Sets the instrument number. (The instrument numbers should be set one by one when multiple instruments are connected.) • Setting range: 0 to 95	0
$\overline{c\overline{h\overline{P}}}$ $\overline{0096}$	Communication speed • Selects a communication speed equal to that of the host computer. • $\overline{0096}$: 9600 bps $\overline{0192}$: 19200 bps $\overline{0384}$: 38400 bps	9600 bps
$\overline{c\overline{h\overline{F\overline{F}}}}$ $\overline{7E\overline{h\overline{n}}}$	Data bit/Parity • Selects data bit and parity. • $\overline{8h00n}$: 8 bits/No parity $\overline{7h00n}$: 7 bits/No parity $\overline{8E\overline{h\overline{n}}}$: 8 bits/Even $\overline{7E\overline{h\overline{n}}}$: 7 bits/Even $\overline{8odd}$: 8 bits/Odd $\overline{7odd}$: 7 bits/Odd	7 bits/Even
$\overline{c\overline{h\overline{L\overline{F}}}}$ $\overline{0001}$	Stop bit • Selects the stop bit. • $\overline{0001}$: 1 bit $\overline{0002}$: 2 bits	1 bit

7.12 Cleansing Group

To enter the Cleansing Group, follow the procedure below.

- ① **CLE** Press the  key 7 times in Display Mode or Cleansing Output Mode.
If EVT□ output (EVT option) is ordered, press the  key 11 times in Display Mode or Cleansing Output Mode.
- ② **CLF** Press the  key.
The unit enters the Cleansing Group, and “Cleansing time” will appear.

Character	Setting Item, Function, Setting Range	Factory Default
CLF □□30	Cleansing time • Sets the time to perform cleansing. (Fig. 7.12-1) • Setting range: 10 to 120 seconds	30 seconds
CLCY OFF□	Cleansing inactive interval • Sets the cleansing inactive interval. (Fig. 7.12-1) • Setting range: OFF□ (None), 10 to 240 minutes	OFF (None)
CLIF □□0	Standby after cleansing • Sets standby time after cleansing action. (Fig. 7.12-1) • Setting range: 0 to 60 seconds	0 seconds

• Cleansing Function

The selected EVT output is turned ON during ‘cleansing time’ after ‘Cleansing inactive interval’ has elapsed.

After ‘Standby after cleansing’ has passed, the above action is repeated.

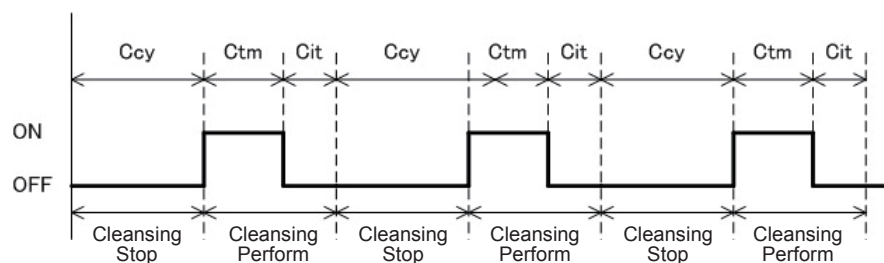
While cleansing action is performing using ‘Cleansing time’ and ‘Standby after cleansing’, other outputs are in OFF status.

Measured value (DO concentration, DO % saturation, Oxygen partial pressure, Water temperature) will be retained.

Normal programmed action will be performed, except during Cleansing Perform action.

If the power is turned on again, starts from ‘Cleansing inactive interval’.

Cleansing Output Action






Ccy: Cleansing inactive interval
Ctm: Cleansing time
Cit: Standby after cleansing










(Fig. 7.12-1)

- If **CLE** (Cleansing output) is selected in any other [EVT type] during cleansing action, the current setting values (Cleansing time, Standby after cleansing, Cleansing inactive interval) will be used for the selected cleansing output.
If cleansing action (caused by cleansing cycle) is activated in calibration mode, cleansing action will not be performed in the current session.
- If **OFF** (None) is selected in [Cleansing inactive interval], or if any item except **CLE** (Cleansing output) is selected in [EVT type], Cleansing Output Mode will end, and the unit will revert to Display Mode.

7.13 Basic Function Group

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

- ① *Off* Press the  key 8 times in Display Mode or Cleansing Output Mode.
If EVT□ output (EVT option) is ordered, press the  key 12 times in Display Mode or Cleansing Output Mode.
- ② *Lock* Press the  key.
The unit enters the Basic Function Group, and the “Set value lock” will appear.

Character	Setting Item, Function, Setting Range	Factory Default
<i>Lock</i> 	Set value lock <ul style="list-style-type: none"> • Locks the set values to prevent setting errors. •  (Unlock): All set values can be changed. <i>Loc 1</i> (Lock 1): None of the set values can be changed. <i>Loc 2</i> (Lock 2): Only EVT1 to EVT6 values can be changed. <i>Loc 3</i> (Lock 3): All set values can be temporarily changed. <p>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, EVT5, EVT6 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.)</p>	Unlock
<i>LI OF</i> 	Auto-light function <ul style="list-style-type: none"> • Selects Auto-light Enabled/Disabled. •  Disabled <i>U4E</i>: Enabled 	Disabled
<i>FI NE</i> <i>0000</i>	Indication time <ul style="list-style-type: none"> • Sets the indication time of the displays after the last key operation until displays turn off while in Display Mode or Cleansing Output Mode. Displays remain lit when set to 00.00. Displays light up when any key is pressed while in unlit status. • Setting range: 00.00 (Remains lit.) 00.01 to 60.00 (Minutes.Seconds) 	00.00 (Remains lit)
<i>I Err</i> <i>OFF</i> 	EVT output when input errors occur <ul style="list-style-type: none"> • If input errors occur, 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 the following type is selected in [EVT□ type]: <i>do_H</i> (DO concentration input high limit action) <i>do_L</i> (DO concentration input low limit action) <i>wt_H</i> (Water temperature input high limit action) <i>wt_L</i> (Water temperature input low limit action) <i>do%_H</i> (DO % saturation input high limit action) <i>do%_L</i> (DO % saturation input low limit action) <i>o2p_H</i> (Oxygen partial pressure input high limit action) <i>o2p_L</i> (Oxygen partial pressure input low limit action) • Selection item: <i>on</i> : Enabled <i>off</i> : Disabled 	Disabled
<i>48</i>  <i>365</i> 	EVT1 value <ul style="list-style-type: none"> • Sets EVT1 value (Sensor cap replacement timer). Available when <i>rcRP</i> (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 1095 days 	365 days




Character	Setting Item, Function, Setting Range	Factory Default
onF1 □□□0	EVT1 ON delay time • Sets EVT1 ON delay time. The EVT1 output does not turn ON after the input value exceeds the EVT1 (Sensor cap replacement timer) value until the time set in [EVT1 ON delay time] elapses. • Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 9999 seconds	0 seconds
oFF1 □□□0	EVT1 OFF delay time • Sets EVT1 OFF delay time. The EVT1 output does not turn OFF after the input value exceeds the EVT1 (Sensor cap replacement timer) value until the time set in [EVT1 OFF delay time] elapses. • Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 9999 seconds	0 seconds
482□ □365	EVT2 value • Sets EVT2 value (Sensor cap replacement timer). Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 1095 days	365 days
onF2 □□□0	EVT2 ON delay time • Sets EVT2 ON delay time. The EVT2 output does not turn ON after the input value exceeds the EVT2 (Sensor cap replacement timer) value until the time set in [EVT2 ON delay time] elapses. • Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 9999 seconds	0 seconds
oFF2 □□□0	EVT2 OFF delay time • Sets EVT2 OFF delay time. The EVT2 output does not turn OFF after the input value exceeds the EVT2 (Sensor cap replacement timer) value until the time set in [EVT2 OFF delay time] elapses. • Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 9999 seconds	0 seconds
483□ □365	EVT3 value • Sets EVT3 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT3 type]. • Setting range: 0 to 1095 days	365 days
onF3 □□□0	EVT3 ON delay time • Sets EVT3 ON delay time. The EVT3 output does not turn ON after the input value exceeds the EVT3 (Sensor cap replacement timer) value until the time set in [EVT3 ON delay time] elapses. • Available when EVT□ output (EVT option) is ordered. Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT3 type]. • Setting range: 0 to 9999 seconds	0 seconds
oFF3 □□□0	EVT3 OFF delay time • Sets EVT3 OFF delay time. The EVT3 output does not turn OFF after the input value exceeds the EVT3 (Sensor cap replacement timer) value until the time set in [EVT3 OFF delay time] elapses. • Available when EVT□ output (EVT option) is ordered. Available when Γ CRP (Sensor cap replacement timer) is selected in [EVT3 type]. • Setting range: 0 to 9999 seconds	0 seconds

Character	Setting Item, Function, Setting Range	Factory Default
484 365	EVT4 value <ul style="list-style-type: none"> • Sets EVT4 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT4 type]. • Setting range: 0 to 1095 days 	365 days
on4 000	EVT4 ON delay time <ul style="list-style-type: none"> • Sets EVT4 ON delay time. <p>The EVT4 output does not turn ON after the input value exceeds the EVT4 (Sensor cap replacement timer) value until the time set in [EVT4 ON delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT4 type]. • Setting range: 0 to 9999 seconds 	0 seconds
off4 000	EVT4 OFF delay time <ul style="list-style-type: none"> • Sets EVT4 OFF delay time. <p>The EVT4 output does not turn OFF after the input value exceeds the EVT4 (Sensor cap replacement timer) value until the time set in [EVT4 OFF delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT4 type]. • Setting range: 0 to 9999 seconds 	0 seconds
485 365	EVT5 value <ul style="list-style-type: none"> • Sets EVT5 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT5 type]. • Setting range: 0 to 1095 days 	365 days
on5 000	EVT5 ON delay time <ul style="list-style-type: none"> • Sets EVT5 ON delay time. <p>The EVT5 output does not turn ON after the input value exceeds the EVT5 (Sensor cap replacement timer) value until the time set in [EVT5 ON delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT5 type]. • Setting range: 0 to 9999 seconds 	0 seconds
off5 000	EVT5 OFF delay time <ul style="list-style-type: none"> • Sets EVT5 OFF delay time. <p>The EVT5 output does not turn OFF after the input value exceeds the EVT5 (Sensor cap replacement timer) value until the time set in [EVT5 OFF delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT5 type]. • Setting range: 0 to 9999 seconds 	0 seconds


Character	Setting Item, Function, Setting Range	Factory Default
486□ □365	EVT6 value <ul style="list-style-type: none"> • Sets EVT6 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 1095 days 	365 days
onT6 □□□0	EVT6 ON delay time <ul style="list-style-type: none"> • Sets EVT6 ON delay time. <p>The EVT6 output does not turn ON after the input value exceeds the EVT6 (Sensor cap replacement timer) value until the time set in [EVT6 ON delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 9999 seconds 	0 seconds
oFF6 □□□0	EVT6 OFF delay time <ul style="list-style-type: none"> • Sets EVT6 OFF delay time. <p>The EVT6 output does not turn OFF after the input value exceeds the EVT6 (Sensor cap replacement timer) value until the time set in [EVT6 OFF delay time] elapses.</p> <ul style="list-style-type: none"> • Available when EVT□ output (EVT option) is ordered. Available when ΓCAP (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 9999 seconds 	0 seconds
rETr □365	Sensor cap replacement timer remainder <ul style="list-style-type: none"> • Indicates the remaining time of the sensor cap replacement timer. • Setting range: 0 to 1095 days 	365 days

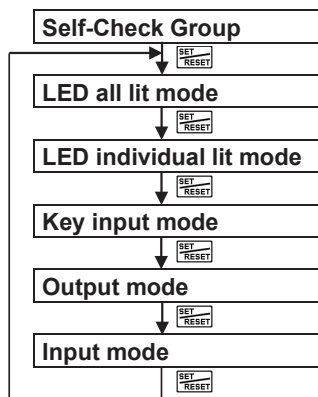
7.14 Self-Check Group

To enter the Self-Check Group, follow the procedure below.









- ① **4.E.L.F** Press the  key 9 times in Display Mode or Cleansing Output Mode.
If EVT output (EVT option) is ordered, press the  key 13 times in Display Mode or Cleansing Output Mode.
- ② **8.8.8.8** Press the  key.
The unit enters the Self-Check Group, and “LED all lit mode” will appear.

Every time the  key is pressed, modes progress as follows.

If the  key is held down for approx. 3 seconds in any setting mode, the unit will revert to the Display Mode or Cleansing Output Mode.



Following is a description of each mode.

Mode	Description		
LED all lit mode	All indications light up. All displays and action indicators light up.		
LED individual lit mode	Each segment lights up sequentially every 0.5 seconds, in a cycle, as shown below. 1 → 2 → → 11 → 1		
	Order	Contents	
	1		'a' segment of DO Display, Temperature Display
	2		'b' segment of DO Display, Temperature Display
	3		'c' segment of DO Display, Temperature Display
	4		'd' segment of DO Display, Temperature Display
	5		'e' segment of DO Display, Temperature Display
	6		'f' segment of DO Display, Temperature Display
	7		'g' segment of DO Display, Temperature Display
	8		'dp' segment of DO Display, Temperature Display
	9	A1	A1 indicator
	10	A2	A2 indicator
11	T/R	T/R indicator	

Mode	Description																				
Key input mode	Characters allocated to each key are indicated. The DO Display indicates <i>LEU</i> , and the Temperature Display indicates the following characters. If 2 or more keys are pressed simultaneously, <i>db</i> will be indicated.																				
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:50%;">Temperature Display</th> <th style="width:50%;">Key Input</th> </tr> </thead> <tbody> <tr> <td><i>nonE</i></td> <td>When no key is pressed</td> </tr> <tr> <td><i>UP</i></td> <td>When the key is pressed</td> </tr> <tr> <td><i>down</i></td> <td>When the key is pressed</td> </tr> <tr> <td><i>db</i></td> <td>When 2 or more keys are pressed simultaneously</td> </tr> </tbody> </table>	Temperature Display	Key Input	<i>nonE</i>	When no key is pressed	<i>UP</i>	When the key is pressed	<i>down</i>	When the key is pressed	<i>db</i>	When 2 or more keys are pressed simultaneously										
	Temperature Display	Key Input																			
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<i>down</i>	When the key is pressed																				
<i>db</i>	When 2 or more keys are pressed simultaneously																				
Output mode	Each EVT output is turned ON. Transmission output 1 and 2 output 20 mA DC. The DO Display indicates <i>oUf</i> , and the Temperature Display indicates the following characters. Every time the key is pressed, each output is turned ON sequentially after being checked.																				
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<i>Tr o 2</i>	Transmission output 2: 20 mA DC																				
Input mode	Indicates each input. Every time the key is pressed, input checking is performed, and the DO Display indicates corresponding input characters, and the Temperature Display indicates corresponding measured value.																				
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If a communication error has occurred, or if the DO Sensor is not connected, the Temperature Display indicates <i>Err 1</i> . If the DO Sensor cap is not attached, or it is incorrectly attached, the Temperature Display indicates <i>Err 2</i> . Sensor cap serial number consists of 6 digits. Since Temperature Display of this instrument has 4 digits, the DO Display indicates upper 2 figures, and the Temperature Display indicates the remaining 4 digits. (e.g.) When serial number is 123456, it is alternately indicated as follows. <div style="text-align: center; margin-top: 10px;"> <table style="border: none; margin: auto;"> <tr> <td style="padding-right: 10px;"><i>ncAP</i></td> <td style="padding-right: 10px;">←→</td> <td style="padding-right: 10px;"><i>12</i></td> <td style="padding-right: 10px;">↔</td> <td><i>3456</i></td> </tr> <tr> <td style="padding-right: 10px;"><i>0000</i></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> </div>	<i>ncAP</i>	←→	<i>12</i>	↔	<i>3456</i>	<i>0000</i>															
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<i>0000</i>																					

7.15 Data Clear Group

To enter the Data Clear Group, follow the procedure below.

- ① \overline{cLr} Press the \overline{C} key 10 times in Display Mode or Cleansing Output Mode.
If EVT output (EVT option) is ordered, press the \overline{C} key 14 times in Display Mode or Cleansing Output Mode.

- ② $\overline{cL4L}$ Press the $\overline{SET/RESET}$ key.

The unit enters the Data Clear group, and the "Data clear selection" will appear.

Character	Setting Item, Function, Setting Range	Factory Default
$\overline{cL4L}$ \overline{cRL}	Data clear selection • Selects either Calibration value or Set value to clear. • \overline{cRL} : Calibration value $\overline{4Er}$: Set value	Calibration value
\overline{cLr} \overline{no}	Data clear Stop/Perform • Selects Data clear Stop/Perform. • \overline{no} : Data clear Stop $\overline{4E4}$: Data clear Perform	Data clear Stop

Depending on the selection in [Data clear Stop/Perform], the unit operates as shown below.

- **When 'Data clear Stop' is selected:**

Data clearing is not executed, and the unit returns to the mode prior to Data clear Stop (either Display Mode or Cleansing Output Mode).

- **When 'Data clear Perform' is selected:**

Data is cleared. The unit returns to the mode prior to Data clear Perform (either Display Mode or Cleansing Output Mode).

(While data is being cleared, all indications are momentarily unlit.)

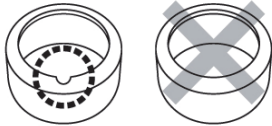
8. Calibration

The following are descriptions for DO concentration 1-point calibration mode, DO concentration 2-point calibration mode, Concentration option calibration mode, Transmission output 1 and 2 adjustment modes.

8.1 DO Concentration Calibration

8.1.1 Preparation

- (1) Clean the DO Sensor body and measurement section, and remove all moisture.
- (2) Remove the storage cap of the calibration container, and replace with a calibration cap (ventilating cap).



Calibration cap Storage cap
(Fig. 8.1.1-1)

- (3) Keep the water, used for DO Sensor and calibration, at room temperature for approx. 30 minutes.
- (4) Select a mode from Sections 8.1.2 (DO Concentration 1-point Calibration Mode), 8.1.3 (DO Concentration 2-point Calibration Mode), and 8.1.4 (Concentration Option Calibration Mode), and perform calibration.

8.1.2 DO Concentration 1-point Calibration Mode



Caution

- If salinity concentration has been previously corrected, return the salinity concentration correction value to 0 PSU, then start calibration.
Refer to [Salinity correction (p.23)].
If calibration is performed with previously corrected salinity concentration, an error will occur, or calibration will not be performed normally.
- When using a sensor in geographically high elevation sites, perform altitude correction for accurate calibration, then start calibration.
Refer to [Altitude correction (p.23)].

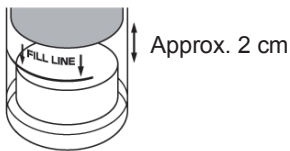
The unit cannot enter DO concentration 1-point calibration mode in the following cases.

- When $L O C 1$ (Lock 1), $L O C 2$ (Lock 2) or $L O C 3$ (Lock 3) is selected in [Set value lock (p.34)]
- When $C L E C$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and while cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'
- When the following errors have occurred.

Error Code	Description
$E r r 0$	Non-volatile IC memory error
$E r r 1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.
$E r r 2$	DO Sensor cap is not attached, or it is incorrectly attached.

The following outlines calibration procedure.

- (1) Pour approx. 10 mL of ion-exchanged water into the calibration container sponge.
- (2) Insert the DO Sensor into the calibration container until the measurement section of the sensor is situated approximately 2 cm away from the sponge.





(Fig. 8.1.2-1)

- (3) Allow it to settle, undisturbed, for 5 to 10 minutes.




Caution

- Do not leave the sensor attached to the calibration container for more than 30 minutes. This will result in dew condensation in measurement section, which will affect measurement value. If dew condensation has occurred, remove the moisture from the measurement section, then start calibration again.

- (4) Press and hold the  and  key (in that order) together for approx. 3 seconds in Display Mode or Cleansing Output Mode.


The unit moves to DO concentration 1-point calibration mode, and indicates the following.

Display	Indication Contents
DO Display	DO concentration measured value
Temperature Display	

- (5) Press the  key.

