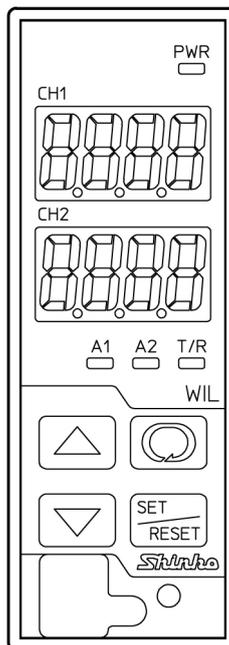# Plug-in Type
Digital Indicating DO Meter
WIL-102-DO

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	⁻ı	０	ı	２	３	４	５	６	７	８	９	⊏	⊦
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication	Ꭺ	ᑲ	⊏	ᑯ	Ε	Ϝ	Ꮐ	Η	ı	┘	⊦	∟	⊓
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	⊓	�口	Ρ	۹	ᵣ	५	┌	⊔	ᵤ	⊔	५	५	☰
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

⚠ Caution

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

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

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

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

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

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

⚠ Warning

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

⚠ SAFETY PRECAUTIONS

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

⚠ Caution with Respect to Export Trade Control Ordinance

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

PRECAUTIONS

1. Installation Precautions

⚠ Caution

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

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

Contents

1. Model

1.1 Model

W I L - 1 0	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.

- WIL-102-DO — Model, Option
- D14-014-6 — Development No.
- MULTI-RANGE — Input indication
- 100to240V AC 50/60Hz 10VA — Power supply voltage, Power consumption
- SERIAL No.194F05000 — Serial number
- SHINKO TECHNOS CO., LTD. — Manufacturer
- MADE IN JAPAN RoHS SF — Factory ID
- RoHS directive compliant
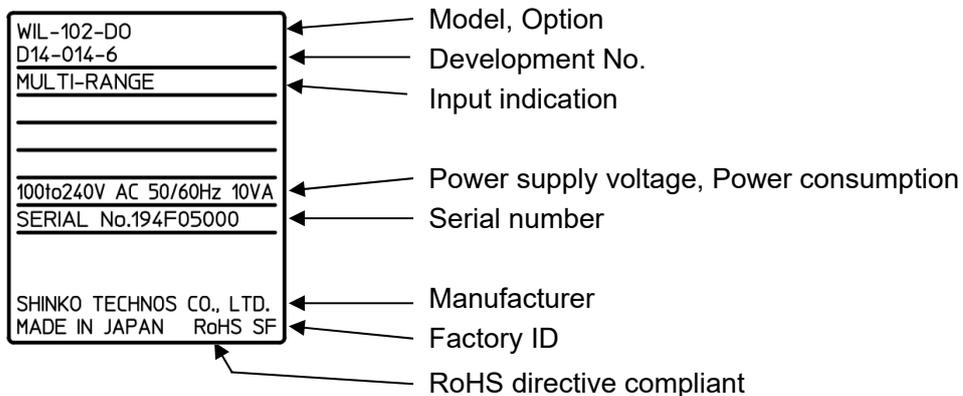
(Fig. 1.2-1)

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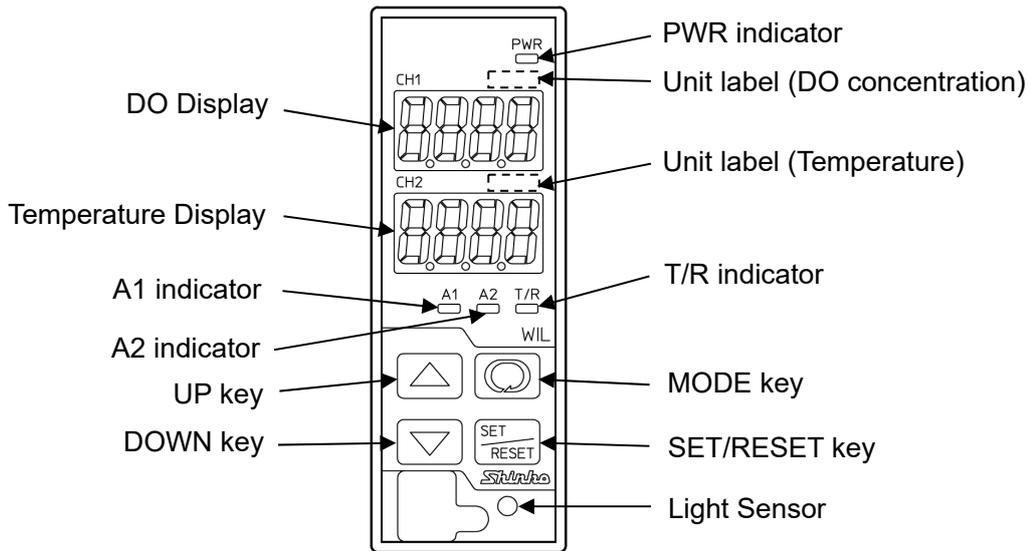
(Fig. 2-1)

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℃ (32 to 122℉) (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℃. Otherwise the life of electronic parts (especially electrolytic capacitors) of the unit will be shortened.