1-point calibration (100% saturation calibration) starts.


During calibration, the measurement value on the DO Display flashes.

Display	Indication Contents
DO Display	DO concentration measured value flashes.
Temperature Display	

- (6) Press the  key.

The measured value will be fixed, and automatic calibration will be performed.

After calibration is finished, Displays show the following.



Display	Indication Contents
DO Display	<i>cRL</i> 
Temperature Display	<i>Good</i>

1-point calibration (100% saturation calibration) is completed.

- (7) Press the  key.

The unit returns to DO concentration 1-point calibration mode.

If calibration cannot be performed during 1-point calibration (100% saturation calibration) due to unstable DO concentration input or temperature correction error, etc., the DO Display turns off, and the Temperature Display indicates *Err3*.

To release the error code, press the  or  key.

8.1.3 DO Concentration 2-point Calibration Mode

Caution

- When using a sensor in geographically high elevation sites, perform altitude correction for accurate calibration, then start calibration.
Refer to [Altitude correction (p.23)].

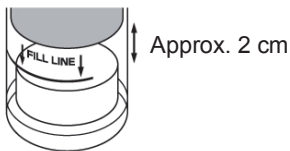
The unit cannot enter DO concentration 2-point calibration mode in the following cases.

- When $L O C 1$ (Lock 1), $L O C 2$ (Lock 2) or $L O C 3$ (Lock 3) is selected in [Set value lock (p.34)]
- When $c L E U$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and while cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'.
- When the following errors have occurred

Error Code	Description
$E r r 0$	Non-volatile IC memory error
$E r r 1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.
$E r r 2$	DO Sensor cap is not attached, or it is incorrectly attached.

The following outlines calibration procedure.

- (1) Pour approx. 10 mL of ion-exchanged water into the calibration container sponge.
- (2) Insert the DO Sensor into the calibration container until the measurement section of the sensor is situated approximately 2 cm away from the sponge.






(Fig. 8.1.3-1)


- (3) Allow it to settle, undisturbed, for 5 to 10 minutes.


Caution

- Do not leave the sensor attached to the calibration container for more than 30 minutes. This will result in dew condensation in measurement section, which will affect measurement value. If dew condensation has occurred, remove the moisture from the measurement section, then start calibration again.

- (4) Press and hold the  and  key (in that order) together for approx. 3 seconds in Display Mode or Cleansing Output Mode.
- (5) Press the  key.


The unit moves to DO concentration 2-point calibration mode, and indicates the following.

Display	Indication Contents
DO Display	DO concentration measured value
Temperature Display	

(6) Press the  key.

1st-point calibration (100% saturation calibration) starts.

During calibration, the measurement value on the DO Display flashes.

Display	Indication Contents
DO Display	DO concentration measured value flashes.
Temperature Display	

(7) Press the  key.

The measured value will be fixed, and automatic calibration will be performed.

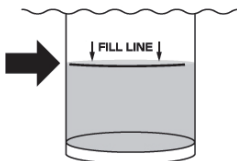
After 1st-point calibration (100% saturation calibration) is finished, Displays show the following.

Display	Indication Contents
DO Display	<i>cAL</i>
Temperature Display	<i>nEWT</i>

(8) Prepare a Zero standard solution.


Zero standard solution is 100 mL of ion-exchanged water into which 5 g or more of sodium sulfite has been added and completely dissolved.

(9) Take out the calibration container sponge used for 1st-point calibration, and pour the Zero standard solution into the calibration container up to the Fill Line.




(Fig. 8.1.3-2)

(10) Insert the temperature sensor of the DO Sensor until it is immersed in the prepared Zero standard solution.

 **Caution**


- Insert the measurement section so that approximately 1 cm of gap is left between it and the bottom of the calibration container.
- Insert the measurement section so that air bubbles cannot attach to it.

(11) Allow it to settle, undisturbed, for at least 5 minutes to stabilize the temperature.

(12) Press the  key.

2nd-point calibration (0-point calibration) starts.

During calibration, the measurement value on the DO Display flashes.

Display	Indication Contents
DO Display	DO concentration measured value flashes.
Temperature Display	

(13) Press the  key.

The measured value will be fixed, and automatic calibration will be performed.

After 2nd-point calibration (0-point calibration) is finished, Displays show the following.



Display	Indication Contents
DO Display	<i>cAL</i>
Temperature Display	<i>Good</i>

2-point calibration (both 100% saturation calibration and 0-point calibration) is completed.

(14) Press the  key.

The unit returns to DO concentration 2-point calibration mode.

If calibration cannot be performed during DO concentration 2-point calibration due to unstable DO concentration input or temperature correction error, etc., the DO Display turns off, and the Temperature Display indicates *Err 3*.

To release the error code, press the  or  key.

8.1.4 Concentration Option Calibration Mode

Immerse the DO Sensor in an aqueous solution (of which DO concentration is known), then the measurement value can be matched to the concentration.

Factory default value: 0.00 mg/L

DO concentration can be set within a range of 0.00 to 20.00 mg/L.

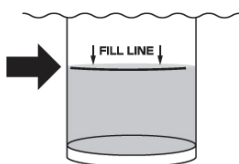
The unit cannot enter Concentration option calibration mode in the following cases.

- When *Loc 1* (Lock 1), *Loc 2* (Lock 2) or *Loc 3* (Lock 3) is selected in [Set value lock (p.34)]
- When *cLE* (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and while cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'.
- When the following errors have occurred.

Error Code	Description
<i>Err 0</i>	Non-volatile IC memory error
<i>Err 1</i>	DO Sensor communication errors have occurred, or DO Sensor is not connected.
<i>Err 2</i>	DO Sensor cap is not attached, or it is incorrectly attached.

The following outlines calibration procedure (Setting to a concentration of 7.77 mg/L).

(1) Pour the already-known concentration solution into the calibration container up to the Fill Line.






(Fig. 8.1.4-1)

(2) Insert the temperature sensor of the DO Sensor until it is immersed in the poured solution.






Caution


- Insert the measurement section so that approximately 1 cm of gap is left between it and the bottom of the calibration container.
- Insert the measurement section without air bubbles being attached.


- (3) Allow it to settle, undisturbed, for at least 5 minutes to stabilize the temperature.
- (4) Press and hold the  and  key (in that order) together for approx. 3 seconds in Display Mode or Cleansing Output Mode.
- (5) Press the  key twice.


The unit moves to Concentration option calibration mode, and indicates the following.

Display	Indication Contents
DO Display	<i>cPdI</i>
Temperature Display	Concentration desired value



- (6) Set the concentration desired value (7.77) with the  or  key, and press the  key. The following will be indicated.

Display	Indication Contents
DO Display	DO concentration measured value flashes.
Temperature Display	



- (7) Press the  key. The measured value will be fixed, and calibration will be performed. If concentration option calibration is finished, Displays show the following.

Display	Indication Contents
DO Display	<i>cRL</i> 
Temperature Display	<i>Good</i>

Concentration option calibration is completed.

- (8) Press the  key. The unit reverts to Concentration option calibration mode.
- (9) Press the  key. The unit reverts to Display Mode or Cleansing Output Mode.

If errors occur during concentration option calibration, the DO Display will turn off, and the Temperature Display will indicate *Err3*.

To release the error code, press the  or  key.

8.2 Transmission Output 1 Adjustment Mode

Fine adjustment of Transmission output 1 is performed.



The WIL-102-DO is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and output value of this instrument.

In this case, perform Transmission output 1 Zero adjustment and Span adjustment.

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



- When $L O C 1$ (Lock 1), $L O C 2$ (Lock 2) or $L O C 3$ (Lock 3) is selected in [Set value lock (p.34)]
- When $C L E C$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'
- During DO concentration calibration

The following outlines the procedure for Transmission output 1 adjustment.

- (1) Press and hold the  and  key (in that order) together for approx. 3 seconds in Display Mode or Cleansing Output Mode.

- (2) The unit enters Transmission output 1 Zero adjustment mode, and indicates the following.

Display	Indication Contents
DO Display	$R U E 1$
Temperature Display	Transmission output 1 Zero adjustment value



- (3) Set Transmission output 1 Zero adjustment value with the  or  key, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: $\pm 5.00\%$ of Transmission output 1 span

- (4) Press the  key.

The unit enters Transmission output 1 Span adjustment mode, and indicates the following.

Display	Indication Contents
DO Display	$R U 4 1$
Temperature Display	Transmission output 1 Span adjustment value

- (5) Set Transmission output 1 Span adjustment value with the  or  key, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: $\pm 5.00\%$ of Transmission output 1 span

Transmission output 1 adjustment is completed.

- (6) Press the  key.

The unit reverts to Display Mode or Cleansing Output Mode.

8.3 Transmission Output 2 Adjustment Mode

Fine adjustment of Transmission output 2 is performed.



The WIL-102-DO is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and output value of this instrument.

In this case, perform Transmission output 2 Zero adjustment and Span adjustment.

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



- When $L O C 1$ (Lock 1), $L O C 2$ (Lock 2) or $L O C 3$ (Lock 3) is selected in [Set value lock (p.34)]
- When $C L E C$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'
- During DO concentration calibration

The following outlines the procedure for Transmission output 2 adjustment.


- (1) Press and hold the  and  key (in that order) together for approx. 3 seconds in Display Mode or Cleansing Output Mode.

- (2) The unit enters Transmission output 2 Zero adjustment mode, and indicates the following.

Display	Indication Contents
DO Display	$R U E 2$
Temperature Display	Transmission output 2 Zero adjustment value



- (3) Set Transmission output 2 Zero adjustment value with the  or  key, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: $\pm 5.00\%$ of Transmission output 2 span

- (4) Press the  key.

The unit enters Transmission output 2 Span adjustment mode, and indicates the following.

Display	Indication Contents
DO Display	$R U 4 2$
Temperature Display	Transmission output 2 Span adjustment value

- (5) Set Transmission output 2 Span adjustment value with the  or  key, while viewing the value indicated on the connected equipment (recorders, etc.).

Setting range: $\pm 5.00\%$ of Transmission output 2 span

Transmission output 2 adjustment is completed.

- (6) Press the  key.

The unit reverts to Display Mode or Cleansing Output Mode.

9. Measurement

9.1 Starting Measurement

For approx. 8 seconds after the power is switched ON, the following characters are indicated on the DO Display and Temperature Display.

Display	Indication Contents
DO Display	do□□
Temperature Display	□□.□□ [Version number (e.g.) 1.00]

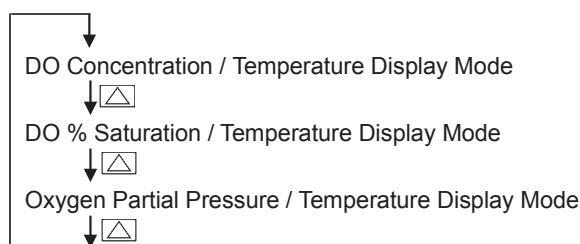
During this time, all outputs are in OFF status, and action indicators except the PWR indicator turn off.

After that, measurement starts, indicating DO concentration on the DO Display, and the measured temperature on the Temperature Display.

This status is called Display Mode or Cleansing Output Mode.

Switching Between Modes

Every time the  key is pressed, modes on the DO Display progress as follows.



9.2 Outside Measurement Range

If DO concentration, DO % saturation, Oxygen partial pressure or temperature is outside the range, the following will be indicated.

Input	DO Display	Temperature Display
DO concentration	Flashes at 20.00 or 0.00.	Measured value
DO % saturation	Flashes at 200.0 or 0.0.	Measured value
Oxygen partial pressure	Flashes at 150.0 or 0.0.	Measured value
Temperature	Measured value	Flashes at 50.0 or 0.0.

9.3 Error Code

When the following errors occur, the DO Display turns off, and the Temperature Display indicates corresponding error code.

Error Code	Description	Occurrence
Err0	Non-volatile IC memory error	Constantly
Err1	DO Sensor communication errors have occurred, or DO Sensor is not connected. After a command is sent to the DO Sensor, if there is no response for 500 ms, the command will be sent again. If no response occurs 4 times consecutively, this error code will be indicated. If communication status returns to normal, the error will be released, and the unit will automatically return to normal status. When this error code is indicated, the previous measured value is retained.	When measuring and calibrating
Err2	DO Sensor cap is not attached, or it is incorrectly attached.	
Err3	Calibration error (If input errors have occurred, or if calibration cannot be performed 30 minutes after starting calibration)	When calibrating
Err4	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.	When measuring and calibrating

9.4 About Transmission Output 1 and 2

Converting DO concentration, water temperature, DO % saturation, or Oxygen partial pressure to analog signal every update cycle via communication, and outputs in current.

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

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

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

For the following errors, Transmission output 1 or 2 will output 2 mA DC.

Error Code	Description
Err1	DO Sensor communication error, or DO Sensor is not connected.
Err2	DO Sensor cap is not attached, or it is incorrectly attached.
Err3	Calibration error (If input errors have occurred, or if calibration cannot be performed 30 minutes after starting calibration)

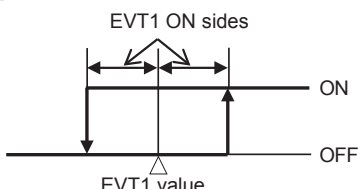
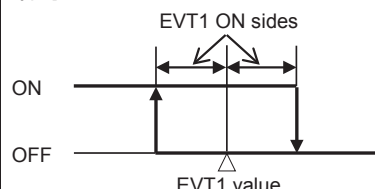
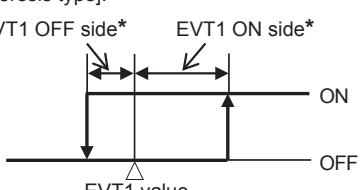
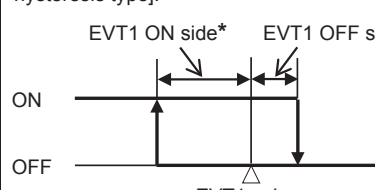
9.5 EVT1 to EVT6 Outputs

When any one of the following actions is selected in [EVT1 type (p.26)], it will perform as (Fig. 9.5-1).

do_H (DO concentration input high limit action), do_L (DO concentration input low limit action), wt_H (Water temperature input high limit action), wt_L (Water temperature input low limit action), ds_H (DO % saturation input high limit action), ds_L (DO % saturation input low limit action), opr_H (Oxygen partial pressure input high limit action), opr_L (Oxygen partial pressure input low limit action)

The same applies to EVT2, EVT3, EVT4, EVT5 and EVT6.

• EVT1 Action (Activated based on the indication value)

DO concentration input high limit Water temperature input high limit DO % saturation input high limit Oxygen partial pressure input high limit	DO concentration input low limit Water temperature input low limit DO % saturation input low limit Oxygen partial pressure input low limit
When measurement value is higher than EVT1 value, EVT1 output is turned ON. When measurement value is lower than EVT1 value, EVT1 output is turned OFF.	When measurement value is lower than EVT1 value, EVT1 output is turned ON. When measurement value is higher than EVT1 value, EVT1 output is turned OFF.
If Medium Value is selected in [EVT1 hysteresis type]: 	If Medium Value is selected in [EVT1 hysteresis type]: 
If Reference Value is selected in [EVT1 hysteresis type]: EVT1 OFF side* EVT1 ON side* 	If Reference Value is selected in [EVT1 hysteresis type]: EVT1 ON side* EVT1 OFF side* 

(Fig. 9.5-1)

*** Setting Example:**

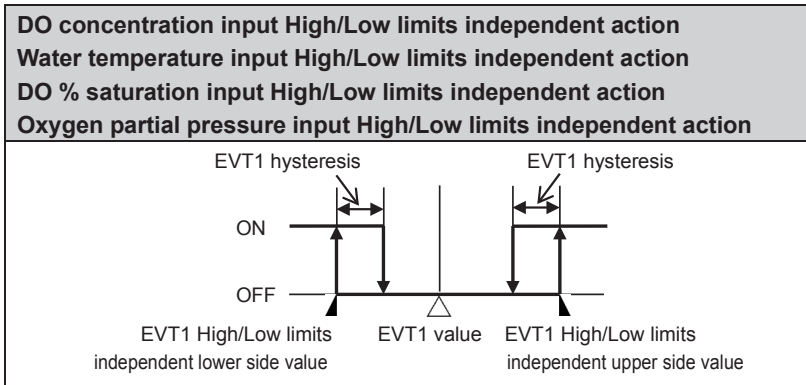
If [EVT1 ON side (dFo l)] is set to 0, EVT1 output can be turned ON at the value set in [EVT1 value (4B)].

If [EVT1 OFF side (dFu l)] is set to 0, EVT1 output can be turned OFF at the value set in [EVT1 value (4B)].

When any one of the following actions is selected in [EVT1 type (p.26)], it will perform as (Fig. 9.5-2).

- $d\bar{o}HL$ (DO concentration input High/Low limits independent action),
- $f\bar{r}HL$ (Water temperature input High/Low limits independent action),
- $d\%HL$ (DO % saturation input High/Low limits independent action),
- $\bar{o}PHL$ (Oxygen partial pressure input High/Low limits independent action)

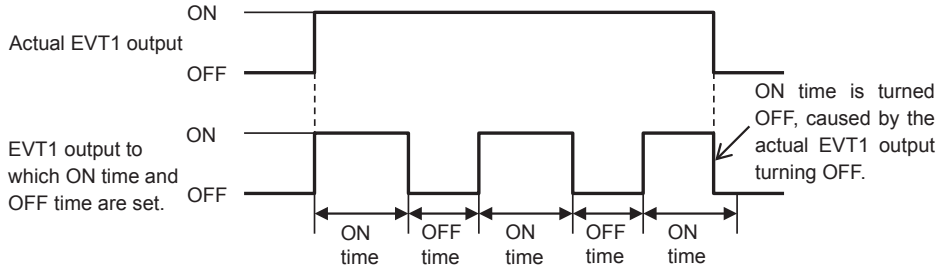
The same applies to EVT2, EVT3, EVT4, EVT5 and EVT6.



(Fig. 9.5-2)

When 'Output ON time and OFF time when EVT1 Output is ON' are set, the following action is performed.

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



(Fig. 9.5-3)

EVT output status can be read by reading Status flag 2 (EVT1 to EVT6 output flag bit) in Serial communication.

EVT output status, when input errors occur, differs depending on the selection in [EVT output when input errors occur (p.34)].

- If $\bar{o}FF$ (Disabled) is selected: EVT output is turned OFF when input errors occur.
- If $\bar{o}n$ (Enabled) is selected: EVT output is maintained when input errors occur.

9.6 Sensor Cap Replacement Timer Output

When $\overline{r} \underline{c} \overline{R} \overline{P}$ (Sensor cap replacement timer output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], the unit operates as follows.

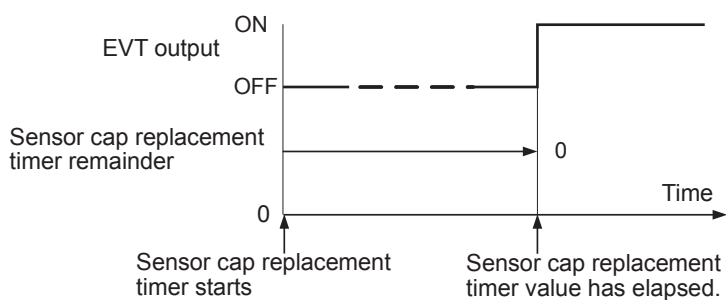
- (1) If Sensor cap replacement timer value has elapsed (when Sensor cap replacement timer remainder is "0"), the selected EVT output will be turned ON. (*1)

The DO Display indicates DO concentration measured value and $\overline{r} \underline{c} \overline{R} \overline{P}$ alternately, informing the user to replace the sensor cap. (*2)

- (2) Replace the sensor cap.

After replacing the sensor cap, this unit automatically resets the Sensor cap replacement remainder to the Sensor cap replacement timer value.

Sensor Cap Replacement Timer Output



(Fig. 9.6-1)

(*1) Even if power to this instrument is turned OFF and ON, EVT output remains ON until the sensor cap is replaced.

(*2) After Sensor cap replacement timer value has elapsed, and if Outside measurement range error has occurred simultaneously, $\overline{r} \underline{c} \overline{R} \overline{P}$ and the Outside measurement range value will be displayed alternately.

9.7 Cleansing Output

If $\square L E \square$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], the unit will enter Cleansing Output Mode.

After 'Cleansing inactive interval' has elapsed, the selected EVT output is turned ON during the 'Cleansing time'.

After 'Standby after cleansing' has passed, the above action is repeated.

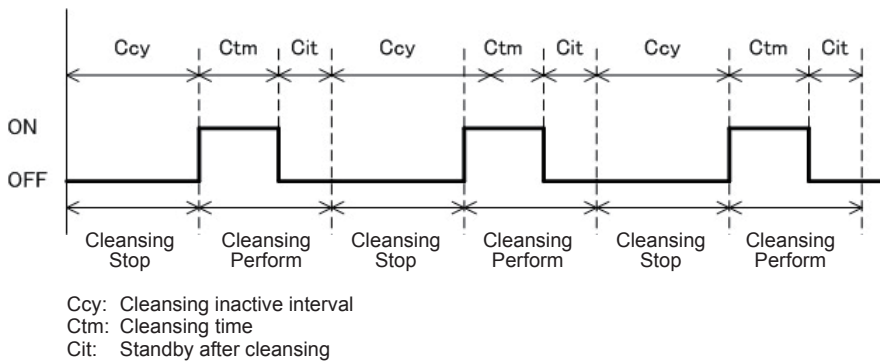
While cleansing is being performed using 'Cleansing time' and 'Standby after cleansing', other outputs are in OFF status.

Measured values (DO concentration, DO % saturation, Oxygen partial pressure, water temperature) are retained.

Normal programmed action will be performed, except during 'Cleansing Perform'.

When power is turned ON again, starts from 'Cleansing inactive interval'.

• Cleansing Output Action



(Fig. 9.7-1)


• If $\square L E \square$ (Cleansing output) is selected in any other [EVT type] during cleansing action, the current setting values (Cleansing time, Cleansing inactive interval, Standby after cleansing) will be used for the selected cleansing output.

If cleansing action (caused by cleansing cycle) is activated in calibration mode, cleansing action will not be performed in the current session.

• If $\square F F \square$ (None) is selected in [Cleansing inactive interval], or if any item except $\square L E \square$ (Cleansing output) is selected in [EVT1 to EVT6 types (pp. 26, 31)], Cleansing Output Mode will end, and the unit will revert to Display Mode.

If $\square L E \square$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and if $\square F F \square$ (None) is selected in [Cleansing inactive interval], only Forced cleansing mode will be enabled.

9.8 Forced Cleansing Mode

By pressing the  key for approx. 3 seconds, the unit enters Forced cleansing mode.

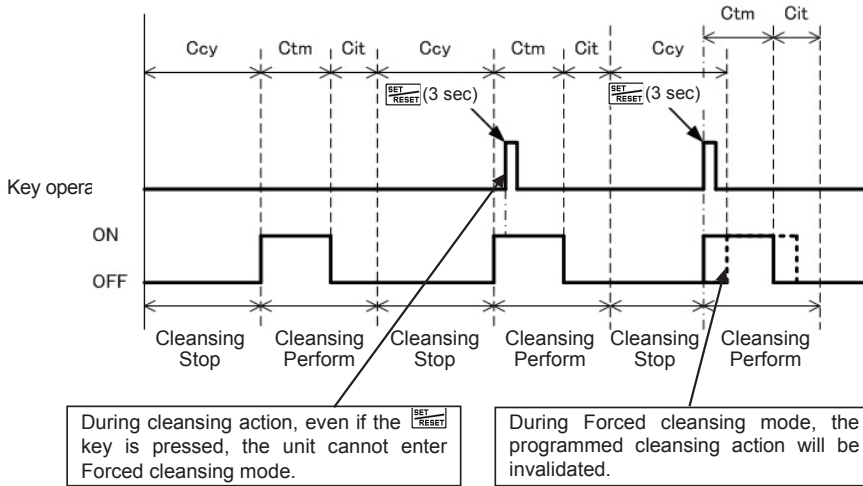
In Forced cleansing mode, cleansing is performed using 'Cleansing time' and 'Standby after cleansing'.

After cleansing action is finished, the unit automatically reverts to Cleansing Output Mode.

This mode will not be accessible by the  key if programmed cleansing is currently being performed.

During Forced cleansing mode, if programmed cleansing action initiates after 'Cleansing inactive interval' has passed, the programmed cleansing action will not be performed in the current session.

• Forced Cleansing Mode Action



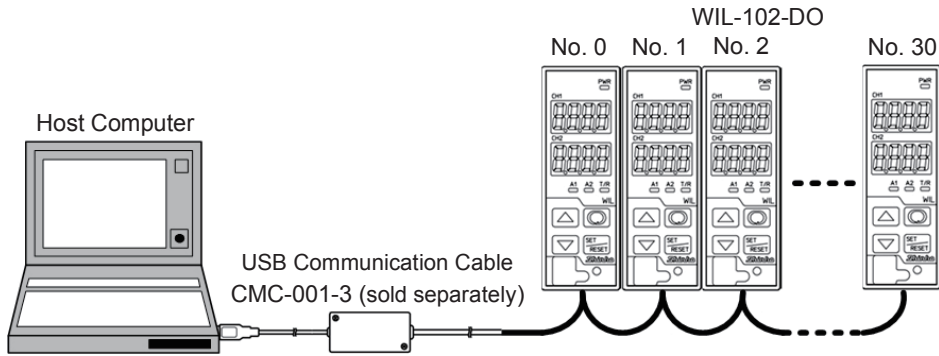
Ccy: Cleansing inactive interval
 Ctm: Cleansing time
 Cit: Standby after cleansing

(Fig. 9.8-1)

10. Communication

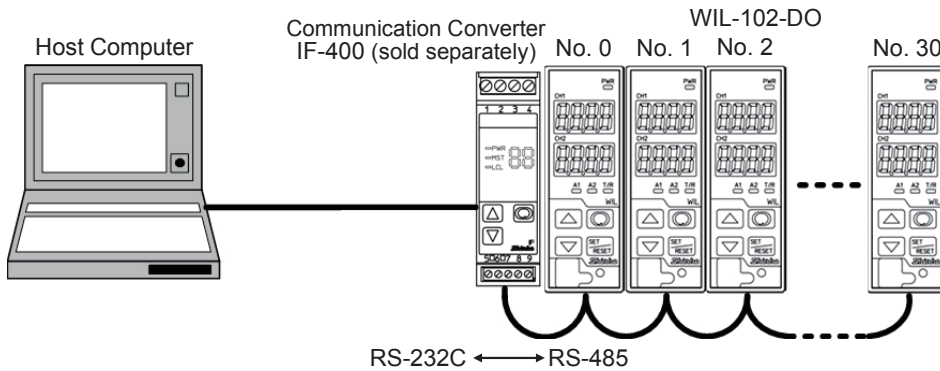
10.1 System Configuration Example

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



(Fig. 10.1-1)

- When using the Communication Converter IF-400 (sold separately)









(Fig. 10.1-2)

10.2 Setting Method of the Instrument

Communication parameters can be set in the Communication Group.

To enter the Communication Group, follow the procedure below.

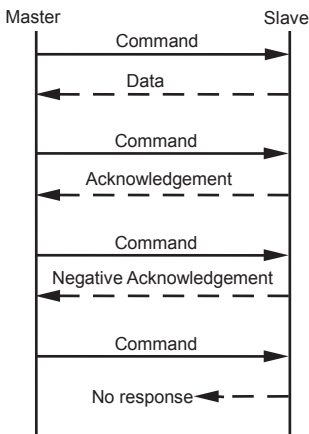
- ① $\text{c}\bar{\text{a}}\bar{\text{r}}\bar{\text{r}}$ Press the  key 6 times in Display Mode or Cleansing Output Mode.
If EVT□ output (EVT option) is ordered, press the  key 10 times in Display Mode or Cleansing Output Mode.
- ② $\text{c}\bar{\text{r}}\bar{\text{r}}\bar{\text{L}}$ Press the  key.
The unit enters Communication Group, and 'Communication protocol' will appear.
- ③ Set each item. (Use the  or  key for settings, and register the value with the  key.)

Character	Setting Item, Function, Setting Range	Factory Default
$\text{c}\bar{\text{r}}\bar{\text{r}}\bar{\text{L}}$ $\text{r}\bar{\text{o}}\bar{\text{r}}\bar{\text{L}}$	Communication protocol • Selects communication protocol. • $\text{r}\bar{\text{o}}\bar{\text{r}}\bar{\text{L}}$: Shinko protocol $\bar{\text{n}}\bar{\text{o}}\bar{\text{d}}\bar{\text{A}}$: MODBUS ASCII mode $\bar{\text{n}}\bar{\text{o}}\bar{\text{d}}\bar{\text{r}}$: MODBUS RTU mode	Shinko protocol
$\text{c}\bar{\text{r}}\bar{\text{n}}\bar{\text{o}}$ $\square\square\square 0$	Instrument number • Sets the instrument number. The instrument numbers should be set one by one when multiple instruments are connected in Serial communication, otherwise communication is impossible. • Setting range: 0 to 95	0
$\text{c}\bar{\text{r}}\bar{\text{r}}\bar{\text{P}}$ $\square\square 96$	Communication speed • Selects a communication speed equal to that of the host computer. • $\square\square 96$: 9600 bps $\square 192$: 19200 bps $\square 384$: 38400 bps	9600 bps
$\text{c}\bar{\text{r}}\bar{\text{r}}\bar{\text{r}}$ $\bar{\text{r}}\bar{\text{E}}\bar{\text{B}}\bar{\text{n}}$	Data bit/Parity • Selects data bit and parity. • $\bar{\text{B}}\bar{\text{n}}\bar{\text{o}}\bar{\text{n}}$: 8 bits/No parity $\bar{\text{r}}\bar{\text{n}}\bar{\text{o}}\bar{\text{n}}$: 7 bits/No parity $\bar{\text{B}}\bar{\text{E}}\bar{\text{B}}\bar{\text{n}}$: 8 bits/Even $\bar{\text{r}}\bar{\text{E}}\bar{\text{B}}\bar{\text{n}}$: 7 bits/Even $\bar{\text{B}}\bar{\text{o}}\bar{\text{d}}\bar{\text{d}}$: 8 bits/Odd $\bar{\text{r}}\bar{\text{o}}\bar{\text{d}}\bar{\text{d}}$: 7 bits/Odd	7 bits/Even
$\text{c}\bar{\text{r}}\bar{\text{r}}\bar{\text{r}}$ $\square\square\square 1$	Stop bit • Selects the stop bit. • $\square\square\square 1$: 1 bit $\square\square\square 2$: 2 bits	1 bit

- ④ Press the  key several times. The unit reverts to Display Mode or Cleansing Output Mode.

10.3 Communication Procedure

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



(Fig.10.3-1)

• Response with Data

When the master sends the reading command, the slave responds with the corresponding set value or current status.

• Acknowledgement

When the master sends the setting command, the slave responds by sending acknowledgement after the processing is terminated.

• Negative Acknowledgement

When the master sends a non-existent command or value out of the setting range, the slave returns a negative acknowledgement.

• No Response

The slave will not respond to the master in the following cases:

- Global address (Shinko protocol) is set.
- Broadcast address (MODBUS protocol) is set.
- Communication error (framing error, parity error)
- Checksum error (Shinko protocol), LRC discrepancy (MODBUS ASCII mode), CRC-16 discrepancy (MODBUS RTU mode)

Communication Timing of the RS-485

Master Side (Take note while programming)

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

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

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

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

Slave Side

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

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

10.4 Shinko Protocol

10.4.1 Transmission Mode

Shinko protocol is composed of ASCII.

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

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

Error detection: Checksum

10.4.2 Command Configuration

All commands are composed of ASCII.

The data (set value, decimal number) is represented by hexadecimal numbers.

The negative numbers are represented in 2's complement.

Numerals written below the command represent the number of characters.

(1) Setting Command

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

(2) Reading Command

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

(3) Response with Data

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

(4) Acknowledgement

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

(5) Negative Acknowledgement

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

Header: Control code to represent the beginning of the command or the response.

ASCII codes are used.

Setting command, Reading command: STX (02H) fixed.

Response with data, Acknowledgement: ACK (06H) fixed.

Negative acknowledgement: NAK (15H) fixed.

Instrument Number (Address): Numbers by which the master discerns each slave.

Instrument number 0 to 94 and Global address 95.

ASCII codes (20H to 7FH) are used by adding 20H to instrument numbers 0 to 95 (00H to 5FH).

95 (7FH) is called Global address, which is used when the same command is sent to all the slaves connected. However, the response is not returned.

Sub Address: 20H fixed.

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

Data Item: Classification of the command object.

Composed of 4-digit hexadecimal numbers, using ASCII.

Refer to "10.6. Communication Command Table". (pp. 64 to 72)

- Data:** The contents of data (set value) differ depending on the setting command.
Composed of 4-digit hexadecimal numbers, using ASCII.
Refer to "10.6. Communication Command Table". (pp. 64 to 72)
- Checksum:** 2-character data to detect communication errors.
Refer to "10.4.3 Checksum Calculation".
- Delimiter:** Control code to represent the end of command.
ASCII code ETX (03H) fixed.
- Error Code:** Represents an error type using ASCII.
 - 1 (31H)-----Non-existent command
 - 2 (32H)-----Not used
 - 3 (33H)-----Value outside the setting range
 - 4 (34H)-----Status unable to be set (e.g. During calibration)
 - 5 (35H)-----During setting mode by keypad operation

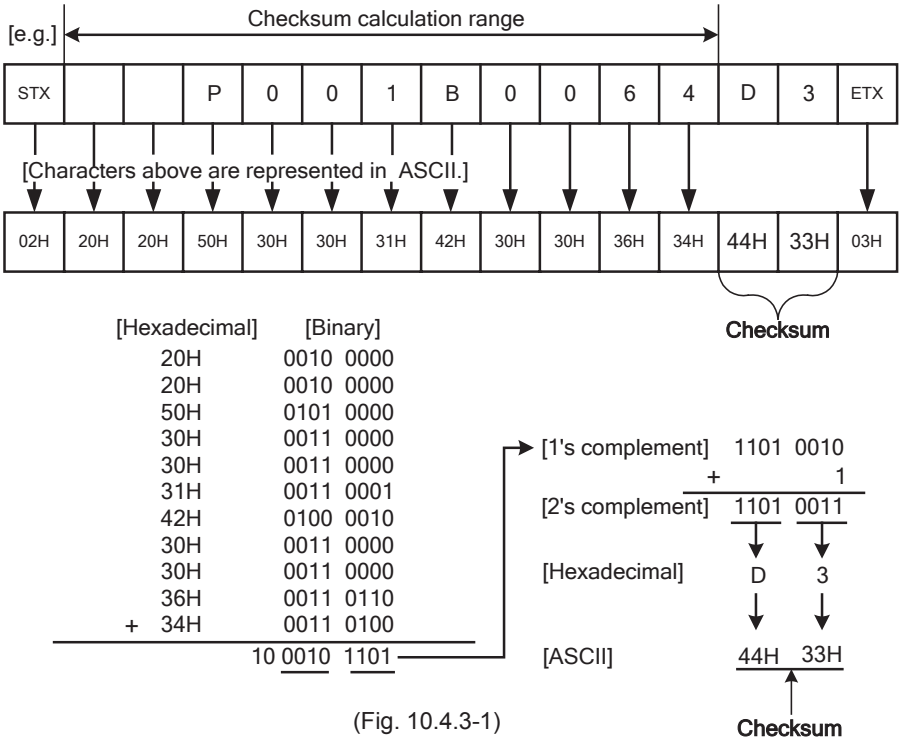
10.4.3 Checksum Calculation

Checksum is used to detect receiving errors in the command or data.
Set the program for the master side as well to calculate the checksum of the response data from the slaves so that communication errors can be checked.
The ASCII code (hexadecimal) corresponding to the characters which range from the address to that before the checksum is converted to binary notation, and the total value is calculated.
The lower one byte of the total value is converted to 2's complement, and then to hexadecimal numbers, that is, ASCII code for the checksum.

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

Checksum Calculation Example

Data item 001BH (EVT1 ON delay time): 100 seconds (0064H)
Address (instrument number): 0 (20H)



10.5 MODBUS Protocol

10.5.1 Transmission Mode

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

ASCII Mode

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

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

Error detection : LRC (Longitudinal Redundancy Check)

RTU Mode

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

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

Error detection: CRC-16 (Cyclic Redundancy Check)

10.5.2 Data Communication Interval

ASCII Mode

Max.1 second of interval between ASCII mode characters

RTU Mode

Communication speed 9600 bps, 19200 bps:

To transmit continuously, an interval between characters which consist of one message, must be within 1.5-character transmission times.

Communication speed 38400 bps:

To transmit continuously, an interval between characters which consist of one message, must be within 750 μ s.

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

10.5.3 Message Configuration

ASCII Mode

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

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

RTU Mode

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

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

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

(1) Slave Address

Slave address is an individual instrument number on the slave side, and is set within the range 0 to 95 (00H to 5FH). The master identifies slaves by the slave address of the requested message.

The slave informs the master which slave is responding to the master by placing its own address in the response message.

Slave address 00H (Broadcast address) can identify all the slaves connected. However, slaves do not respond.

(2) Function Code

The function code is the command code for the slave to undertake one of the following actions.

(Table 10.5.3-1)

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

The Function code is used to discern whether the response is normal (acknowledgement) or if any error (negative acknowledgement) has occurred when the slave returns the response message to the master.

When acknowledgement is returned, the slave simply returns the original function code.

When negative acknowledgement is returned, the MSB of the original function code is set as 1 for the response.

(For example, if the master sends request message setting 10H to the function code by mistake, slave returns 90H by setting the MSB to 1, because the former is an illegal function.)

For negative acknowledgement, the exception codes below are set to the data of the response message, and returned to the master in order to inform it of what kind of error has occurred. (Table 10.5.3-2)

(Table 10.5.3-2)

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

(3) Data

Data differs depending on the function code.

A request message from the master is composed of a data item, amount of data and setting data.

A response message from the slave is composed of the byte count, data and exception codes in negative acknowledgements.

The effective range of data is -32768 to 32767 (8000H to 7FFFH).

(4) Error Check

ASCII Mode

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

How to calculate LRC

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

RTU Mode

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

How to calculate CRC-16

In the CRC-16 system, the information is divided by the polynomial series. The remainder is added to the end of the information and transmitted. The generation of a polynomial series is as follows.

(Generation of polynomial series: $X^{16} + X^{15} + X^2 + 1$)

- ① Initialize the CRC-16 data (assumed as X) (FFFFH).
- ② Calculate exclusive OR (XOR) with the 1st data and X. This is assumed as X.
- ③ Shift X one bit to the right. This is assumed as X.
- ④ When a carry is generated as a result of the shift, XOR is calculated by X of ③ and the fixed value (A001H). This is assumed as X. If a carry is not generated, go to step ⑤.
- ⑤ Repeat steps ③ and ④ until shifting 8 times.
- ⑥ XOR is calculated with the next data and X. This is assumed as X.
- ⑦ Repeat steps ③ to ⑤.
- ⑧ Repeat steps ③ to ⑤ up to the final data.
- ⑨ Set X as CRC-16 to the end of message in sequence from low order to high order.

10.5.4 Message Example

ASCII Mode

Numerals written below the command represent the number of characters.

① Reading [Slave address 1, Data item 0080H (DO concentration)]

- A request message from the master

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

Header	Slave address	Function code	Data item	Amount of data	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)	[0080H] (30H 30H 38H 30H)	[0001H] (30H 30H 30H 31H)	(37H 42H)	(0DH 0AH)
1	2	2	4	4	2	2

- Response message from the slave in normal status [When DO concentration is 1.00 mg/L (0064H)]
The response byte count means the byte count of data which have been read. It is fixed as (30H 32H).