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

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

3.2 External Dimensions (Scale: mm)
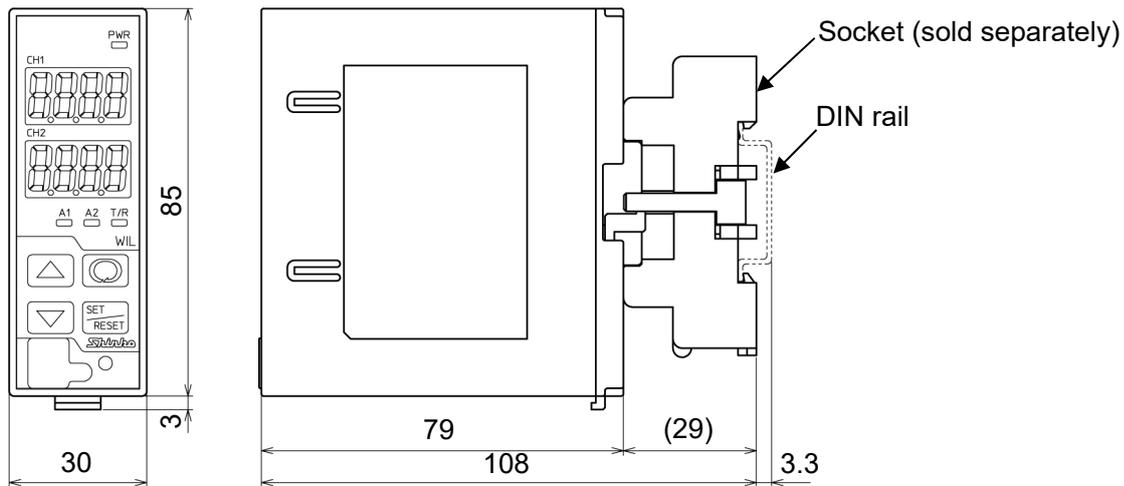
(Fig. 3.2-1)

3.3 Mounting

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

Hook the upper part of the socket on the DIN rail.
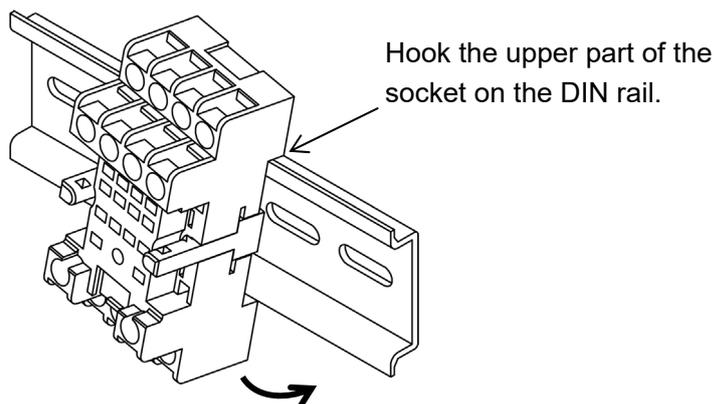
(Fig. 3.3-1)

> ### ⚠ 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.
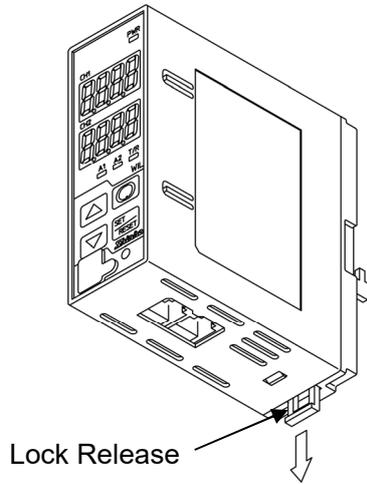
Lock Release

(Fig. 3.3-2)

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

When inserting, be careful about the position of pins and slots.
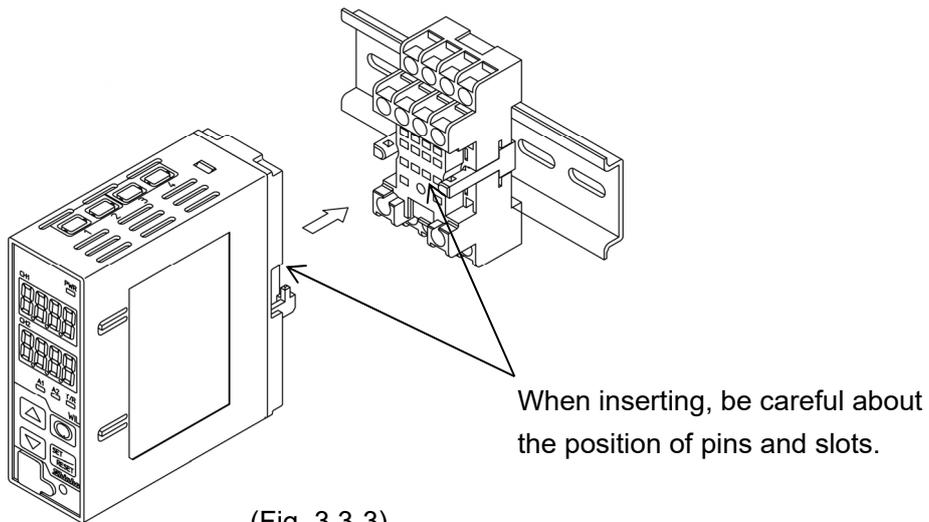
(Fig. 3.3-3)

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

Check that the WIL-102-DO and the socket are locked by pushing the Lock Release up.
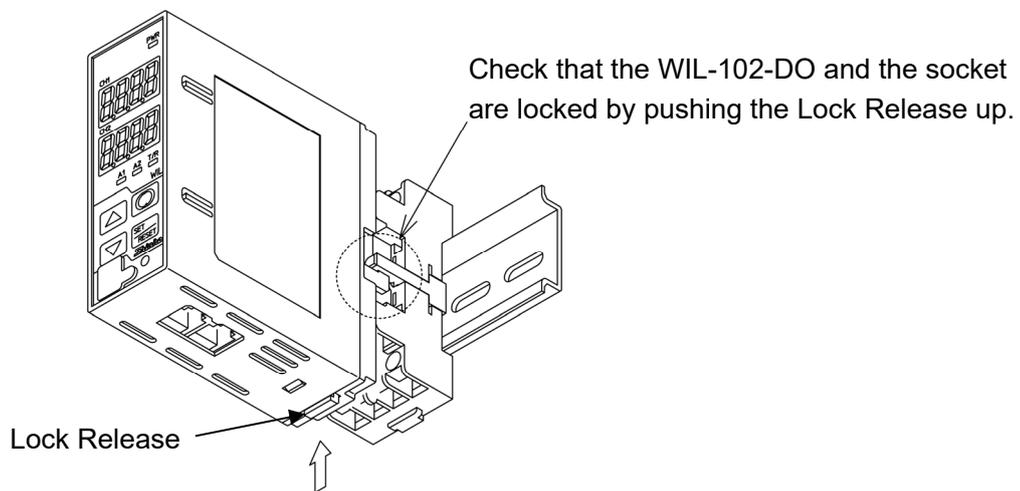
Lock Release

(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.

Check that the WIL-102-DO and
the socket are unlocked by pulling
the Lock Release down.
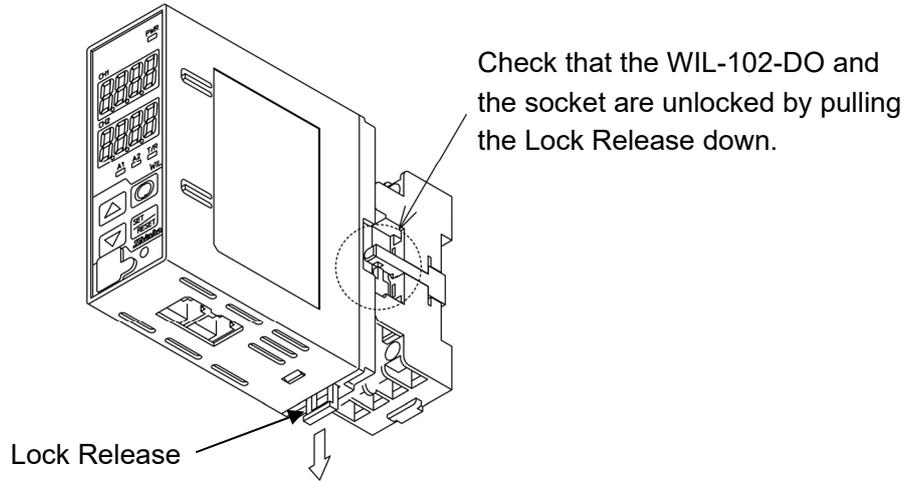
Lock Release

(Fig. 3.4-1)

(3) Separate the WIL-102-DO from the socket.
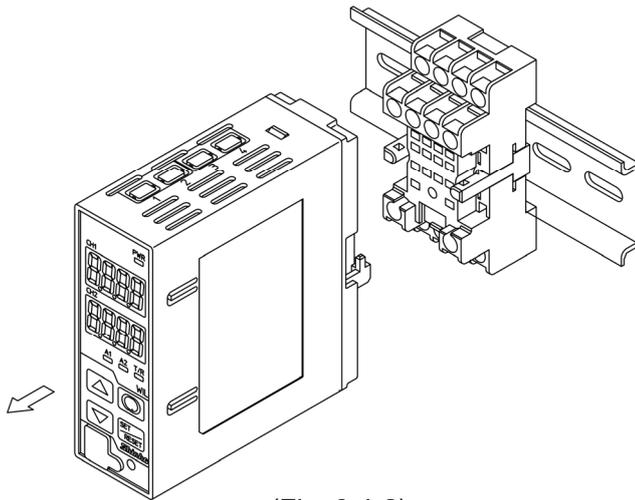
(Fig. 3.4-2)

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

Lock Release
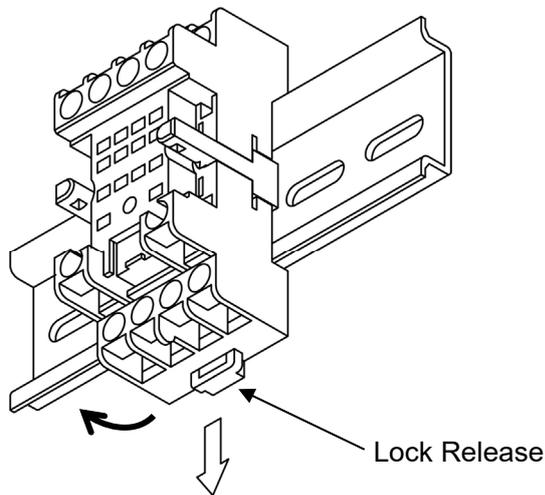
(Fig. 3.4-3)

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)	Calibration container

(Fig. 4.1-1)
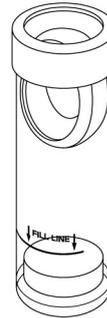
4.2 Caution when Using DO Sensor

⚠ **Caution**

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

 (Fig. 4.2-1)	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.
 (Fig. 4.2-2)	Do not subject the sensor to any rough treatment. Do not drop the unit. Handle with care.
 (Fig. 4.2-3)	Do not touch the measurement section. If it is not clean, wipe it with a clean, soft cloth.
 (Fig. 4.2-4)	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.
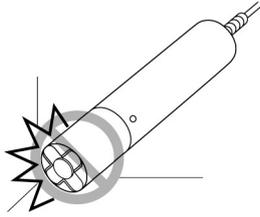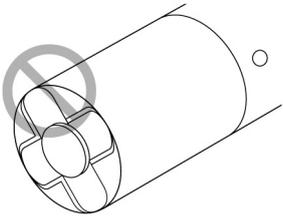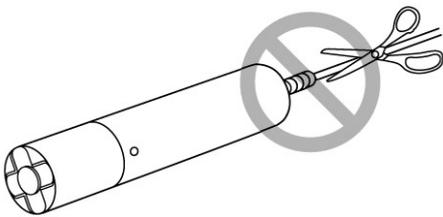
4.3 Name of Sections

Protective cover

Sensor cap   Humidity sensor

Detection area

Measurement section

(Fig. 4.3-1)
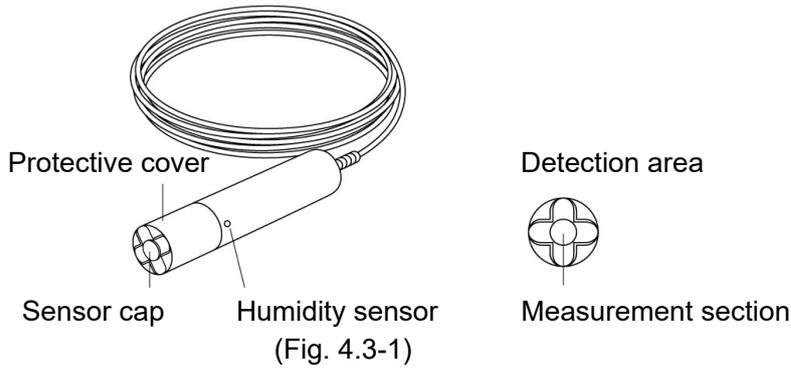
4.4 Attaching the Sensor Cap

⚠ **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.