Header	Slave address	Function code	Response byte count	Data	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)	[02H] (30H 32H)	[0064H] (30H 30H 36H 34H)	(39H 36H)	(0DH 0AH)
1	2	2	2	4	2	2

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

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

② Setting [Slave address 1, Data item 001BH (EVT1 ON delay time)]

- A request message from the master [When EVT1 ON delay time is set to 100 seconds (0064H)]

Header	Slave address	Function code	Data item	Data	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	[001BH] (30H 30H 31H 42H)	[0064H] (30H 30H 36H 34H)	(44H 45H)	(0DH 0AH)
1	2	2	4	4	2	2

- Response message from the slave in normal status

Header	Slave address	Function code	Data item	Data	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	[001BH] (30H 30H 31H 42H)	[0064H] (30H 30H 36H 34H)	(44H 45H)	(0DH 0AH)
1	2	2	4	4	2	2

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

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

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

RTU Mode

Numerals written below the command represent number of characters.

① Reading [Slave address 1, Data item 0080H (DO concentration)]

- A request message from the master

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

3.5 idle characters	Slave address (01H)	Function code (03H)	Data item (0080H)	Amount of data (0001H)	Error check CRC-16 (85E2H)	3.5 idle characters
	1	1	2	2	2	

- Response message from the slave in normal status [When DO concentration is 1.00 mg/L (0064H)]

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

3.5 idle characters	Slave address (01H)	Function code (03H)	Response byte count (02H)	Data (0064H)	Error check CRC-16 (B9AFH)	3.5 idle characters
	1	1	1	2	2	

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

The function code MSB is set to 1 for the response message in exception (error) status (83H is returned).

The exception code (02H: Non-existent data address) is returned (error).

3.5 idle characters	Slave address (01H)	Function code (83H)	Exception code (02H)	Error check CRC-16 (C0F1H)	3.5 idle characters
	1	1	1	2	

② Setting (Slave address 1, Data item 001BH (EVT1 ON delay time))

- A request message from the master [When EVT1 ON delay time is set to 100 seconds (0064H)]

3.5 idle characters	Slave address (01H)	Function code (06H)	Data item (001BH)	Data (0064H)	Error check CRC-16 (F826H)	3.5 idle characters
	1	1	2	2	2	

- Response message from the slave in normal status

3.5 idle characters	Slave address (01H)	Function code (06H)	Data item (001BH)	Data (0064H)	Error check CRC-16 (F826H)	3.5 idle characters
	1	1	2	2	2	

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

The function code MSB is set to 1 for the response message in exception (error) status (86H is returned.).

The exception code (03H: Value out of the setting range) is returned (error).

3.5 idle characters	Slave address (01H)	Function code (86H)	Exception code (03H)	Error check CRC-16 (0261H)	3.5 idle characters
	1	1	1	2	

10.6 Communication Command Table

10.6.1 Notes about Setting/Reading Command

- The data (set value, decimal) is converted to hexadecimal numbers.
Negative numbers are represented in 2's complement.
- When connecting multiple slaves, the address (instrument number) must not be duplicated.
- Data items 0200H to 0209H (User save area 1 to 10) can be read or set in 1 word units.
Effective range of data is -32768 to 32767 (8000H to 7FFFH).
- MODBUS protocol uses Holding Register addresses. The Holding Register addresses are created as follows. A Shinko command data item is converted to decimal number, and the offset of 40001 is added. The result is the Holding Register address.
Using Data item 0001H (Signal output response time) as an example: Data item in the sending message is 0001H, however, MODBUS protocol Holding Register address is 40002 (1 + 40001).
- Even if EVT□ output (EVT option) is not ordered, setting or reading via software communication will be possible. However, EVT3 to EVT6 command contents will not function.

(1) Setting Command

- Up to 1,000,000 (one million) entries can be stored in non-volatile IC memory.
If the number of settings exceeds the limit, the data will not be saved. So, do not change the set values 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.)
- Be sure to select Lock 3 when changing the set value frequently via software communication. If Lock 3 is selected, all set 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, EVT5, EVT6 types). If they are changed, they will affect other setting items.
- Setting range of each item is the same as that of keypad operation.
- When the data (set value) has a decimal point, a whole number (hexadecimal) without a decimal point is used.
- If EVT type is changed in [EVT1 type] to [EVT6 type], EVT1 to EVT6 value will default to 0 (zero). The output status of EVT1 to EVT6 will also be initialized.
- Settings via software communication are possible while in Set value lock status.
- Communication parameters such as Instrument Number, Communication Speed of the slave cannot be set by software communication. They can only be set via the keypad. (p.56)
- When sending a command by Global address [95 (7FH), Shinko protocol] or Broadcast address [(00H), MODBUS protocol], the same command is sent to all the slaves connected. However, the response is not returned.

(2) Reading Command

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

10.6.2 Setting/Reading Command

Shinko Command Type	MODBUS Function Code	Data Item	Data
50H/20H	06H/03H	0001H Signal output response time	Set value (1 to 120) '1' corresponds to 5 seconds, and '120' corresponds to 600 seconds.
50H/20H	06H/03H	0003H Salinity correction	Set value
50H/20H	06H/03H	0004H Altitude correction	Set value
50H	06H	0005H DO concentration calibration mode	0000H: Display Mode 0001H: DO concentration 1-point calibration mode 0002H: DO concentration 2-point calibration mode 0003H: Concentration option calibration mode
50H	06H	0006H DO concentration calibration start	DO concentration 1-point calibration: 0000H: DO concentration 1-point calibration mode 0001H: 1-point calibration (100% saturation calibration) start 0003H: Measured value fixed DO concentration 2-point calibration: 0000H: DO concentration 2-point calibration mode 0001H: 1 st -point calibration (100% saturation calibration) start 0002H: 2 nd -point calibration (0-point calibration) start 0003H: Measured value fixed Concentration option calibration: 0000H: Concentration option calibration mode 0001H: Concentration option calibration start 0003H: Measured value fixed
50H/20H	06H/03H	0007H Concentration desired value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0008H Transmission output 1 type	0000H: DO concentration transmission 0001H: Water temperature transmission 0002H: DO % saturation transmission 0003H: Oxygen partial pressure transmission
50H/20H	06H/03H	0009H Transmission output 1 high limit	Set value (Decimal point ignored.)
50H/20H	06H/03H	000AH Transmission output 1 low limit	Set value (Decimal point ignored.)
50H/20H	06H/03H	000BH Transmission output 2 type	0000H: DO concentration transmission 0001H: Water temperature transmission 0002H: DO % saturation transmission 0003H: Oxygen partial pressure transmission
50H/20H	06H/03H	000CH Transmission output 2 high limit	Set value (Decimal point ignored.)
50H/20H	06H/03H	000DH Transmission output 2 low limit	Set value (Decimal point ignored.)
50H	06H	000EH Transmission output 1 adjustment mode	0000H: Display Mode 0001H: Transmission output 1 Zero adjustment mode 0002H: Transmission output 1 Span adjustment mode
50H/20H	06H/03H	000FH Transmission output 1 Zero adjustment value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0010H Transmission output 1 Span adjustment value	Set value (Decimal point ignored.)

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H	06H	0011H	Transmission output 2 adjustment mode	0000H: Display Mode 0001H: Transmission output 2 Zero adjustment mode 0002H: Transmission output 2 Span adjustment mode
50H/20H	06H/03H	0012H	Transmission output 2 Zero adjustment value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0013H	Transmission output 2 Span adjustment value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0014H	EVT1 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action
50H/20H	06H/03H	0015H	EVT1 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0018H	EVT1 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0019H	EVT1 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	001AH	EVT1 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	001BH	EVT1 ON delay time	Set value
50H/20H	06H/03H	001CH	EVT1 OFF delay time	Set value
50H/20H	06H/03H	0020H	Output ON Time when EVT1 Output ON	Set value
50H/20H	06H/03H	0021H	Output OFF Time when EVT1 Output ON	Set value
50H/20H	06H/03H	0022H	EVT2 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	0023H	EVT2 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0026H	EVT2 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0027H	EVT2 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0028H	EVT2 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0029H	EVT2 ON delay time	Set value
50H/20H	06H/03H	002AH	EVT2 OFF delay time	Set value
50H/20H	06H/03H	002EH	Output ON Time when EVT2 Output ON	Set value
50H/20H	06H/03H	002FH	Output OFF Time when EVT2 Output ON	Set value
50H/20H	06H/03H	0030H	EVT3 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action
50H/20H	06H/03H	0031H	EVT3 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0034H	EVT3 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0035H	EVT3 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0036H	EVT3 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0037H	EVT3 ON delay time	Set value
50H/20H	06H/03H	0038H	EVT3 OFF delay time	Set value
50H/20H	06H/03H	003CH	Output ON Time when EVT3 Output ON	Set value
50H/20H	06H/03H	003DH	Output OFF Time when EVT3 Output ON	Set value

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	003EH	EVT4 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action
50H/20H	06H/03H	003FH	EVT4 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0042H	EVT4 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0043H	EVT4 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0044H	EVT4 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0045H	EVT4 ON delay time	Set value
50H/20H	06H/03H	0046H	EVT4 OFF delay time	Set value
50H/20H	06H/03H	004AH	Output ON Time when EVT4 Output ON	Set value
50H/20H	06H/03H	004BH	Output OFF Time when EVT4 Output ON	Set value
50H/20H	06H/03H	004CH	EVT5 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action

Shinko Command Type	MODBUS Function Code	Data Item		Data
50H/20H	06H/03H	004DH	EVT5 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0050H	EVT5 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	0051H	EVT5 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0052H	EVT5 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0053H	EVT5 ON delay time	Set value
50H/20H	06H/03H	0054H	EVT5 OFF delay time	Set value
50H/20H	06H/03H	0058H	Output ON Time when EVT5 Output ON	Set value
50H/20H	06H/03H	0059H	Output OFF Time when EVT5 Output ON	Set value
50H/20H	06H/03H	005AH	EVT6 type	0000H: No action 0001H: DO concentration input high limit action 0002H: DO concentration input low limit action 0003H: Water temperature input high limit action 0004H: Water temperature input low limit action 0005H: DO % saturation input high limit action 0006H: DO % saturation input low limit action 0007H: Oxygen partial pressure input high limit action 0008H: Oxygen partial pressure input low limit action 0009H: Sensor cap replacement timer 000AH: Self-check output 000BH: Cleansing output 000CH: DO concentration input High/Low limits independent action 000DH: Water temperature input High/Low limits independent action 000EH: DO % saturation input High/Low limits independent action 000FH: Oxygen partial pressure input High/Low limits independent action
50H/20H	06H/03H	005BH	EVT6 value	Set value (Decimal point ignored.)
50H/20H	06H/03H	005EH	EVT6 hysteresis type	0000H: Medium Value 0001H: Reference Value
50H/20H	06H/03H	005FH	EVT6 ON side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0060H	EVT6 OFF side	Set value (Decimal point ignored.)
50H/20H	06H/03H	0061H	EVT6 ON delay time	Set value
50H/20H	06H/03H	0062H	EVT6 OFF delay time	Set value
50H/20H	06H/03H	0066H	Output ON Time when EVT6 Output ON	Set value
50H/20H	06H/03H	0067H	Output OFF Time when EVT6 Output ON	Set value
50H/20H	06H/03H	0068H	Cleansing time	Set value
50H/20H	06H/03H	0069H	Cleansing inactive interval	Set value
50H	06H	006AH	Forced cleansing mode	0001H: Forced cleansing mode
50H/20H	06H/03H	006BH	Set value lock	0000H: Unlock 0001H: Lock 1 0002H: Lock 2 0003H: Lock 3
50H/20H	06H/03H	006CH	Auto-light function	0000H: Disabled 0001H: Enabled
50H/20H	06H/03H	006DH	Indication time	Set value
50H/20H	06H/03H	0074H	EVT output when input errors occur	0000H: Enabled 0001H: Disabled

Shinko Command Type	MODBUS Function Code		Data Item	Data
50H/20H	06H/03H	0075H	Data clear selection	0000H: Calibration value 0001H: Set value
50H	06H	0076H	Data clear Stop/Perform	0000H: Data clear Stop 0001H: Data clear Perform
50H/20H	06H/03H	0077H	Standby after cleansing	Set value
50H	06H	007FH	Key operation change flag clearing	0001H: Clear change flag
50H/20H	06H/03H	0100H	EVT1 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0101H	EVT2 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0102H	EVT3 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0103H	EVT4 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0104H	EVT5 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0105H	EVT6 High/Low limits independent lower side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0106H	EVT1 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0107H	EVT2 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0108H	EVT3 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	0109H	EVT4 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	010AH	EVT5 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	010BH	EVT6 High/Low limits independent upper side value	Set value (Decimal point ignored.)
50H/20H	06H/03H	010CH	EVT1 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	010DH	EVT2 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	010EH	EVT3 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	010FH	EVT4 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	0110H	EVT5 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	0111H	EVT6 hysteresis	Set value (Decimal point ignored.)
50H/20H	06H/03H	0112H	Transmission output 1 status when calibrating	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0113H	Transmission output 1 value HOLD when calibrating	Set value (Decimal point ignored.)
50H/20H	06H/03H	0114H	Transmission output 2 status when calibrating	0000H: Last value HOLD 0001H: Set value HOLD 0002H: Measured value
50H/20H	06H/03H	0115H	Transmission output 2 value HOLD when calibrating	Set value (Decimal point ignored.)
50H/20H	06H/03H	0200H	User save area 1	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0201H	User save area 2	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0202H	User save area 3	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0203H	User save area 4	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0204H	User save area 5	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0205H	User save area 6	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0206H	User save area 7	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0207H	User save area 8	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0208H	User save area 9	-32768 to 32767 (8000H to 7FFFH)
50H/20H	06H/03H	0209H	User save area 10	-32768 to 32767 (8000H to 7FFFH)

10.6.3 Read Only Command

Shinko Command Type	MODBUS Function Code	Data Item	Data																															
20H	03H	0080H	DO concentration	DO concentration (Decimal point ignored.)																														
20H	03H	0081H	DO % saturation	DO % saturation (Decimal point ignored.)																														
20H	03H	0082H	Oxygen partial pressure	Oxygen partial pressure (Decimal point ignored.)																														
20H	03H	0083H	Status flag 1	<p>0000 0000 0000 0000 2^{15} to 2^0</p> <p>2^0 digit: Outside measurement range of DO concentration (high limit) 0: Normal 1: Error</p> <p>2^1 digit: Outside measurement range of DO concentration (low limit) 0: Normal 1: Error</p> <p>2^2 digit: Outside measurement range of DO % saturation (high limit) 0: Normal 1: Error</p> <p>2^3 digit: Outside measurement range of DO % saturation (low limit) 0: Normal 1: Error</p> <p>2^4 digit: Outside measurement range of Oxygen partial pressure (high limit) 0: Normal 1: Error</p> <p>2^5 digit: Outside measurement range of Oxygen partial pressure (low limit) 0: Normal 1: Error</p> <p>2^6 digit: Communication errors have occurred or DO Sensor is not connected. 0: Normal 1: Error</p> <p>2^7 digit: DO Sensor cap is not attached, or it is incorrectly attached. 0: Normal 1: Error</p> <p>2^8 digit: Calibration error 0: Normal 1: Error</p> <p>2^9 digit: Unit status flag 0: Display Mode 1: Setting mode</p> <p>2^{10}, 2^{11} digits: Calibration mode status flag</p> <table border="1"> <thead> <tr> <th>2^{11}</th> <th>2^{10}</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Display Mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>DO concentration 1-point calibration mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>DO concentration 2-point calibration mode</td> </tr> <tr> <td>1</td> <td>1</td> <td>Concentration option calibration mode</td> </tr> </tbody> </table> <p>2^{12}, 2^{13} digits: Calibration status flag</p> <table border="1"> <thead> <tr> <th>2^{13}</th> <th>2^{12}</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Standby</td> </tr> <tr> <td>0</td> <td>1</td> <td>During 1st-point calibration (100% saturation calibration)</td> </tr> <tr> <td>1</td> <td>0</td> <td>During 2nd-point calibration (0-point calibration)</td> </tr> <tr> <td>1</td> <td>1</td> <td>During concentration option calibration</td> </tr> </tbody> </table> <p>2^{14} digit: DO Sensor internal memory deletion 0: No 1: Yes</p> <p>2^{15} digit: Change in key operation 0: No 1: Yes</p>	2^{11}	2^{10}	Status	0	0	Display Mode	0	1	DO concentration 1-point calibration mode	1	0	DO concentration 2-point calibration mode	1	1	Concentration option calibration mode	2^{13}	2^{12}	Status	0	0	Standby	0	1	During 1 st -point calibration (100% saturation calibration)	1	0	During 2 nd -point calibration (0-point calibration)	1	1	During concentration option calibration
2^{11}	2^{10}	Status																																
0	0	Display Mode																																
0	1	DO concentration 1-point calibration mode																																
1	0	DO concentration 2-point calibration mode																																
1	1	Concentration option calibration mode																																
2^{13}	2^{12}	Status																																
0	0	Standby																																
0	1	During 1 st -point calibration (100% saturation calibration)																																
1	0	During 2 nd -point calibration (0-point calibration)																																
1	1	During concentration option calibration																																

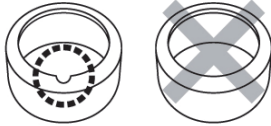
Shinko Command Type	MODBUS Function Code	Data Item	Data																																							
20H	03H	0090H	Temperature Temperature (Decimal point ignored.)																																							
20H	03H	0091H	Sensor cap replacement timer remainder Sensor cap replacement timer remaining time																																							
20H	03H	0093H	<p>Status flag 2 0000 0000 0000 0000 2¹⁵ to 2⁰</p> <p>2⁰ digit: Outside measurement range of temperature (high limit) 0: Normal 1: Error</p> <p>2¹ digit: Outside measurement range of temperature (low limit) 0: Normal 1: Error</p> <p>2² digit: EVT1 output 0: OFF 1: ON</p> <p>2³ digit: EVT2 output 0: OFF 1: ON</p> <p>2⁴ digit: EVT3 output 0: OFF 1: ON</p> <p>2⁵ digit: EVT4 output 0: OFF 1: ON</p> <p>2⁶ digit: EVT5 output 0: OFF 1: ON</p> <p>2⁷ digit: EVT6 output 0: OFF 1: ON</p> <p>2⁸, 2⁹ digits: Transmission output 1 adjustment status flag</p> <table border="1"> <thead> <tr> <th>2⁹</th> <th>2⁸</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Display Mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode</td> </tr> </tbody> </table> <p>2¹⁰, 2¹¹ digits: Transmission output 2 adjustment status flag</p> <table border="1"> <thead> <tr> <th>2¹¹</th> <th>2¹⁰</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Display Mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode</td> </tr> </tbody> </table> <p>2¹², 2¹³ digits: Cleansing status flag</p> <table border="1"> <thead> <tr> <th>2¹³</th> <th>2¹²</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Display Mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>During cleansing inactive interval</td> </tr> <tr> <td>1</td> <td>0</td> <td>During cleansing time</td> </tr> <tr> <td>1</td> <td>1</td> <td>During standby after cleansing</td> </tr> </tbody> </table> <p>2¹⁴, 2¹⁵ digits: Not used (Always 0)</p>	2 ⁹	2 ⁸	Status	0	0	Display Mode	0	1	During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode	1	0	During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode	2 ¹¹	2 ¹⁰	Status	0	0	Display Mode	0	1	During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode	1	0	During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode	2 ¹³	2 ¹²	Status	0	0	Display Mode	0	1	During cleansing inactive interval	1	0	During cleansing time	1	1	During standby after cleansing
2 ⁹	2 ⁸	Status																																								
0	0	Display Mode																																								
0	1	During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode																																								
1	0	During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode																																								
2 ¹¹	2 ¹⁰	Status																																								
0	0	Display Mode																																								
0	1	During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode																																								
1	0	During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode																																								
2 ¹³	2 ¹²	Status																																								
0	0	Display Mode																																								
0	1	During cleansing inactive interval																																								
1	0	During cleansing time																																								
1	1	During standby after cleansing																																								

10.7 DO Concentration Calibration by Communication Command

There are 3 calibration methods (like a key operation) for DO concentration calibration via communication:
DO concentration 1-point calibration mode, DO concentration 2-point calibration mode,
Concentration option calibration mode

10.7.1 Preparation

- (1) Clean the DO Sensor body and measurement section, and remove all moisture.
- (2) Remove the storage cap of the calibration container, and replace with a calibration cap (ventilating cap).