Date of manufacture 04/2016
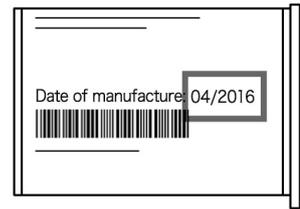
(Fig. 4.4-1)

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

Protective cap   Protective cover
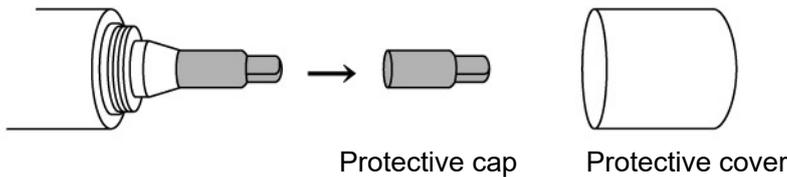
(Fig. 4.4-2)

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

OPTEX

DOS-CP SENSOR CAP

RDO

(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.

⇨ ⇦ RDO
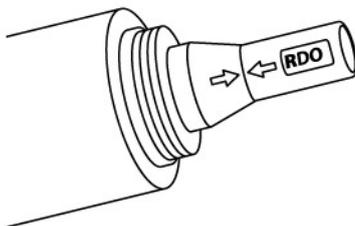
(Fig. 4.4-4)

(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.

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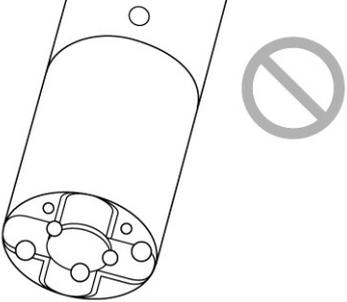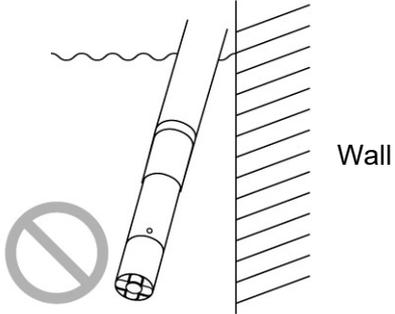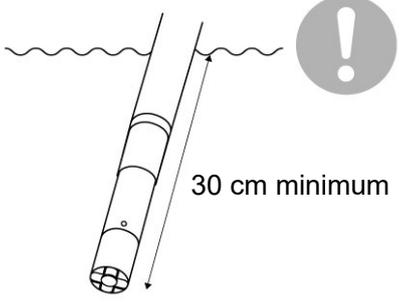
Recommendations

  • 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.

Stanchion pole (PS-1)

PVC pipe: VP-40
(To be supplied by the user)

(2) 2-pipe hanger (40A)

(3) 2-fitting

(*) Recommended

398

505

500(*)

300(*)

100

100

(1) 4-U bolt
SUS304 50AxM10

675

φ60.5

(4) Pipe attachment joint
PVC (1$\frac{1}{4}$ - 11$\frac{1}{2}$ inch NPT male screw/40A)
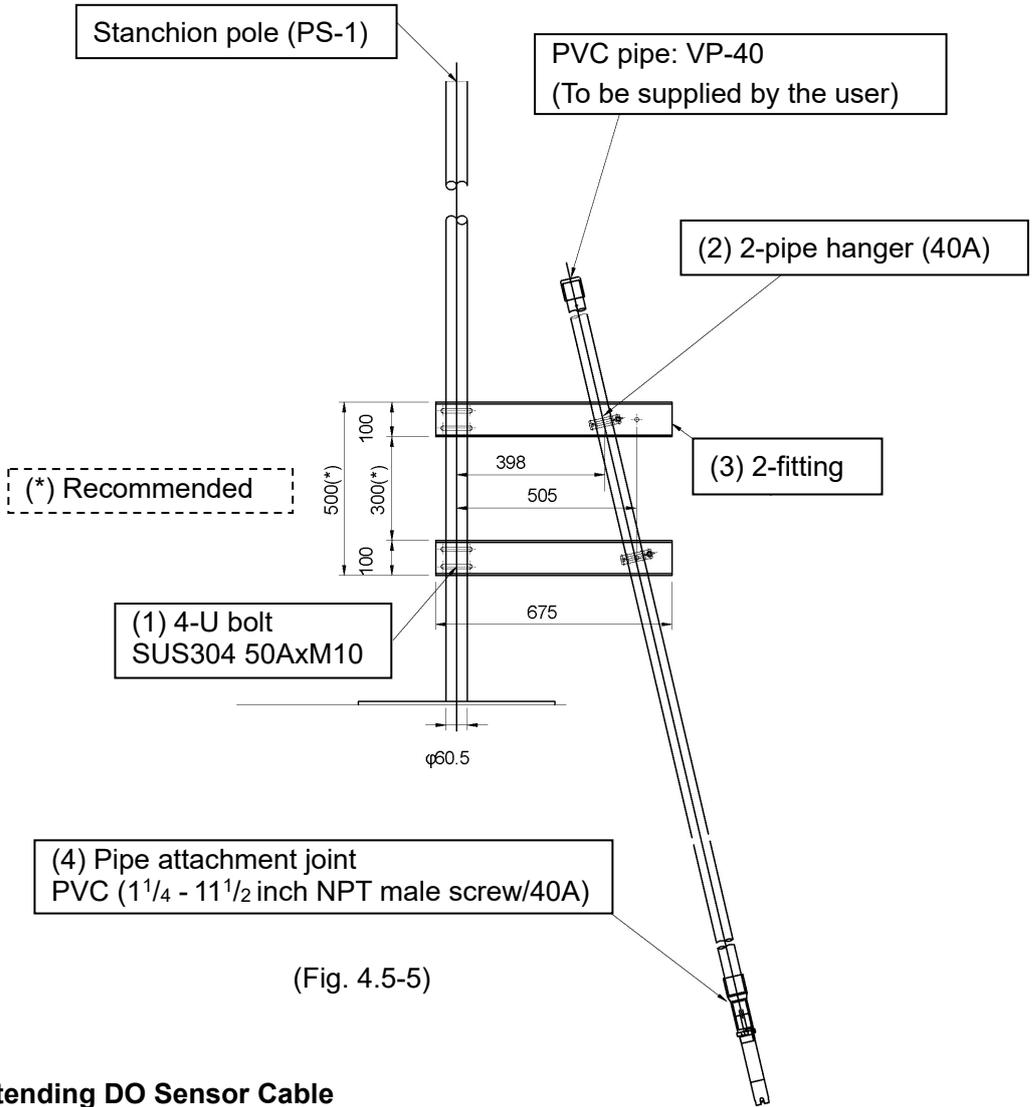
(Fig. 4.5-5)

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.

Pull box, etc.
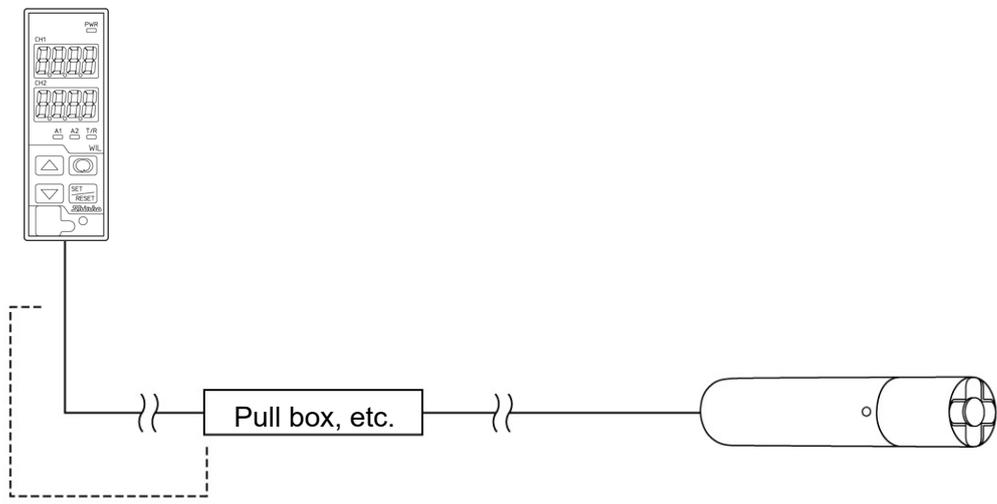
Extendable cable length: 1200 m (Nominal cross-section area: 0.2 to 1.25 mm^2)

(Fig. 4.6-1)

15

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

3.2 mm minimum
5.9 mm max.
4 mm max.
4.8 mm minimum
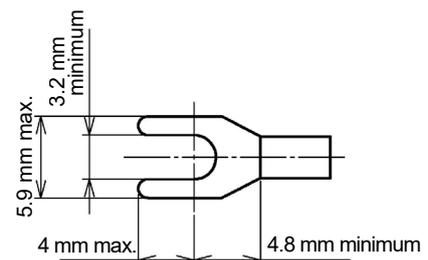
(Fig. 5.1-1)

5.2 Terminal Arrangement

Standard specifications
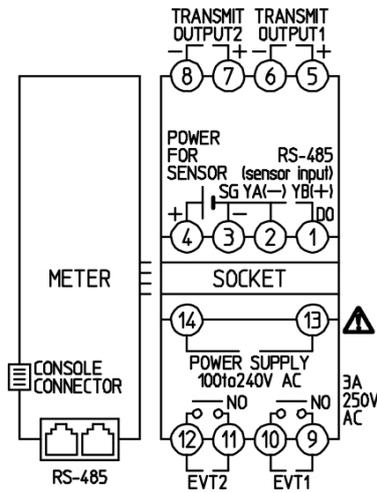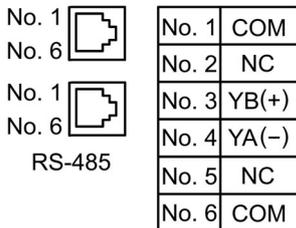
EVT option
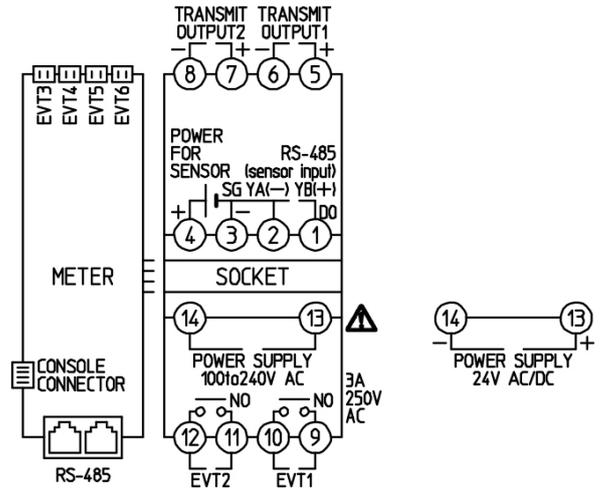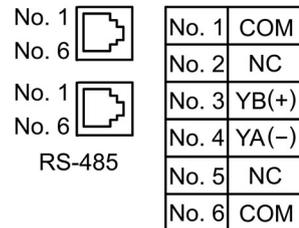
(Fig. 5.2-1)

(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

100 to 240 V AC

Power Supply
(12 to 36 V DC)
To be supplied by the user.

(Blue)
(Green)
(Red)(Black)

WIL-102-DO

+ −
Input
terminals

Power
terminals

Recorders, etc.

DO Sensor
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.

DO Sensor shield
Electrically insulate the DO Sensor shield, and connect the shield and black wire to (-) terminal of external power supply.