Calibration cap Storage cap

(Fig. 10.7.1-1)

- (3) Keep the water, used for DO Sensor and calibration, at room temperature for approx. 30 minutes.
- (4) Select a mode from Sections 10.7.2 (DO Concentration 1-point Calibration Mode), 10.7.3 (DO Concentration 2-point Calibration Mode) and 10.7.4 (Concentration Option Calibration Mode), and perform calibration.

10.7.2 DO Concentration 1-point Calibration Mode

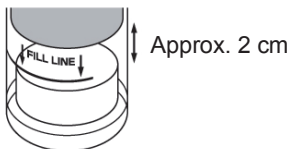


Caution

- If salinity concentration has been previously corrected, return the salinity concentration correction value to 0 PSU, then start calibration.
[Data item 0003H (Salinity correction)]
If calibration is performed with previously corrected salinity concentration, an error will occur, or calibration will not be performed normally.
- When using a sensor in geographically high elevation sites, perform altitude correction for accurate calibration, then start calibration.
[Data item 0004H (Altitude correction)]

The following outlines calibration procedure.

- (1) Pour approx. 10 mL of ion-exchanged water into the calibration container sponge.
- (2) Insert the DO Sensor into the calibration container until the measurement section of the sensor is situated approximately 2 cm away from the sponge.



(Fig. 10.7.2-1)

- (3) Allow it to settle, undisturbed, for 5 to 10 minutes.



Caution

- Do not leave the sensor attached to the calibration container for more than 30 minutes. This will result in dew condensation in measurement section, which will affect measurement value.
If dew condensation has occurred, remove the moisture from the measurement section, then start calibration again.

- (4) Set Data item 0005H (DO concentration calibration mode) to 0001H.
The unit moves to DO concentration 1-point calibration mode.
If 2¹¹, 2¹⁰ digits are read at Data item 0083H (Status flag 1), 01 (DO concentration 1-point calibration mode) will be returned.
- (5) Set Data item 0006H (DO concentration calibration start) to 0001H.
1-point calibration (100% saturation calibration) starts.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 01 [During 1st-point calibration (100% saturation calibration)] will be returned.
- (6) Set Data item 0006H (DO concentration calibration start) to 0003H.
The measured value will be fixed, and automatic calibration will be performed.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 00 (Standby) will be returned.
1-point calibration (100% saturation calibration) is completed.
- (7) Set Data item 0006H (DO concentration calibration start) to 0000H.
The unit reverts to DO concentration 1-point calibration mode.
- (8) Set Data item 0005H (DO concentration calibration mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

If calibration cannot be performed during 1-point calibration (100% saturation calibration) due to unstable DO concentration input or temperature correction error, etc., and if 2⁸ digit is read at Data item 0083H (Status flag 1), 1 (Error) will be returned.

To release the error, set Data item 0005H (DO concentration calibration mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

10.7.3 DO Concentration 2-point Calibration Mode



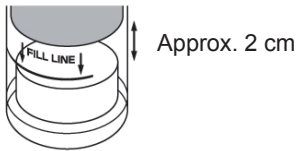
Caution

- When using a sensor in geographically high elevation sites, perform altitude correction for accurate calibration, then start calibration.

[Data item 0004H (Altitude correction)]

The following outlines calibration procedure.

- (1) Pour approx. 10 mL of ion-exchanged water into the calibration container sponge.
- (2) Insert the DO Sensor into the calibration container until the measurement section of the sensor is situated approximately 2 cm away from the sponge.



(Fig. 10.7.3-1)

- (3) Allow it to settle, undisturbed, for 5 to 10 minutes.

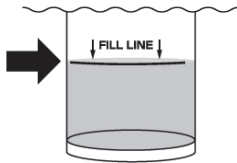


Caution

- Do not leave the sensor attached to the calibration container for more than 30 minutes. This will result in dew condensation in measurement section, which will affect measurement value. If dew condensation has occurred, remove the moisture from the measurement section, then start calibration again.

- (4) Set Data item 0005H (DO concentration calibration mode) to 0002H.
The unit moves to DO concentration 2-point calibration mode.
If 2¹¹, 2¹⁰ digits are read at Data item 0083H (Status flag 1), 10 (DO concentration 2-point calibration mode) will be returned.
- (5) Set Data item 0006H (DO concentration calibration start) to 0001H.
1st-point calibration (100% saturation calibration) starts.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 01 [During 1st-point calibration (100% saturation calibration)] will be returned.
- (6) Set Data item 0006H (DO concentration calibration start) to 0003H.
The measured value will be fixed, and automatic calibration will be performed.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 00 (Standby) will be returned.
1st-point calibration (100% saturation calibration) is completed.
- (7) Prepare a zero standard solution.
Zero standard solution is 100 mL of ion-exchanged water into which 5 g or more of sodium sulfite has been added and completely dissolved.

- (8) Take out the calibration container sponge used for 1st-point calibration, and pour the zero standard solution into the calibration container up to the Fill Line.



(Fig. 10.7.3-2)

- (9) Insert the temperature sensor of the DO Sensor until it is immersed in the prepared zero standard solution.



Caution

- Insert the measurement section so that approximately 1 cm of gap is left between it and the bottom of the calibration container.
- Insert the measurement section so that air bubbles cannot attach to it.

- (10) Allow it to settle, undisturbed, for at least 5 minutes to stabilize the temperature.
- (11) Set Data item 0006H (DO concentration calibration start) to 0002H.
2nd-point calibration (0-point calibration) starts.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 10 [During 2nd-point calibration (0-point calibration)] will be returned.
- (12) Set Data item 0006H (DO concentration calibration start) to 0003H.
The measured value will be fixed, and automatic calibration will be performed.
If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 00 (Standby) will be returned.
2nd-point calibration (0-point calibration) is completed.
2-point calibration (both 100% saturation calibration and 0-point calibration) is completed.
- (13) Set Data item 0006H (DO concentration calibration start) to 0000H.
The unit reverts to DO concentration 2-point calibration mode.
- (14) Set Data item 0005H (DO concentration calibration mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

If calibration cannot be performed during DO concentration 2-point calibration due to unstable DO concentration input or temperature correction error, etc., and if 2⁸ digit is read at Data item 0083H (Status flag 1), 1 (Error) will be returned.

To release the error, set Data item 0005H (DO concentration calibration mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

10.7.4 Concentration Option Calibration Mode

Immerse the DO Sensor in an aqueous solution (of which DO concentration is known), then the measured value can be matched to the concentration.

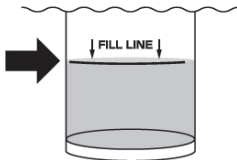
Factory default value: 0.00 mg/L

DO concentration can be set within a range of 0.00 to 20.00 mg/L.

The following outlines calibration procedure.

(e.g.) Setting to a (already-known) concentration of 7.77 mg/L

(1) Pour the already-known concentration solution into the calibration container up to the Fill Line.



(Fig. 10.7.4-1)

(2) Insert the temperature sensor of the DO Sensor until it is immersed in the poured solution.



Caution

- Insert the measurement section so that approximately 1 cm of gap is left between it and the bottom of the calibration container.
- Insert the measurement section so that air bubbles cannot attach to it.

(3) Allow it to settle, undisturbed, for at least 5 minutes to stabilize the temperature.

(4) Set Data item 0005H (DO concentration calibration mode) to 0003H.

The unit moves to Concentration option calibration mode.

If 2¹¹, 2¹⁰ digits are read at Data item 0083H (Status flag 1), 11 (Concentration option calibration mode) will be returned.

(5) Set Data item 0007H (Concentration desired value) to the desired value (7.77).

(6) Set Data item 0006H (DO concentration calibration start) to 0001H.

Concentration option calibration starts.

If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 11 (During concentration option calibration) will be returned.

(7) Set Data item 0006H (DO concentration calibration start) to 0003H.

The measured value will be fixed, and calibration will be performed.

If 2¹³, 2¹² digits are read at Data item 0083H (Status flag 1), 00 (Standby) will be returned.

Concentration option calibration is completed.

(8) Set Data item 0006H (DO concentration calibration start) to 0000H.

The unit reverts to Concentration option calibration mode.

(9) Set Data item 0005H (DO concentration calibration mode) to 0000H.

The unit reverts to Display Mode or Cleansing Output Mode.

If errors occur during concentration option calibration, and if 2⁸ digit is read at Data item 0083H (Status flag 1), 1 (Error) will be returned.

To release the error, set Data item 0005H (DO concentration calibration mode) to 0000H.

The unit reverts to Display Mode or Cleansing Output Mode.

10.8 Transmission Output 1 and 2 Adjustment

10.8.1 Transmission Output 1 Adjustment Mode

Fine adjustment of Transmission output 1 is performed.

WIL-102-DO is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and the output value of this unit. In this case, perform Transmission output 1 Zero adjustment and Span adjustment.

The following outlines the procedure for Transmission output 1 adjustment.

- (1) Set Data item 000EH (Transmission output 1 adjustment mode) to 0001H.
The unit moves to Transmission output 1 Zero adjustment mode.
If 2⁹, 2⁸ digits are read at Data item 0093H (Status flag 2), 01 (During Transmission output 1 Zero adjustment in Transmission output 1 adjustment mode) will be returned.
- (2) Set Transmission output 1 Zero adjustment value at Data item 000FH (Transmission output 1 Zero adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: $\pm 5.00\%$ of Transmission output 1 span
- (3) Set Data item 000EH (Transmission output 1 adjustment mode) to 0002H.
The unit moves to Transmission output 1 Span adjustment mode.
If 2⁹, 2⁸ digits are read at Data item 0093H (Status flag 2), 10 (During Transmission output 1 Span adjustment in Transmission output 1 adjustment mode) will be returned.
- (4) Set Transmission output 1 Span adjustment value at Data item 0010H (Transmission output 1 Span adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: $\pm 5.00\%$ of Transmission output 1 span
- (5) Repeat steps (1) to (4) if necessary.
- (6) Set Data item 000EH (Transmission output 1 adjustment mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

10.8.2 Transmission Output 2 Adjustment Mode

Fine adjustment of Transmission output 2 is performed.

WIL-102-DO is adjusted at the factory, however, differences may occur between the indication value of the connected equipment (recorders, etc.) and the output value of this unit. In this case, perform Transmission output 2 Zero adjustment and Span adjustment.

The following outlines the procedure for Transmission output 2 adjustment.

- (1) Set Data item 0011H (Transmission output 2 adjustment mode) to 0001H.
The unit moves to Transmission output 2 Zero adjustment mode.
If 2¹¹, 2¹⁰ digits are read at Data item 0093H (Status flag 2), 01 (During Transmission output 2 Zero adjustment in Transmission output 2 adjustment mode) will be returned.
- (2) Set Transmission output 2 Zero adjustment value at Data item 0012H (Transmission output 2 Zero adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: $\pm 5.00\%$ of Transmission output 2 span
- (3) Set Data item 0011H (Transmission output 2 adjustment mode) to 0002H.
The unit moves to Transmission output 2 Span adjustment mode.
If 2¹¹, 2¹⁰ digits are read at Data item 0093H (Status flag 2), 10 (During Transmission output 2 Span adjustment in Transmission output 2 adjustment mode) will be returned.
- (4) Set Transmission output 2 Span adjustment value at Data item 0013H (Transmission output 2 Span adjustment value), while viewing the value indicated on the connected equipment (recorders, etc.).
Setting range: $\pm 5.00\%$ of Transmission output 2 span
- (5) Repeat steps (1) to (4) if necessary.
- (6) Set Data item 0011H (Transmission output 2 adjustment mode) to 0000H.
The unit reverts to Display Mode or Cleansing Output Mode.

10.9 Notes on Programming Monitoring Software

10.9.1 How to Speed up the Scan Time

When monitoring multiple units of WIL-102-DO, set the program so that the requisite minimum pieces of data such as Data item 0080H (DO concentration), Data item 0090H (Temperature), Data item 0083H (Status flag 1), Data item 0093H (Status flag 2) can be read. For other data, set the program so that they can be read only when their set value has been changed. This will speed up the scan time.

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

If any set value is changed by keypad operation, the WIL-102-DO will set [0083H (Status flag 1) 2¹⁵: Change in key operation] to 1 (Yes).

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

(1) Reading method 1

- ① On the monitoring software side, check that [0083H (Status flag 1) 2¹⁵: Change in key operation] has been set to 1 (Yes), then read all set values.
- ② Clear the [0083H (Status flag 1) 2¹⁵: Change in key operation], by setting Data item 007FH (Key operation change flag clearing) to 0001H (Clear change flag).
If [007FH (Key operation change flag clearing)] is set to [Clear change flag (0001H)] during setting mode of this instrument, Error code 5 (35H, Shinko protocol) or Exception Code 18 (12H, MODBUS protocol) will be returned as a negative acknowledgement. And [0083H (Status flag 1) 2¹⁵: Change in key operation] cannot be cleared.
Set a program so that all set values can be read when a negative acknowledgement is returned.
- ③ Read all set values again after acknowledgement is returned.

(2) Reading method 2

- ① On the monitoring software side, check that [0083H (Status flag 1) 2¹⁵: Change in key operation] has been set to 1 (Yes), then set 007FH (Key operation change flag clearing) to 0001H (Clear change flag).
- ② Set the program depending on acknowledgement or negative acknowledgement as follows.
When acknowledgement is returned:
Consider it as settings completed, and read all set values.
When Error code 5 (35H, Shinko protocol) or Exception code 18 (12H, MODBUS protocol) is returned as a negative acknowledgement:
Consider it as still in setting mode, and read the requisite minimum pieces of data such as 0080H (DO concentration), 0090H (Temperature), 0083H (Status flag 1), 0093H (Status flag 2), then return to step ①.

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

10.9.3 Note when sending all set values at one time

- If EVT1, EVT2, EVT3, EVT4, EVT5 or EVT6 type is changed at Data items 0014H (EVT1 type), 0022H (EVT2 type), 0030H (EVT3 type), 003EH (EVT4 type), 004CH (EVT5 type) or 005AH (EVT6 type), the EVT1, EVT2, EVT3, EVT4, EVT5 or EVT6 value will default to 0 (zero).
Output status of EVT1, EVT2, EVT3, EVT4, EVT5 or EVT6 will also be initialized.
First, send the EVT1, EVT2, EVT3, EVT4, EVT5 or EVT6 type, then send the EVT1, EVT2, EVT3, EVT4, EVT5 or EVT6 value set at Data items 0015H (EVT1 value), 0023H (EVT2 value), 0031H (EVT3 value), 003FH (EVT4 value), 004DH (EVT5 value) or 005BH (EVT6 value).

11. Specifications

11.1 Specification of WIL-102-DO

11.1.1 Standard Specifications

Rating

Rated scale	Input	Input Range	Resolution
	DO concentration	0.00 to 20.00 mg/L	0.01 mg/L
	DO % saturation	0.0 to 200.0%	0.1%
	Oxygen partial pressure	0.0 to 150.0 kPa	0.1 kPa
	Temperature	0.0 to 50.0°C	0.1°C
Input	Optical DO Sensor		
Power supply	Model	WIL-102-DO	WIL-102-DO 1
	Power supply	100 to 240 V AC 50/60 Hz	24 V AC/DC 50/60 Hz
	Allowable voltage fluctuation range	85 to 264 V AC	20 to 28 V AC/DC

General Structure

External dimensions	30 x 88 x 108 mm (W x H x D, including socket)	
Mounting	DIN rail	
Case	Material: Flame-resistant resin, Color: Light gray	
Front panel	Membrane sheet	
Indicating structure	Display	
	DO Display	Red LED 4-digits Character size: 10 x 4.6 mm (H x W)
	Temperature Display	Red LED 4-digits Character size: 10 x 4.6 mm (H x W)
	Action indicators	
	PWR (Yellow)	Instrument Power ON: Lit
	A1 (Red)	EVT1 output (Contact output 1) ON: Lit
	A2 (Yellow)	EVT2 output (Contact output 2) ON: Lit
	T/R (Yellow)	Serial communication TX output (transmitting): Lit
Setting structure	Setting method: Input system using membrane sheet key	



Indication Performance

Indication accuracy	Depends on the accuracy of the Optical DO Sensor.
Time accuracy	Within $\pm 1\%$ of setting time
Data update cycle	5 seconds

Standard Function

Calibration	DO concentration 1-point calibration, DO concentration 2-point calibration, Concentration option calibration	
Signal output response time	Moving average is calculated from the set signal output response time, and the resulting value is updated every Data update cycle (5 seconds) as a measurement value. However, signal output response time will be invalidated during DO concentration calibration mode, Transmission output 1 or 2 adjustment mode.	
Transmission output 1	Converts any one of – DO concentration, water temperature, DO % saturation, or Oxygen partial pressure – to an analog signal every update cycle, and outputs in current. If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC.	
	Resolution	12000
	Current	4 to 20 mA DC (Load resistance: Max. 550 Ω)
	Output accuracy	Within ±0.3% of Transmission output 1 span
Transmission output 1 adjustment	Fine adjustment of the Transmission output 1 is performed via Transmission output 1 Zero and Span adjustments.	
Transmission output 1 status when calibrating	Selects Transmission output 1 output status when calibrating DO concentration.	
	Last value HOLD	Retains the last value before DO concentration calibration, and outputs it.
	Set value HOLD	Outputs the value set in [Transmission output 1 value HOLD when calibrating].
	Measured value	Outputs the measured value when calibrating DO concentration.
Transmission output 2	Converts any one of – DO concentration, water temperature, DO % saturation, or Oxygen partial pressure – to an analog signal every update cycle, and outputs in current. If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC.	
	Resolution	12000
	Current	4 to 20 mA DC (Load resistance: Max. 550 Ω)
	Output accuracy	Within ±0.3% of Transmission output 2 span
Transmission output 2 adjustment	Fine adjustment of the Transmission output 2 is performed via Transmission output 2 Zero and Span adjustments.	
Transmission output 2 status when calibrating	Selects Transmission output 2 output status when calibrating DO concentration.	
	Last value HOLD	Retains the last value before DO concentration calibration, and outputs it.
	Set value HOLD	Outputs the value set in [Transmission output 2 value HOLD when calibrating].
	Measured value	Outputs the measured value when calibrating DO concentration.

EVT <input type="checkbox"/> output (Contact output)		
Action		ON/OFF control action
EVT <input type="checkbox"/> ON side EVT <input type="checkbox"/> OFF side		DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa
EVT <input type="checkbox"/> High/Low limits independent upper side value, EVT <input type="checkbox"/> High/Low limits independent lower side value		DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa
EVT <input type="checkbox"/> hysteresis		DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa
Type		Selectable by keypad operation <ul style="list-style-type: none"> • No action • DO concentration input high limit action • DO concentration input low limit action • Water temperature input high limit action • Water temperature input low limit action • DO % saturation input high limit action • DO % saturation input low limit action • Oxygen partial pressure input high limit action • Oxygen partial pressure input low limit action • Sensor cap replacement timer • Self-check output • Cleansing output • DO concentration input High/Low limits independent action • Water temperature input High/Low limits independent action • DO % saturation input High/Low limits independent action • Oxygen partial pressure 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 $\cos\phi=0.4$)
		Electrical life 100,000 cycles
EVT <input type="checkbox"/> ON delay time		0 to 9999 seconds
EVT <input type="checkbox"/> OFF delay time		0 to 9999 seconds
Output ON Time/ OFF Time when EVT <input type="checkbox"/> Output ON		If ON time and OFF time are set, the output can be turned ON/OFF in a configured cycle when EVT <input type="checkbox"/> output is ON.
Sensor cap replacement timer output		The selected EVT output is turned ON after sensor cap replacement timer value has elapsed (Sensor cap replacement timer remainder is "0"). DO concentration measured value and r_{cRP} are alternately indicated on the DO Display.