(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

Top view (WIL-102-DO)

Interior view (WIL-102-DO)

Alarm unit   Wire harness WJ

EVT6

EVT5

EVT4

EVT3

+ −
DC power supply

(Fig. 5.2-4)

18
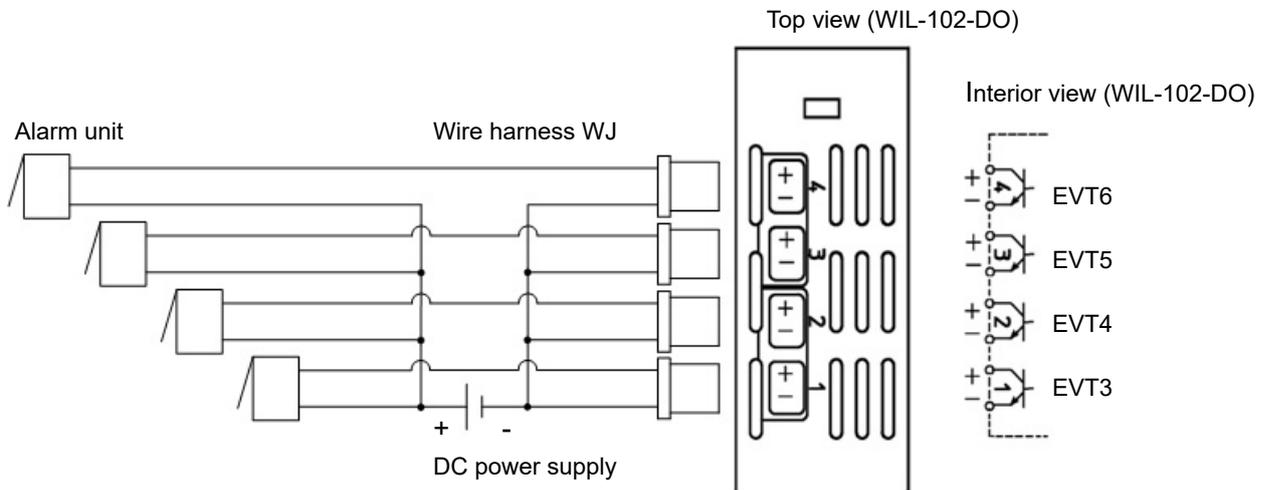
5.3 Wire the Communication Cable

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)**
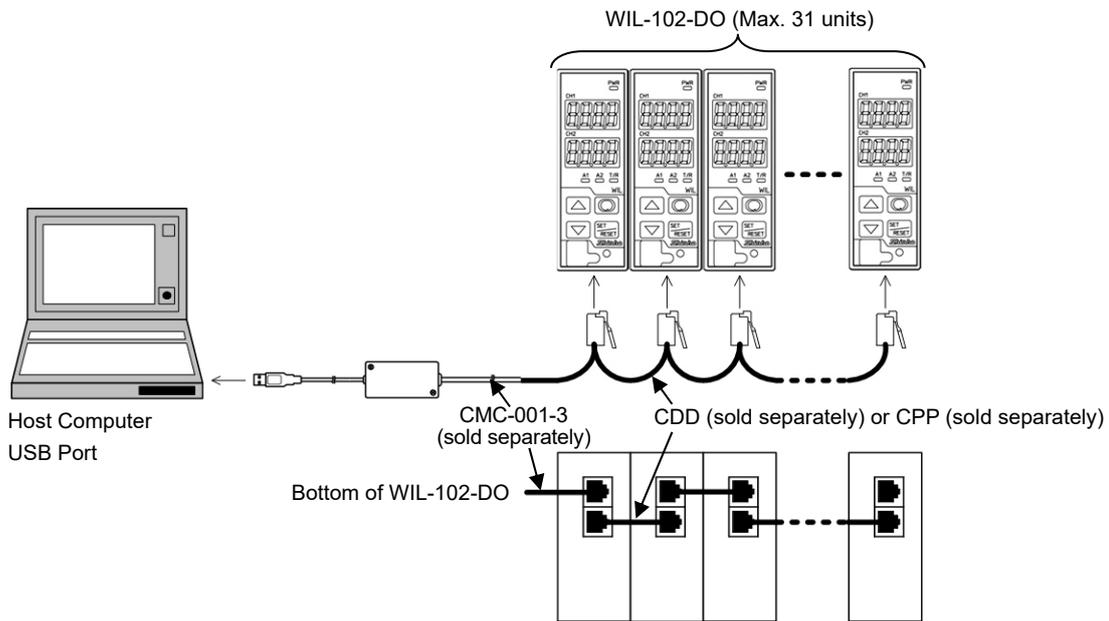
(Fig. 5.3-1)

• **Wiring Example Using the Communication Converter IF-400 (sold separately)**
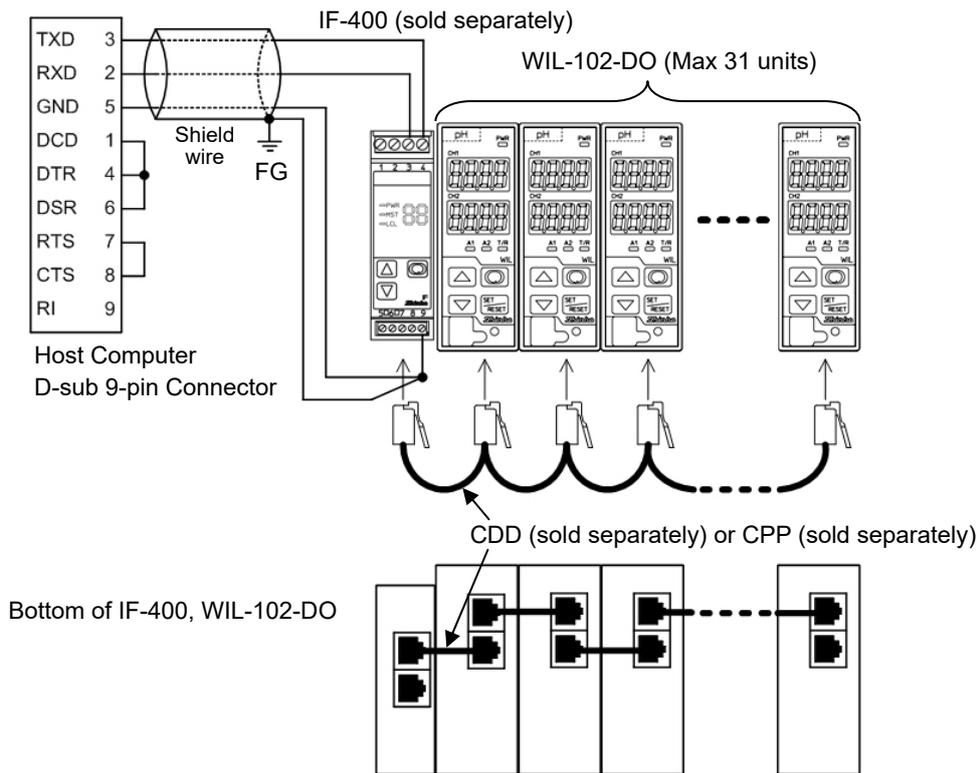
(Fig. 5.3-2)