Self-check output	The selected EVT output is turned ON for the following errors.			
	$E_{rr}1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.		
	$E_{rr}2$	DO Sensor cap is not attached, or it is incorrectly attached.		
	$E_{rr}3$	Calibration error (If input errors have occurred, or if calibration cannot be performed 30 minutes after starting calibration)		
	$E_{rr}4$	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.		
Cleansing output	<p>Cleansing Output Mode: After 'Cleansing inactive interval' has elapsed, the selected EVT output is turned ON during the preset 'Cleansing time'. After 'Standby after cleansing' has passed, the above action is repeated. While cleansing is being performed using 'Cleansing time' and 'Standby after cleansing', other outputs are in OFF status. The measured values (DO concentration, DO % saturation, Oxygen partial pressure, water temperature) are retained. Normal programmed action will be performed, except during 'Cleansing Perform'. When power is turned ON again, starts from 'Cleansing inactive interval'.</p> <p>Forced Cleansing Mode: By pressing the  key for approx. 3 seconds, the unit enters Forced cleansing mode. In Forced cleansing mode, cleansing is performed using 'Cleansing time' and 'Standby after cleansing'. After cleansing action is finished, the unit automatically reverts to Cleansing Output Mode. This mode will not be accessible by the  key if programmed cleansing is currently being performed. During Forced cleansing mode, if programmed cleansing action initiates after 'Cleansing inactive interval' has passed, the programmed cleansing action will not be performed in the current session.</p>			
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 DO concentration, DO % saturation, Oxygen partial pressure, temperature and status (3) Function change, adjustment (4) Reading and setting of user save area			
Cable length	1.2 km (Max.), Cable resistance: 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 bit, 2 bits (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

Insulation, Dielectric Strength

Circuit insulation configuration	<p> : EVT option </p>
Dielectric strength	<p> Insulation Resistance: 10 MΩ minimum, at 500 V DC </p> <p> 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 </p>

Attached Function

Set value lock	<p> Lock 1: None of the set values can be changed. Lock 2: Only EVT1 to EVT6 values can be changed. Lock 3: All set 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. </p>															
Outside measurement range	<p>If inputs (DO concentration, DO % saturation, Oxygen partial pressure, Temperature) are outside the measurement range, the following will be indicated.</p>															
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th style="width: 33%;">Input</th> <th style="width: 33%;">DO Display</th> <th style="width: 33%;">Temperature Display</th> </tr> </thead> <tbody> <tr> <td>DO concentration</td> <td>Flashes at 20.00 or 0.00.</td> <td>Measured value</td> </tr> <tr> <td>DO % saturation</td> <td>Flashes at 200.0 or 0.0.</td> <td>Measured value</td> </tr> <tr> <td>Oxygen partial pressure</td> <td>Flashes at 150.0 or 0.0.</td> <td>Measured value</td> </tr> <tr> <td>Temperature</td> <td>Measured value</td> <td>Flashes at 50.0 or 0.0.</td> </tr> </tbody> </table>	Input	DO Display	Temperature Display	DO concentration	Flashes at 20.00 or 0.00.	Measured value	DO % saturation	Flashes at 200.0 or 0.0.	Measured value	Oxygen partial pressure	Flashes at 150.0 or 0.0.	Measured value	Temperature	Measured value	Flashes at 50.0 or 0.0.
	Input	DO Display	Temperature Display													
	DO concentration	Flashes at 20.00 or 0.00.	Measured value													
	DO % saturation	Flashes at 200.0 or 0.0.	Measured value													
Oxygen partial pressure	Flashes at 150.0 or 0.0.	Measured value														
Temperature	Measured value	Flashes at 50.0 or 0.0.														
DO concentration	Flashes at 20.00 or 0.00.	Measured value														
DO % saturation	Flashes at 200.0 or 0.0.	Measured value														
Oxygen partial pressure	Flashes at 150.0 or 0.0.	Measured value														
Temperature	Measured value	Flashes at 50.0 or 0.0.														
Power failure countermeasure	<p>The setting data is backed up in the non-volatile IC memory.</p>															
Self-diagnosis	<p>The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the WIL-102-DO is switched to warm-up status.</p>															
Warm-up Indication	<p>For approx. 8 seconds after the power is switched ON, characters below are indicated on the DO Display and Temperature Display.</p>															
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th style="width: 50%;">Display</th> <th style="width: 50%;">Contents</th> </tr> </thead> <tbody> <tr> <td>DO Display</td> <td>do□□</td> </tr> <tr> <td>Temperature Display</td> <td>□□.□□ [Version number (e.g.) 1.00]</td> </tr> </tbody> </table>	Display	Contents	DO Display	do□□	Temperature Display	□□.□□ [Version number (e.g.) 1.00]									
	Display	Contents														
DO Display	do□□															
Temperature Display	□□.□□ [Version number (e.g.) 1.00]															
Temperature Display	□□.□□ [Version number (e.g.) 1.00]															
Display sleep function	<p>If no operation occurs for the duration of the previously set indication time, the displays will go off.</p> <p>By pressing any key, the display re-lights. If the Indication time is set to 00.00, the displays remain lit, and this function is disabled.</p>															
Auto-light function	<p>Automatically measures and controls brightness of the DO Display, Temperature Display and action indicators.</p>															

Error indication	Error Code	Description	Occurrence
	<i>E r r 0</i>	Non-volatile IC memory error	Constantly
	<i>E r r 1</i>	DO Sensor communication errors have occurred, or DO Sensor is not connected. After a command is sent to the DO Sensor, if there is no response for 500 ms, the command will be sent again. If no response occurs 4 times consecutively, this error code will be indicated. If communication status returns to normal, the unit will automatically return to normal status. When this error code is displayed, the previous measured value is retained.	When measuring and calibrating
	<i>E r r 2</i>	DO Sensor cap is not attached, or it is incorrectly attached.	
	<i>E r r 3</i>	Calibration error (when input errors have occurred, or when calibration cannot be performed 30 minutes after starting calibration)	When calibrating
	<i>E r r 4</i>	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.	When measuring and calibrating

Other

Power consumption	Approx. 10 VA
Ambient temperature	0 to 50°C
Ambient humidity	35 to 85 %RH (Non-condensing)
Weight	Approx. 200 g (including socket)
Environmental spec	RoHS directive
Accessories included	Unit label: 1 sheet Instruction manual: 1 copy Wire harness WJ (3 m): 4 lengths (when the EVT option is ordered)
Accessories sold separately	Socket ASK-001-1 (Finger-safe, terminal screw fall prevention)

11.1.2 Optional Specifications

EVT□ Output (Option Code: EVT)

EVT□ output	Same as standard EVT□ except the 'output'.		
Output	Open collector		
	Control capacity	0.1 A 24 V DC	

11.2 DO Sensor Specifications

Model	DOS-20
Power supply	12 to 36 V DC
Sensor cap replacement frequency	One (1) year after installing the DO Sensor (Recommended)
Sensor cap storage period	Two (2) years from the date of manufacture (When storing in the designated container) Storage temperature: 1 to 60°C
Measuring water temperature	0 to 50°C (Not freezing)
Material	ABS
External dimensions	Approx. $\phi 44$ x 203 mm
Weight	Approx. 850 g (including 10 m cable)
Degree of protection	IP68 (Underwater type, maximum depth of 200 m)
Accessories sold separately	DO Sensor attachment: DA-1 Sensor cap for replacement: DOS-CP Stanchion pole: PS-1 Fixing bracket for stanchion pole: PS-TK

12. Troubleshooting

Error codes and solutions to problems are described below.

12.1 Error Codes

Error Code	Description	Occurrence
Err0	Non-volatile IC memory error	Constantly
Err1	DO Sensor communication errors have occurred, or DO Sensor is not connected. After a command is sent to the DO Sensor, if there is no response for 500 ms, the command will be sent again. If no response occurs 4 times consecutively, this error code will be indicated. If communication status returns to normal, the unit will automatically return to normal status. When this error code is displayed, the previous measured value is retained.	When measuring and calibrating
Err2	DO Sensor cap is not attached, or it is incorrectly attached.	
Err3	Calibration error (when input errors have occurred, or when calibration cannot be performed 30 minutes after starting calibration)	When calibrating
Err4	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.	When measuring and calibrating

12.2 Solutions to Problems

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

12.2.1 Indication

Problem	Possible Cause	Solution
The DO Display/ Temperature Display are unlit.	The time set in [Indication time (p.34)] has passed.	If any key is pressed while displays are unlit, it will re-light. Set the Indication time to a suitable time-frame.
The DO Display/ Temperature Display are dark.	U4E (Enabled) is selected in [Auto-light function (p.34)].	Select (Disabled).
Indication of the DO Display/Temperature Display is unstable or irregular.	DO concentration calibration may not have finished.	Perform DO concentration calibration.
	Specification of DO Sensor may not be suitable.	Replace the sensor with a suitable one.
	There may be equipment that interferes with or makes noise near the WIL-102-DO.	Keep WIL-102-DO clear of any potentially disruptive equipment.
Err1 is flashing on the Temperature Display.	DO Sensor communication errors have occurred, or the DO Sensor is not connected.	Turn the power OFF, and check the wiring of the DO Sensor. If the DO Sensor is malfunctioning, repair or replace the sensor.
Err2 is flashing on the Temperature Display.	This occurs when DO Sensor cap is not attached, or when it is incorrectly attached.	For correct attachment, refer to Section "4.4 Attaching the Sensor Cap" (p.13).

Problem	Possible Cause	Solution
$Err3$ is flashing on the Temperature Display.	Calibration error	Remove dirt or air bubbles from the measurement section, and calibrate again. If errors occur again, repair or replace the DO Sensor. If salinity concentration correction has been performed, return the salinity concentration correction value to 0 PSU, and calibrate again.
$Err0$ is flashing on the Temperature Display.	Internal memory is defective.	Contact our agency or us.

12.2.2 Key Operation

Problem	Possible Cause	Solution
Unable to set values. The values do not change by Δ , ∇ keys.	$Loc1$ (Lock 1) is selected in [Set value lock (p. 34)].	Select 0000 (Unlock).
Settings are impossible except EVT□ value. The values do not change by Δ , ∇ keys	$Loc2$ (Lock 2) is selected in [Set value lock (p. 34)].	Select 0000 (Unlock).
Unable to enter Forced cleansing mode.	$CLEW$ (Cleansing output) is not selected in any of [EVT1 to EVT6 types (pp. 26, 31)].	Select $CLEW$ (Cleansing output) in any of [EVT1 to EVT6 types (pp. 26, 31)].
	Cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'.	Execute Forced cleansing after cleansing action is completed.
Unable to enter a calibration mode.	$Loc1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) has been selected in [Set value lock (p.34)].	Select 0000 (Unlock).
	$CLEW$ (Cleansing output) has been selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and cleansing action is performing using the 'Cleansing time' and 'Standby after cleansing'.	Perform calibration after cleansing action is completed.

12.2.3 Communication

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

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

13. Character Tables

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

Setting Groups

Character	Setting Group
F _{nc} [] [] []	DO Concentration Input Group
T _{o1} [] [] []	Transmission Output 1 Group
T _{o2} [] [] []	Transmission Output 2 Group
E _{V1} [] [] []	EVT1 Action Group
E _{V2} [] [] []	EVT2 Action Group
E _{V3} [] [] []	EVT3 Action Group (*)
E _{V4} [] [] []	EVT4 Action Group (*)
E _{V5} [] [] []	EVT5 Action Group (*)
E _{V6} [] [] []	EVT6 Action Group (*)
c _{om} [] [] []	Communication Group
c _{LE} [] [] []	Cleansing Group
a _F [] [] []	Basic Function Group
s _{ELF} [] [] []	Self-Check Group
c _{LR} [] [] []	Data Clear Group

(*) Available only when EVT output (EVT option) is ordered.

DO Concentration Calibration

Character	Setting Item, Setting Range	Factory Default	Data
Measured value (*) [] [] []	DO concentration 1-point calibration mode		
Measured value (*) [] [] []	DO concentration 2-point calibration mode		
c _{Adi} Concentration desired value	Concentration option calibration mode Setting range: 0.00 to 20.00 mg/L	0.00 mg/L	

(*) DO concentration measured value flashes.

Transmission Output 1 Adjustment

Character	Setting Item, Setting Range	Factory Default	Data
<i>RUZ1</i> 0.00	Transmission output 1 Zero adjustment Setting range: $\pm 5.00\%$ of Transmission output 1 span	0.00 mg/L	
<i>RU41</i> 0.00	Transmission output 1 Span adjustment Setting range: $\pm 5.00\%$ of Transmission output 1 span	0.00 mg/L	

Transmission Output 2 Adjustment

Character	Setting Item, Setting Range	Factory Default	Data
<i>RUZ2</i> 0.00	Transmission output 2 Zero adjustment Setting range: $\pm 5.00\%$ of Transmission output 2 span	0.00 mg/L	
<i>RU42</i> 0.00	Transmission output 2 Span adjustment Setting range: $\pm 5.00\%$ of Transmission output 2 span	0.00 mg/L	

DO Concentration Input Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>dFct</i> 0.60	Signal output response time Setting range: 5 to 600 seconds	60 seconds	
<i>4RLT</i> 0.00	Salinity correction Setting range: 0 to 42 PSU	0 PSU	
<i>4EAL</i> 0.00	Altitude correction Setting range: 0 to 5000 m	0 m	

Transmission Output 1 Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>Tral</i> do	Transmission output 1 type <i>do</i> : DO concentration transmission <i>UTAP</i> : Water temperature transmission <i>do4T</i> : DO % saturation transmission <i>UPr4</i> : Oxygen partial pressure transmission	DO concentration transmission	
<i>TrH1</i> 2000	Transmission output 1 high limit Setting range: Transmission output 1 low limit to Measurement range high limit	20.00 mg/L	
<i>TrL1</i> 0.00	Transmission output 1 low limit Setting range: Measurement range low limit to Transmission output 1 high limit	0.00 mg/L	
<i>Trc1</i> bEFH	Transmission output 1 status when calibrating <i>bEFH</i> : Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.) <i>4EFH</i> : Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when calibrating].) <i>PrH</i> : Measured value (Outputs the measured value when calibrating DO concentration.)	Last value HOLD	
<i>Tr41</i> 0.00	Transmission output 1 value HOLD when calibrating Setting range: Measurement range low limit to Measurement range high limit	0.00 mg/L	

Transmission Output 2 Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>Trd2</i> <i>do□□</i>	Transmission output 2 type <i>do</i> □□ : DO concentration transmission <i>WT</i> □□ : Water temperature transmission <i>DO</i> □□ : DO % saturation transmission <i>OP</i> □□ : Oxygen partial pressure transmission	DO concentration transmission	
<i>TrH2</i> <i>20.00</i>	Transmission output 2 high limit Setting range: Transmission output 2 low limit to Measurement range high limit	20.00 mg/L	
<i>TrL2</i> <i>□.000</i>	Transmission output 2 low limit Setting range: Measurement range low limit to Transmission output 2 high limit	0.00 mg/L	
<i>Trc2</i> <i>bEFH</i>	Transmission output 2 status when calibrating <i>bEFH</i> : Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.) <i>4EFH</i> : Set value HOLD (Outputs the value set in [Transmission output 2 value HOLD when calibrating].) <i>PH</i> □□: Measured value (Outputs the measured value when calibrating DO concentration.)	Last value HOLD	
<i>TrV2</i> <i>□.000</i>	Transmission output 2 value HOLD when calibrating Setting range: Measurement range low limit to Measurement range high limit	0.00 mg/L	

EVT1 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>E F F 1</i> [] [] [] []	EVT1 type [] [] [] [] : No action <i>do_H</i> : DO concentration input high limit action <i>do_L</i> : DO concentration input low limit action <i>wt_H</i> : Water temperature input high limit action <i>wt_L</i> : Water temperature input low limit action <i>do_H</i> : DO % saturation input high limit action <i>do_L</i> : DO % saturation input low limit action <i>OP_H</i> : Oxygen partial pressure input high limit action <i>OP_L</i> : Oxygen partial pressure input low limit action <i>rcRP</i> : Sensor cap replacement timer <i>SELF</i> : Self-check output <i>CLEG</i> : Cleansing output <i>doHL</i> : DO concentration input High/Low limits independent action <i>wtHL</i> : Water temperature input High/Low limits independent action <i>doHL</i> : DO % saturation input High/Low limits independent action <i>OPHL</i> : Oxygen partial pressure input High/Low limits independent action	No action	
<i>48</i> [] [] [] [] []	EVT1 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>dIF1</i> <i>4dIF</i>	EVT1 hysteresis type (*2) <i>cdIF</i> : Medium Value <i>4dIF</i> : Reference Value	Reference Value	
<i>dFo1</i> [] [] [] []	EVT1 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
<i>dFU1</i> [] [] [] []	EVT1 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If [] [] [] [] (No action), *rcRP* (Sensor cap replacement timer), *SELF* (Self-check output) or *CLEG* (Cleansing output) is selected in [EVT1 type], this setting item and all subsequent items will not be available.

(*2) Not available if *doHL* (DO concentration input High/Low limits independent action), *wtHL* (Water temperature input High/Low limits independent action), *doHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type].

(*3) Not available if *cdIF* (Medium Value) is selected in [EVT1 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onF1</i> □□□□	EVT1 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oFF1</i> □□□□	EVT1 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oon1</i> □□□□	Output ON Time when EVT1 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooF1</i> □□□□	Output OFF Time when EVT1 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_L1</i> □□□□	EVT1 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H1</i> □□□□	EVT1 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_HY1</i> □□□□	EVT1 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *FWHL* (Water temperature input High/Low limits independent action), *d%HL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type], this setting item and all subsequent items will be available.

EVT2 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>E F F 2</i> <i>----</i>	EVT2 type <i>----</i> : No action <i>do_H</i> : DO concentration input high limit action <i>do_L</i> : DO concentration input low limit action <i>wt_nH</i> : Water temperature input high limit action <i>wt_nL</i> : Water temperature input low limit action <i>do_nH</i> : DO % saturation input high limit action <i>do_nL</i> : DO % saturation input low limit action <i>oP_nH</i> : Oxygen partial pressure input high limit action <i>oP_nL</i> : Oxygen partial pressure input low limit action <i>r_cRP</i> : Sensor cap replacement timer <i>SELF</i> : Self-check output <i>CLEG</i> : Cleansing output <i>doHL</i> : DO concentration input High/Low limits independent action <i>wtHL</i> : Water temperature input High/Low limits independent action <i>doHL</i> : DO % saturation input High/Low limits independent action <i>oPHL</i> : Oxygen partial pressure input High/Low limits independent action	No action	
<i>482</i> <i>000</i>	EVT2 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>d1 F2</i> <i>4d1 F</i>	EVT2 hysteresis type (*2) <i>cd1 F</i> : Medium Value <i>4d1 F</i> : Reference Value	Reference Value	
<i>dF02</i> <i>001</i>	EVT2 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
<i>dFU2</i> <i>001</i>	EVT2 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If *----* (No action), *r_cRP* (Sensor cap replacement timer), *SELF* (Self-check output) or *CLEG* (Cleansing output) is selected in [EVT2 type], this setting item and all subsequent items will not be available.

(*2) Not available if *doHL* (DO concentration input High/Low limits independent action), *wtHL* (Water temperature input High/Low limits independent action), *doHL* (DO % saturation input High/Low limits independent action) or *oPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT2 type].

(*3) Not available if *cd1 F* (Medium Value) is selected in [EVT2 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onF2</i> □□□□	EVT2 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oFF2</i> □□□□	EVT2 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oon2</i> □□□□	Output ON Time when EVT2 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooF2</i> □□□□	Output OFF Time when EVT2 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_L2</i> □□□□	EVT2 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H2</i> □□□□	EVT2 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H2</i> □□□□	EVT2 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *F⁻nHL* (Water temperature input High/Low limits independent action), *d^snHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT2 type], this setting item and all subsequent items will be available.