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 [SET/RESET] key. The unit enters each setting item.
To set each setting item, use the [△] or [▽] key, and register the set value with the [SET/RESET] key.
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 [SET/RESET] 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

- [△], [◯], [SET/RESET]: Press the [△], [◯] or [SET/RESET] key. The unit will proceed to the next setting item, illustrated by an arrow.

  [SET/RESET] or [◯] : Press the [SET/RESET] or [◯] key until the desired setting mode appears.

- [▽] + [◯] (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.

- [SET/RESET] (3 sec), [◯] (3 sec): Press the [SET/RESET] key or [◯] key for approx. 3 seconds.
  The unit will proceed to the next setting mode, illustrated by an arrow.

- [△] + [SET/RESET] (3 sec): Press and hold the [△] key and [SET/RESET] key (in that order) together for approx. 3 seconds. The unit will proceed to Transmission output 1 Zero adjustment.

- [▽] + [SET/RESET] (3 sec): Press and hold the [▽] key and [SET/RESET] 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

Display Mode or Cleansing Output Mode (*1)

DO Concentration/Temperature Display Mode △ → DO % Saturation/Temperature Display Mode △ → Oxygen Partial Pressure/Temperature Display Mode △

▽ + ◯ (3sec) → DO concentration 1-point calibration mode → SET/RESET → 1-point calibration (100% saturation calib.) → SET/RESET

◯ → DO concentration 2-point calibration mode → SET/RESET → 1st-point calibration (*2) (100% saturation calib.) → SET/RESET → 2nd-point calibration (0-point calibration) → SET/RESET

◯ → Concentration option calibration mode → SET/RESET → Concentration option auto calibration → SET/RESET

◯

SET/RESET (3sec) → Forced Cleansing Mode → After cleansing, automatically proceeds.

△ + SET/RESET (3sec) → Transmission output 1 Zero adjustment → SET/RESET → Transmission output 1 Span adjustment → SET/RESET
◯

▽ + SET/RESET (3sec) → Transmission output 2 Zero adjustment → SET/RESET → Transmission output 2 Span adjustment → SET/RESET
◯

Group Selection ◯ | **Item Selection**

DO concentration Input Group → SET/RESET → Signal output response time → SET/RESET ⇄ Altitude correction → SET/RESET
◯ | ◯

Transmission Output 1 Group → SET/RESET → Transmission output 1 type → SET/RESET ⇄ Trans. output 1 value HOLD when calibrating → SET/RESET
◯ | ◯

Transmission Output 2 Group → SET/RESET → Transmission output 2 type → SET/RESET ⇄ Trans. output 2 value HOLD when calibrating → SET/RESET
◯ | ◯

EVT1 Action Group → SET/RESET → EVT1 type ⇄ EVT1 hysteresis → SET/RESET
◯ | ◯

EVT2 Action Group → SET/RESET → EVT2 type ⇄ EVT2 hysteresis → SET/RESET
◯ | ◯

EVT3 Action Group → SET/RESET → EVT3 type ⇄ EVT3 hysteresis → SET/RESET
◯ | ◯

EVT4 Action Group → SET/RESET → EVT4 type ⇄ EVT4 hysteresis → SET/RESET
◯ | ◯

EVT5 Action Group → SET/RESET → EVT5 type ⇄ EVT5 hysteresis → SET/RESET
◯ | ◯

EVT6 Action Group → SET/RESET → EVT6 type ⇄ EVT6 hysteresis → SET/RESET
◯ | ◯

Communication Group → SET/RESET → Communication protocol → SET/RESET ⇄ Stop bit → SET/RESET
◯ | ◯

Cleansing Group → SET/RESET → Cleansing time → SET/RESET ⇄ Standby after cleansing → SET/RESET
◯ | ◯

Basic Function Group → SET/RESET → Set value lock → SET/RESET ⇄ Sensor cap replacement timer remainder → SET/RESET
◯ | ◯

Self-Check Group → SET/RESET → LED all lit mode → SET/RESET ⇄ Input mode → SET/RESET → ◯ (3 sec)
◯ | ◯

Data Clear Group → SET/RESET → Data clear selection → SET/RESET ⇄ Data clear Stop/Perform (*3) → SET/RESET
◯ | ◯

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	_1.00_ [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.

DO Concentration / Temperature Display Mode
↓ △
DO % Saturation / Temperature Display Mode
↓ △
Oxygen Partial Pressure / Temperature Display Mode
↓ △
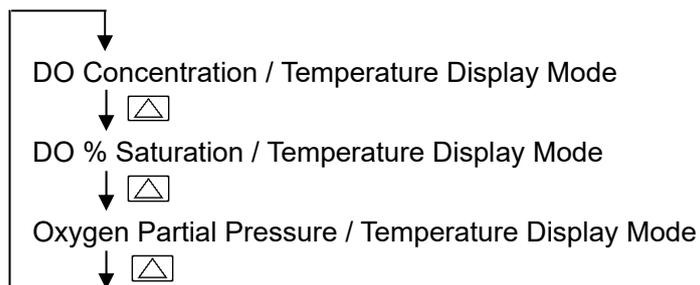
7.2 DO Concentration Input Group

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

① *F.nc*   Press the ⌾ key once in Display Mode or Cleansing Output Mode.