EVT3 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>E F F 3</i> <i>----</i>	EVT3 type <i>----</i> : No action <i>d o _ H</i> : DO concentration input high limit action <i>d o _ L</i> : DO concentration input low limit action <i>u p r H</i> : Water temperature input high limit action <i>u p r L</i> : Water temperature input low limit action <i>d o % H</i> : DO % saturation input high limit action <i>d o % L</i> : DO % saturation input low limit action <i>u p r H</i> : Oxygen partial pressure input high limit action <i>u p r L</i> : Oxygen partial pressure input low limit action <i>r c R P</i> : Sensor cap replacement timer <i>s e l f</i> : Self-check output <i>c l e o</i> : Cleansing output <i>d o H L</i> : DO concentration input High/Low limits independent action <i>r n H L</i> : Water temperature input High/Low limits independent action <i>d % H L</i> : DO % saturation input High/Low limits independent action <i>u p H L</i> : Oxygen partial pressure input High/Low limits independent action	No action	
<i>4 8 3</i> <i>0.00</i>	EVT3 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>d i F 3</i> <i>4 d i F</i>	EVT3 hysteresis type (*2) <i>c d i F</i> : Medium Value <i>4 d i F</i> : Reference Value	Reference Value	
<i>d F o 3</i> <i>0.0 1</i>	EVT3 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
<i>d F U 3</i> <i>0.0 1</i>	EVT3 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If *----* (No action), *r c R P* (Sensor cap replacement timer), *s e l f* (Self-check output) or *c l e o* (Cleansing output) is selected in [EVT3 type], this setting item and all subsequent items will not be available.

(*2) Not available if *d o H L* (DO concentration input High/Low limits independent action), *r n H L* (Water temperature input High/Low limits independent action), *d % H L* (DO % saturation input High/Low limits independent action) or *u p H L* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT3 type].

(*3) Not available if *c d i F* (Medium Value) is selected in [EVT3 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onF3</i> □□□□	EVT3 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oFF3</i> □□□□	EVT3 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oon3</i> □□□□	Output ON Time when EVT3 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooF3</i> □□□□	Output OFF Time when EVT3 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_L3</i> □□□□	EVT3 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H3</i> □□□□	EVT3 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>EHy3</i> □□□□	EVT3 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *F[~]nHL* (Water temperature input High/Low limits independent action), *d[~]sHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT3 type], this setting item and all subsequent items will be available.

EVT4 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
E _{FF4} [] [] [] []	EVT4 type [] [] [] [] : No action d _o _H : DO concentration input high limit action d _o _L : DO concentration input low limit action T _F H : Water temperature input high limit action T _F L : Water temperature input low limit action d _o %H : DO % saturation input high limit action d _o %L : DO % saturation input low limit action O ₂ P _r H : Oxygen partial pressure input high limit action O ₂ P _r L : Oxygen partial pressure input low limit action r _c RP : Sensor cap replacement timer SELF : Self-check output CLEO : Cleansing output d _o HL : DO concentration input High/Low limits independent action T _F HL : Water temperature input High/Low limits independent action d _o %HL : DO % saturation input High/Low limits independent action O ₂ P _r HL : Oxygen partial pressure input High/Low limits independent action	No action	
484 [] [] [] []	EVT4 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
d _{IF4} 4d _{IF}	EVT4 hysteresis type (*2) c _d I _F : Medium Value 4d _{IF} : Reference Value	Reference Value	
d _F o ₄ [] [] [] []	EVT4 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
d _F U ₄ [] [] [] []	EVT4 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If [] [] [] [] (No action), r_cRP (Sensor cap replacement timer), SELF (Self-check output) or CLEO (Cleansing output) is selected in [EVT4 type], this setting item and all subsequent items will not be available.

(*2) Not available if d_oHL (DO concentration input High/Low limits independent action), T_FHL (Water temperature input High/Low limits independent action), d_o%HL (DO % saturation input High/Low limits independent action) or O₂P_rHL (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT4 type].

(*3) Not available if c_dI_F (Medium Value) is selected in [EVT4 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onF4</i> □□□□	EVT4 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oFF4</i> □□□□	EVT4 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oon4</i> □□□□	Output ON Time when EVT4 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooF4</i> □□□□	Output OFF Time when EVT4 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_L4</i> □□□□	EVT4 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H4</i> □□□□	EVT4 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>EHy4</i> □□□□	EVT4 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *F⁻nHL* (Water temperature input High/Low limits independent action), *d^sHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT4 type], this setting item and all subsequent items will be available.

EVT5 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>E T F 5</i> [] [] [] []	EVT5 type [] [] [] [] : No action <i>do_H</i> : DO concentration input high limit action <i>do_L</i> : DO concentration input low limit action <i>wt_H</i> : Water temperature input high limit action <i>wt_L</i> : Water temperature input low limit action <i>do_H</i> : DO % saturation input high limit action <i>do_L</i> : DO % saturation input low limit action <i>OP_H</i> : Oxygen partial pressure input high limit action <i>OP_L</i> : Oxygen partial pressure input low limit action <i>rcRP</i> : Sensor cap replacement timer <i>SELF</i> : Self-check output <i>CLEG</i> : Cleansing output <i>doHL</i> : DO concentration input High/Low limits independent action <i>wtHL</i> : Water temperature input High/Low limits independent action <i>doHL</i> : DO % saturation input High/Low limits independent action <i>OPHL</i> : Oxygen partial pressure input High/Low limits independent action	No action	
<i>485</i> [] [] [] []	EVT5 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>d1 F5</i> <i>4d1 F</i>	EVT5 hysteresis type (*2) <i>cd1 F</i> : Medium Value <i>4d1 F</i> : Reference Value	Reference Value	
<i>dF05</i> [] [] [] []	EVT5 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
<i>dF05</i> [] [] [] []	EVT5 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If [] [] [] [] (No action), *rcRP* (Sensor cap replacement timer), *SELF* (Self-check output) or *CLEG* (Cleansing output) is selected in [EVT5 type], this setting item and all subsequent items will not be available.

(*2) Not available if *doHL* (DO concentration input High/Low limits independent action), *wtHL* (Water temperature input High/Low limits independent action), *doHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT5 type].

(*3) Not available if *cd1 F* (Medium Value) is selected in [EVT5 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onFS</i> □□□□	EVT5 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>offFS</i> □□□□	EVT5 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oonFS</i> □□□□	Output ON Time when EVT5 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooffFS</i> □□□□	Output OFF Time when EVT5 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_LLS</i> □□□□	EVT5 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_HLS</i> □□□□	EVT5 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_HYS</i> □□□□	EVT5 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *FWHL* (Water temperature input High/Low limits independent action), *d%HL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT5 type], this setting item and all subsequent items will be available.

EVT6 Action Group

Character	Setting Item, Setting Range	Factory Default	Data
E _{TT} F ₆ [] [] [] []	EVT6 type [] [] [] [] : No action d _o _H : DO concentration input high limit action d _o _L : DO concentration input low limit action T _W H : Water temperature input high limit action T _W L : Water temperature input low limit action d _o %H : DO % saturation input high limit action d _o %L : DO % saturation input low limit action O ₂ P _r H : Oxygen partial pressure input high limit action O ₂ P _r L : Oxygen partial pressure input low limit action r _c RP : Sensor cap replacement timer S _{EL} F : Self-check output c _{LE} O : Cleansing output d _o H _L : DO concentration input High/Low limits independent action T _W H _L : Water temperature input High/Low limits independent action d _o %H _L : DO % saturation input High/Low limits independent action O ₂ P _r H _L : Oxygen partial pressure input High/Low limits independent action	No action	
486 [] [] [] []	EVT6 value (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
d _i F ₆ 4 _d i F	EVT6 hysteresis type (*2) c _d i F : Medium Value 4 _d i F : Reference Value	Reference Value	
dF _o 6 [] [] [] []	EVT6 ON side (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
dF _U 6 [] [] [] []	EVT6 OFF side (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0°C DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If [] [] [] [] (No action), r_cRP (Sensor cap replacement timer), S_{EL}F (Self-check output) or c_{LE}O (Cleansing output) is selected in [EVT6 type], this setting item and all subsequent items will not be available.

(*2) Not available if d_oH_L (DO concentration input High/Low limits independent action), T_WH_L (Water temperature input High/Low limits independent action), d_o%H_L (DO % saturation input High/Low limits independent action) or O₂P_rH_L (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT6 type].

(*3) Not available if c_di F (Medium Value) is selected in [EVT6 hysteresis type].

Character	Setting Item, Setting Range	Factory Default	Data
<i>onF6</i> □□□□	EVT6 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oFF6</i> □□□□	EVT6 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
<i>oon6</i> □□□□	Output ON Time when EVT6 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>ooF6</i> □□□□	Output OFF Time when EVT6 Output ON Setting range: 0 to 9999 seconds	0 seconds	
<i>E_L6</i> □□□□	EVT6 High/Low limits independent lower side value (*) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H6</i> □□□□	EVT6 High/Low limits independent upper side value DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0°C DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	DO concentration input: 0.00 mg/L Water temperature input: 0.0°C DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
<i>E_H6</i> □□□□	EVT6 hysteresis DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0°C DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	DO concentration input: 0.01 mg/L Water temperature input: 1.0°C DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If *doHL* (DO concentration input High/Low limits independent action), *FWHL* (Water temperature input High/Low limits independent action), *dSHL* (DO % saturation input High/Low limits independent action) or *OPHL* (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT6 type], this setting item and all subsequent items will be available.

Communication Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>cñ4L</i> <i>noñL</i>	Communication protocol <i>noñL</i> : Shinko protocol <i>ñodr</i> : MODBUS ASCII mode <i>ñodr</i> : MODBUS RTU mode	Shinko protocol	
<i>cñno</i> <i>□□□0</i>	Instrument number 0 to 95	0	
<i>cñ4P</i> <i>□□96</i>	Communication speed <i>□□96</i> : 9600 bps <i>□192</i> : 19200 bps <i>□384</i> : 38400 bps	9600 bps	
<i>cñFF</i> <i>7EBn</i>	Data bit/Parity <i>8non</i> : 8 bits/No parity <i>7non</i> : 7 bits/No parity <i>8EBn</i> : 8 bits/Even <i>7EBn</i> : 7 bits/Even <i>8odd</i> : 8 bits/Odd <i>7odd</i> : 7 bits/Odd	7 bits/Even	
<i>cñ4F</i> <i>□□□1</i>	Stop bit <i>□□□1</i> : 1 bit <i>□□□2</i> : 2 bits	1 bit	

Cleansing Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>cLñ</i> <i>□□30</i>	Cleansing time Setting range: 10 to 120 seconds	30 seconds	
<i>cLcY</i> <i>oFF□</i>	Cleansing inactive interval <i>oFF□</i> (None), 10 to 240 minutes	OFF (None)	
<i>cLIF</i> <i>□□□0</i>	Standby after Cleansing Setting range: 0 to 60 seconds	0 seconds	



Basic Function Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>Loct</i> <i>□□□□</i>	Set value lock <i>□□□□</i> (Unlock): All set values can be changed. <i>Loc 1</i> (Lock 1): None of the set values can be changed. <i>Loc 2</i> (Lock 2): Only EVT1 to EVT6 values can be changed. <i>Loc 3</i> (Lock 3): All set 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.	Unlock	
<i>LI GF</i> <i>□□□□</i>	Auto-light function <i>□□□□</i> : Disabled <i>U4E□</i> : Enabled	Disabled	
<i>TI ñE</i> <i>00.00</i>	Indication time Setting range: 00.00 (Remains lit) 00.01 to 60.00 (Minutes.Seconds)	00.00 (Remains lit)	

Character	Setting Item, Setting Range	Factory Default	Data
1Err OFF	EVT output when input errors occur on : Enabled OFF : Disabled	Disabled	
481 365	EVT1 value Setting range: 0 to 1095 days	365 days	
on1 0	EVT1 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
off1 0	EVT1 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
482 365	EVT2 value Setting range: 0 to 1095 days	365 days	
on2 0	EVT2 ON delay time Setting range: 0 to 9999 seconds	0 seconds	
off2 0	EVT2 OFF delay time Setting range: 0 to 9999 seconds	0 seconds	
483 365	EVT3 value (*) Setting range: 0 to 1095 days	365 days	
on3 0	EVT3 ON delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
off3 0	EVT3 OFF delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
484 365	EVT4 value (*) Setting range: 0 to 1095 days	365 days	
on4 0	EVT4 ON delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
off4 0	EVT4 OFF delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
485 365	EVT5 value (*) Setting range: 0 to 1095 days	365 days	
on5 0	EVT5 ON delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
off5 0	EVT5 OFF delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
486 365	EVT6 value (*) Setting range: 0 to 1095 days	365 days	
on6 0	EVT6 ON delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
off6 0	EVT6 OFF delay time (*) Setting range: 0 to 9999 seconds	0 seconds	
retn 365	Sensor cap replacement timer remainder Setting range: 0 to 1095 days	365 days	

(*) Available only when EVT output (EVT option) is ordered.

Self-Check Group

Character	Mode	
All lit	LED all lit mode	
Individually lit	LED individual lit mode	
<i>KEY</i> <i>none</i>	Key input mode	
	Temperature Display	Key Input
	<i>none</i>	When no key is pressed
	<i>UP</i>	When the  key is pressed
	<i>down</i>	When the  key is pressed
	<i>db</i>	When 2 or more keys are pressed simultaneously
<i>out</i> <i>off</i>	Output mode	
	Temperature Display	Output
	<i>off</i>	All EVT outputs: OFF, Transmission output 1 and 2: 4 mA DC
	<i>EVT 1</i>	EVT1 output ON
	<i>EVT 2</i>	EVT2 output ON
	<i>EVT 3</i>	EVT3 output ON
	<i>EVT 4</i>	EVT4 output ON
	<i>EVT 5</i>	EVT5 output ON
	<i>EVT 6</i>	EVT6 output ON
	<i>Tran 1</i>	Transmission output 1: 20 mA DC
	<i>Tran 2</i>	Transmission output 2: 20 mA DC
<i>do</i> Measured value	Input mode	
	DO Display	Temperature Display
	<i>do</i>	DO concentration measured value
	<i>WTMP</i>	Water temperature measured value
	<i>DO%F</i>	DO % saturation measured value
	<i>OPr4</i>	Oxygen partial pressure measured value
	<i>ncRP</i>	Sensor cap serial number

Data Clear Group

Character	Setting Item, Setting Range	Factory Default	Data
<i>CL4L</i> <i>CAL</i>	Data clear selection <i>CAL</i> : Calibration value <i>SET</i> : Set value	Calibration value	
<i>CLR</i> <i>no</i>	Data clear Stop/Perform <i>no</i> : Data clear Stop <i>YE4</i> : Data clear Perform	Data clear Stop	

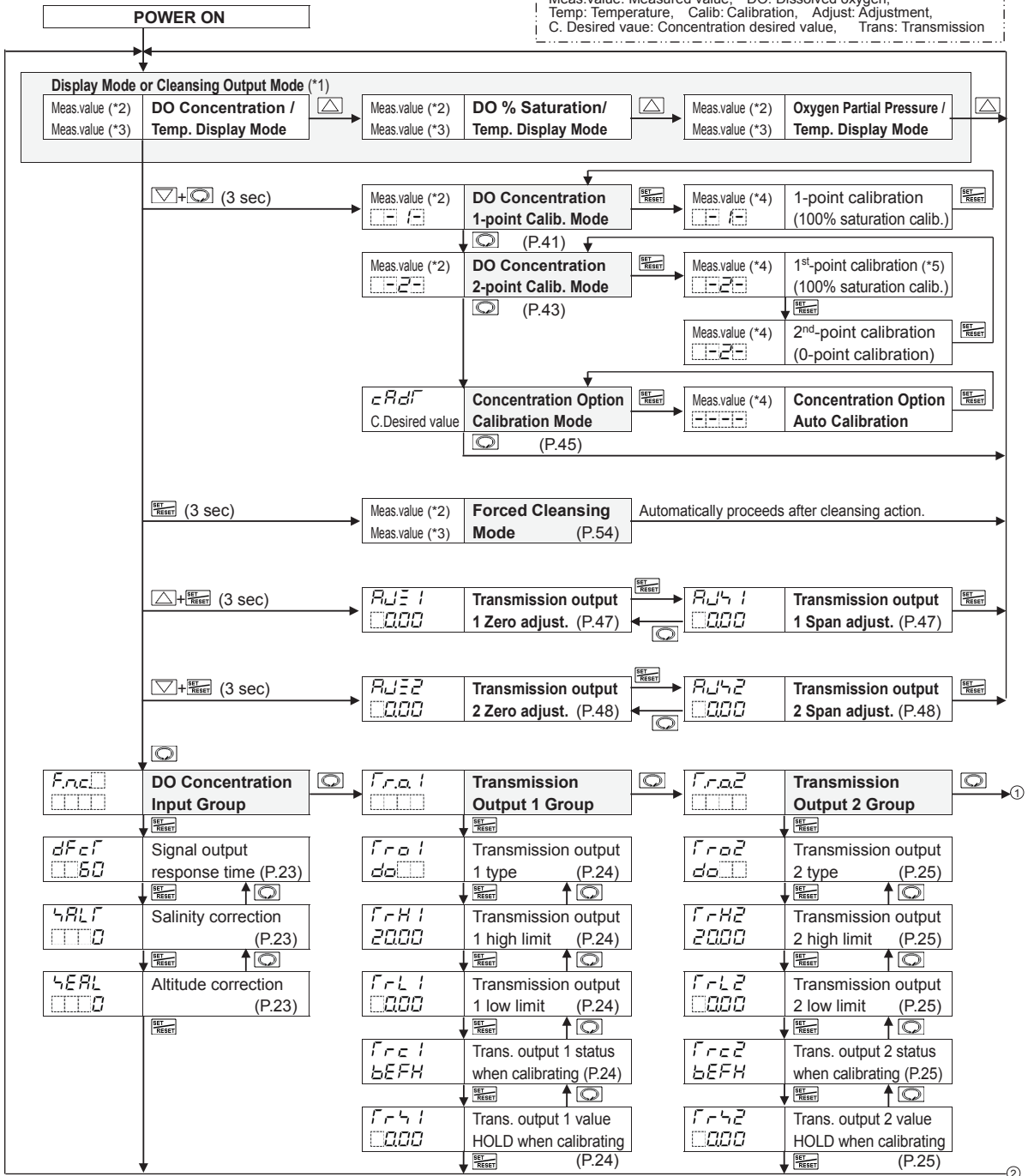
Error Codes

The following error codes are indicated on the Temperature Display.

Error Code	Description	Occurrence
<i>Err0</i>	Non-volatile IC memory error	Constantly
<i>Err1</i>	DO Sensor communication errors have occurred, or DO Sensor is not connected. After a command is sent to the DO Sensor, if there is no response for 500 ms, the command will be sent again. If no response occurs 4 times consecutively, this error code will be displayed. If communication status returns to normal, the unit will automatically return to normal status. When this error code is displayed, the previous measured value is retained.	When measuring and calibrating
<i>Err2</i>	DO Sensor cap is not attached, or it is incorrectly attached.	
<i>Err3</i>	Calibration error (when input errors have occurred, or when calibration cannot be performed 30 minutes after starting calibration)	When calibrating
<i>Err4</i>	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.	When measuring and calibrating

14. Key Operation Flowchart

Abbreviations:
 Meas.value: Measured value, DO: Dissolved oxygen,
 Temp: Temperature, Calib: Calibration, Adjust: Adjustment,
 C. Desired value: Concentration desired value, Trans: Transmission



● About Setting Item

dFct Signal output response time (P.23)

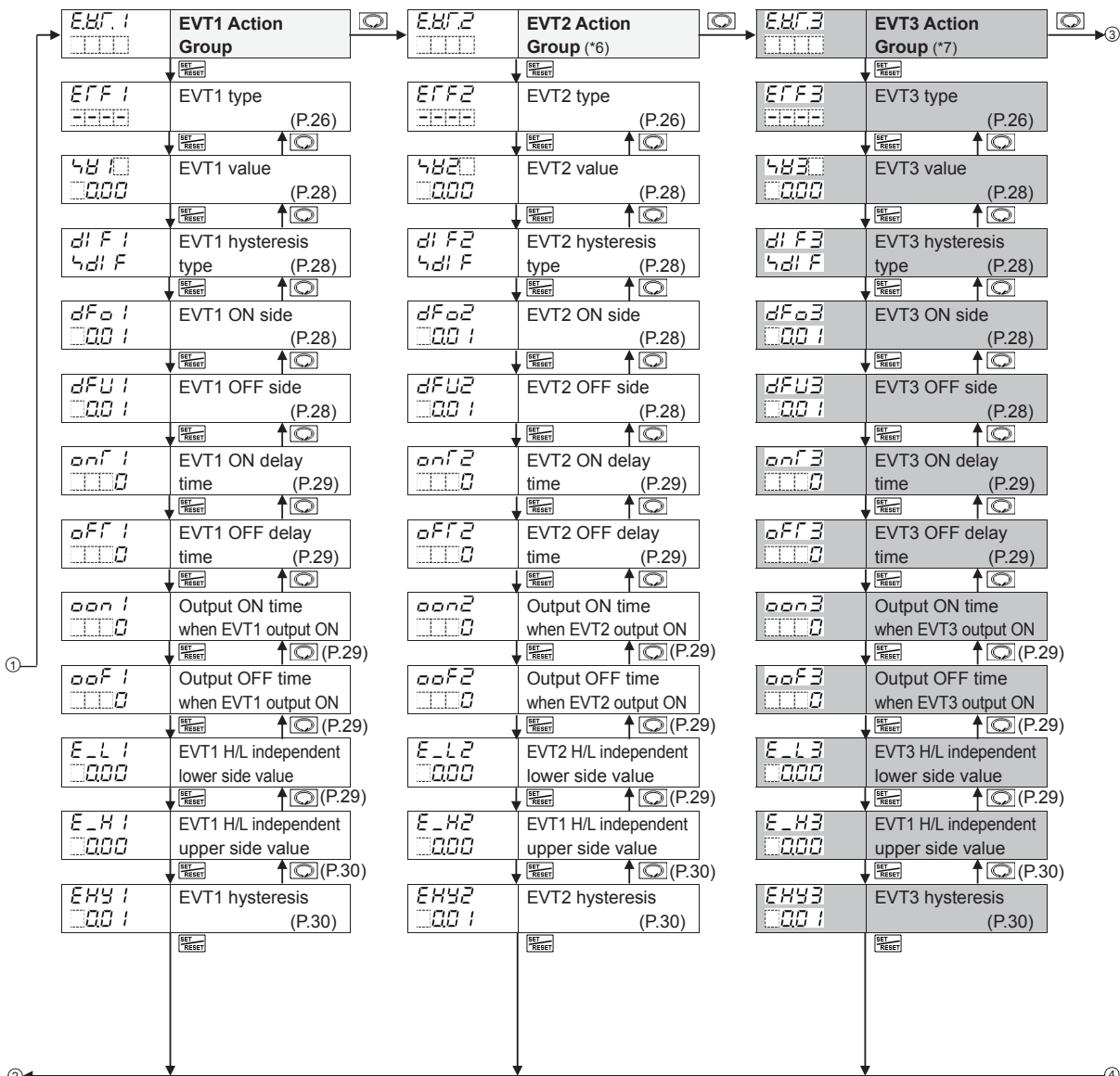
• **Upper left:** DO Display: Indicates the setting item characters. • **Lower left:** Temperature Display: Indicates the factory default. • **Right side:** Indicates the setting item and reference page.

EVT3 **EVT3 Action Group**

Setting item in shaded section will be displayed only when the corresponding option is ordered.

(*1) In Cleansing Output Mode, the measured value (DO concentration, DO % saturation, Oxygen partial pressure, temperature) is held during cleansing action (using 'Cleansing time' and 'Standby after cleansing').
 (*2) Indicates the measured value of DO concentration, DO % saturation or Oxygen partial pressure.
 (*3) Indicates temperature measured value. (*4) During calibration, DO concentration measured value flashes.
 (*5) If errors occur during 1st-point calibration (100% saturation calibration) in 2-point Calibration Mode, the unit will revert to the Display Mode or Cleansing Output Mode by pressing the or key.

Abbreviation: H/L: High/Low limits



● Key Operation

- (3 sec): Press the , , or key. The unit will proceed to the next setting item, illustrated by an arrow.
- + (3 sec): Press and hold the and keys (in that order) together for 3 seconds. The unit will proceed to the next mode.
- (3 sec): Press the key for 3 seconds. The unit will proceed to the next setting item, illustrated by an arrow.
- + (3 sec): Press and hold the and keys (in that order) together for 3 seconds. The unit will proceed to the next mode.
- + (3 sec): Press and hold the and keys (in that order) together for 3 seconds. The unit will proceed to the next mode.
- To set each item, use the or key, and register the set value with the key.
- If the key is pressed for 3 seconds at any setting item, the unit will revert to Display Mode or Cleansing Output Mode.

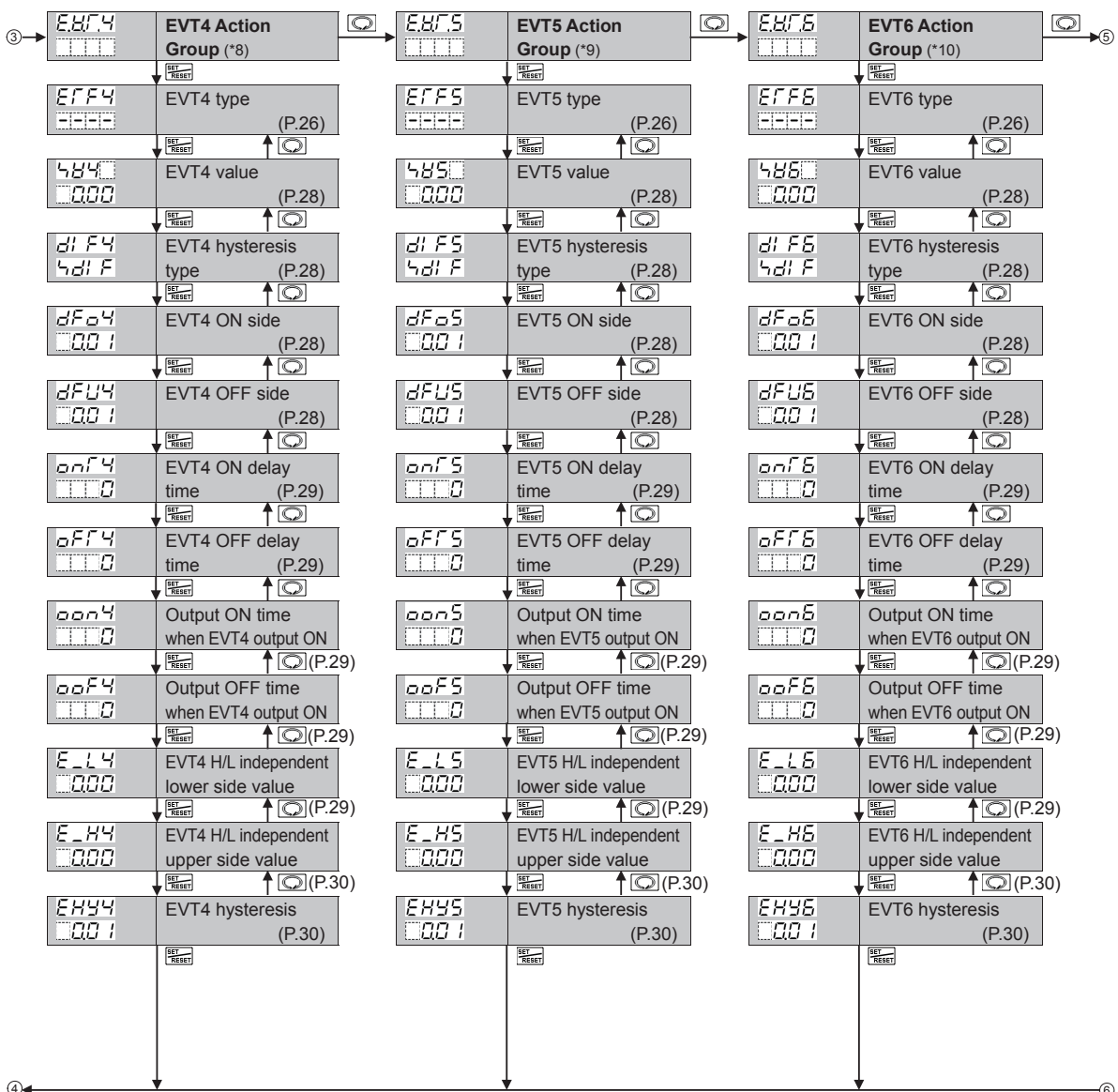
(*6) Action, indication condition and setting range of the EVT2 Action Group are the same EVT1 Action Group.

Substitute EVT1 character (*i*) with EVT2 character (*z*). Refer to EVT1 Action Group (pp. 26 to 30).

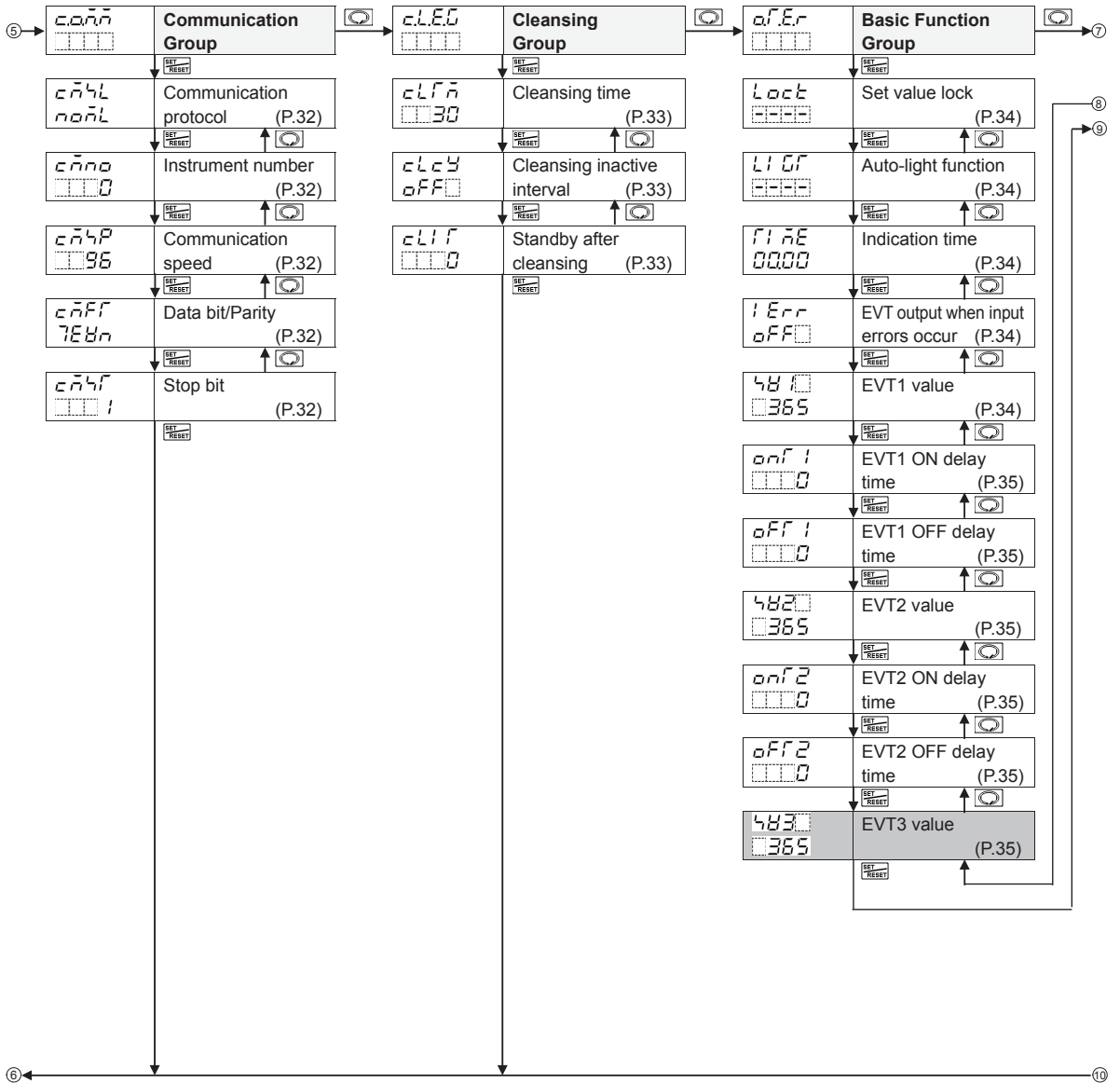
(*7) Action, indication condition and setting range of the EVT3 Action Group are the same EVT1 Action Group.

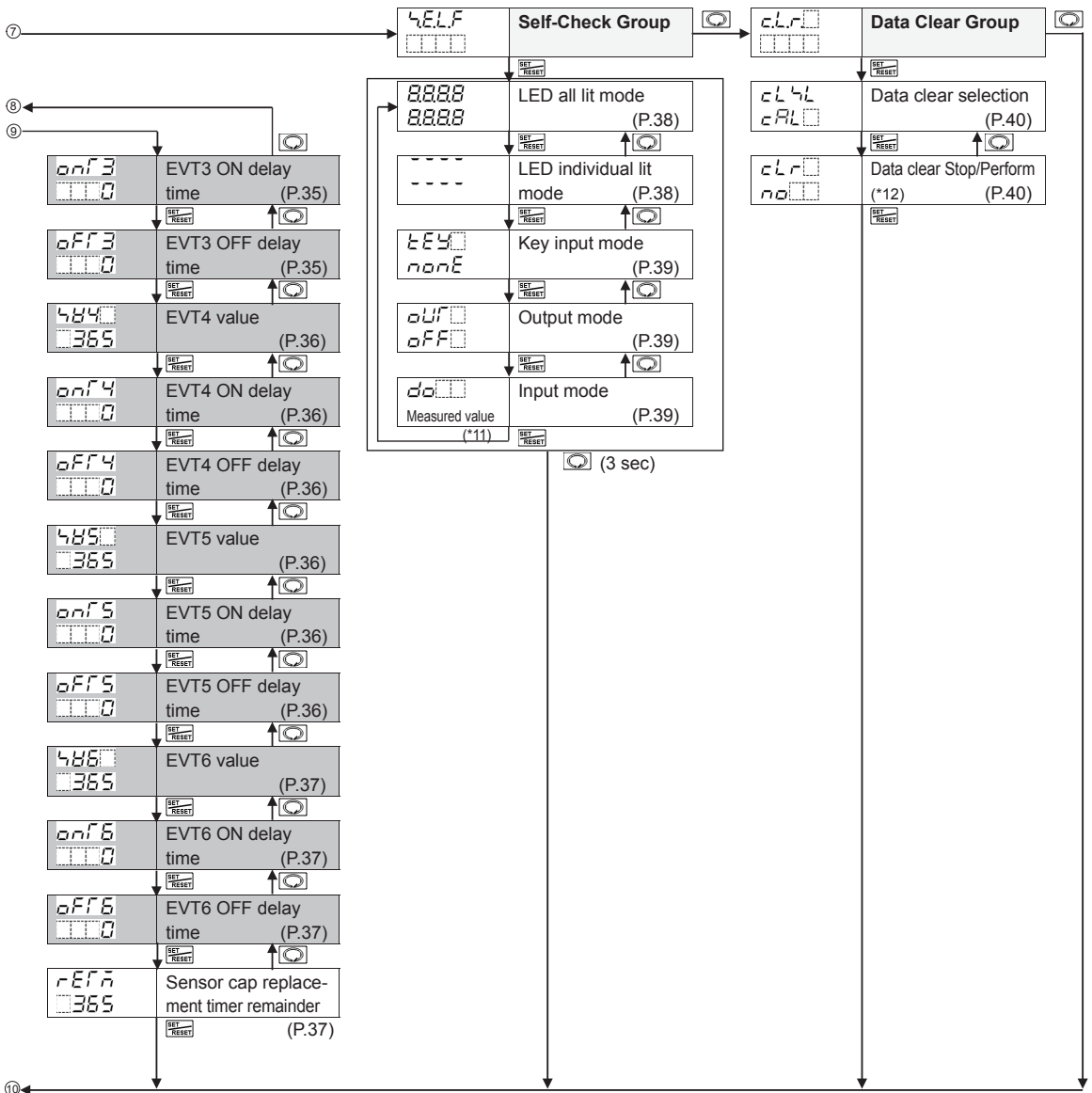
Substitute EVT1 character (*i*) with EVT3 character (*z*). Refer to EVT1 Action Group (pp. 26 to 30).

Abbreviation: H/L: High/Low limits



(*8) Action, indication condition and setting range of the EVT4 Action Group are the same EVT1 Action Group. Substitute EVT1 character (1) with EVT4 character (4). Refer to EVT1 Action Group (pp. 26 to 30).
 (*9) Action, indication condition and setting range of the EVT5 Action Group are the same EVT1 Action Group. Substitute EVT1 character (1) with EVT5 character (5). Refer to EVT1 Action Group (pp. 26 to 30).
 (*10) Action, indication condition and setting range of the EVT6 Action Group are the same EVT1 Action Group. Substitute EVT1 character (1) with EVT6 character (6). Refer to EVT1 Action Group (pp. 26 to 30).





(*11) Indicates DO concentration measured value.

(*12) Depending on the selection in [Data clear Stop/Perform], the unit operates as follows.

If 'Data clear Stop' is selected, data will not be cleared. The unit will revert to the mode prior to Data clear Stop (either Display Mode or Cleansing Output Mode).

If 'Data clear Perform' is selected, data will be cleared. The unit will revert to the mode prior to Data clear Perform (either Display Mode or Cleansing Output Mode). (While data is being cleared, all indications are momentarily unlit.)

15. Maintenance

15.1 Maintenance

- Please perform the following maintenance procedure every month.
 - Clean the measurement section with tap water.
 - Check that the measurement section is not damaged or deteriorated.
 - Check that DO Sensor cable is not damaged or deteriorated.
 - Check that installation devices are not corroded.

15.2 Periodic Inspection

- Please check the following items every 3 months.
 - The DO meter (WIL-102-DO) is securely fixed in place.
 - Check that the DO meter (WIL-102-DO) is not damaged.
 - Check that screws in the terminal block are not rusty.

15.3 Replacement of Consumables (Maintenance Parts)

- Purchase new sensor cap (DOS-CP), and replace one (1) year after installation (Recommended).

15.4 Calibration

- The DO meter (WIL-102-DO) is designed to be used for a long period of time, however, calibrate it at least once a year to maintain measurement reliability.
See Section “8. Calibration” (p.41).

15.5 Long-Term Storage

- When the DO meter (WIL-102-DO) and DO Sensor are not used for a long period of time, store them as follows.
 - Disconnect the power from the mains electricity.
 - Pull the DO Sensor out of the water, and clean it.
 - Store the DO meter (WIL-102-DO) and DO Sensor away from direct sunlight.

16. Reference Chart

Amount of saturated DO in water at each temperature

(At an atmospheric pressure 1, Salinity concentration 0 PSU)

Temperature (°C)	Amount of saturated DO (mg/L)	Temperature (°C)	Amount of saturated DO (mg/L)	Temperature (°C)	Amount of saturated DO (mg/L)	Temperature (°C)	Amount of saturated DO (mg/L)
1	13.77	11	10.67	21	8.68	31	7.42
2	13.40	12	10.43	22	8.53	32	7.32
3	13.04	13	10.20	23	8.39	33	7.22
4	12.70	14	9.97	24	8.25	34	7.13
5	12.37	15	9.76	25	8.11	35	7.04
6	12.06	16	9.56	26	7.99	36	6.94
7	11.75	17	9.37	27	7.87	37	6.86
8	11.47	18	9.18	28	7.75	38	6.76
9	11.19	19	9.01	29	7.64	39	6.68
10	10.92	20	8.84	30	7.53	40	6.59

***** Inquiries *****

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

[Example]

- Model ----- WIL-102-DO
- Serial number ----- No. 194F05000

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

SHINKO TECHNOS CO., LTD.
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