② *dFcr*   Press the [SET/RESET] key.

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

Character	Setting Item, Function, Setting Range	Factory Default
dFcr *60*	**Signal output response time**	60 seconds
	• 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	
SALr *0*	**Salinity correction**	0 PSU
	• Sets the salinity concentration correction value. • Setting range: 0 to 42 PSU	
SEAL *0*	**Altitude correction**	0 m
	• Sets altitude. • Setting range: 0 to 5000 m	

7.3 Transmission Output 1 Group

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

① ⌐.⌐.◌.╵ Press the ◌ key twice in Display Mode or Cleansing Output Mode.

② ⌐⌐◌╵ Press the SET/RESET key.

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

Character	Setting Item, Function, Setting Range	Factory Default

⌐⌐◌╵
do◻
	Transmission output 1 type
	
	• Selects Transmission output 1 type.
	• do◻ : DO concentration transmission
	  ⌐⌐⌐P : Water temperature transmission
	  do५⌐ : DO % saturation transmission
	  ⌐P⌐५ : Oxygen partial pressure transmission
		DO concentration transmission

⌐⌐H╵ 20.00	**Transmission output 1 high limit** • Sets Transmission output 1 high limit value. (This value correponds to 20 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Setting range: Transmission output 1 low limit to Measurement range high limit	20.00 mg/L
⌐⌐L╵ ◻0.00	**Transmission output 1 low limit** • Sets Transmission output 1 low limit value. (This value correponds to 4 mA DC output.) If Transmission output 1 high limit and low limit are set to the same value, Transmission output 1 will be fixed at 4 mA DC. • Setting range: Measurement range low limit to Transmission output 1 high limit	0.00 mg/L

⌐⌐c╵
bEFH
	Transmission output 1 status when calibrating
	
	• Selects Transmission output 1 output status when calibrating DO concentration.
	• Selection item:
	  bEFH: Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.)
	  ५E⌐H: Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when calibrating].)
	  P५H◻: Measured value (Outputs the measured value when calibrating DO concentration.)
		Last value HOLD

⌐⌐५╵ ◻0.00	**Transmission output 1 value HOLD when calibrating** • Sets Transmission output 1 value HOLD. • Available only when ५E⌐H (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 ⌐⌐.o2   Press the ◎ key 3 times in Display Mode or Cleansing Output Mode.

② ⌐⌐o2   Press the [SET/RESET] key.

     The unit enters Transmission Output 2 Group, and "Transmission output 2 type" will appear.
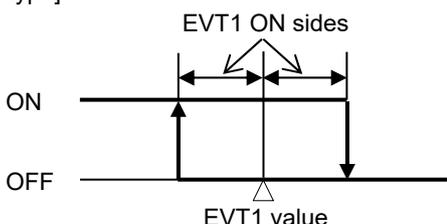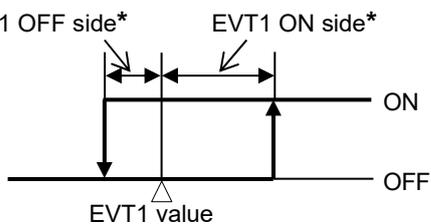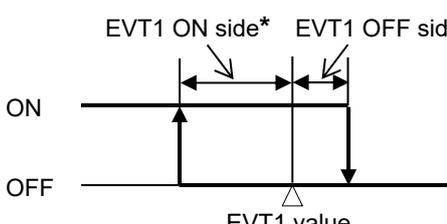
Character	Setting Item, Function, Setting Range	Factory Default

⌐⌐o2
do□□
	Transmission output 2 type
	• Selects Transmission output 2 type.
	• do□□ : DO concentration transmission
	  ⌐⌐⌐P : Water temperature transmission
	  do⁴⌐ : DO % saturation transmission
	  oPr⁴ : Oxygen partial pressure transmission
		DO concentration transmission

⌐⌐H2 20.00	**Transmission output 2 high limit** 20.00 mg/L • Sets Transmission output 2 high limit value. (This value correponds to 20 mA DC output.) If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Setting range: Transmission output 2 low limit to Measurement range high limit	20.00 mg/L
⌐⌐L2 □0.00	**Transmission output 2 low limit** 0.00 mg/L • Sets Transmission output 2 low limit value. (This value correponds to 4 mA DC output.) If Transmission output 2 high limit and low limit are set to the same value, Transmission output 2 will be fixed at 4 mA DC. • Setting range: Measurement range low limit to Transmission output 2 high limit	0.00 mg/L

⌐⌐c2
bEFH
	Transmission output 2 status when calibrating Last value HOLD
	• Selects Transmission output 2 output status when calibrating DO concentration.
	• Selection item:
	  bEFH: Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.)
	  ⁴⌐H: Set value HOLD (Outputs the value set in [Transmission output 2 value HOLD when calibrating].)
	  PHH□: Measured value (Outputs the measured value when calibrating DO concentration.)
		Last value HOLD

⌐⌐⁴2 □0.00	**Transmission output 2 value HOLD when calibrating** • Sets Transmission output 2 value HOLD. • Available only when ⁴⌐H (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.ᗺᄃ.1   Press the ◯ key 4 times in Display Mode or Cleansing Output Mode.
② EᄃF1   Press the [SET/RESET] key.

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

Character	Setting Item, Function, Setting Range	Factory Default

EᄃF1
 ⌐⌐⌐⌐
	EVT1 type
	
	 • Selects an EVT1 output type.
	  Note: If EVT1 type is changed, EVT1 value defaults to 0.00 or 0.0.
	 • ⌐⌐⌐⌐ : No action
	  do_H : DO concentration input high limit action
	  do_L : DO concentration input low limit action
	  ᗺᄃᆱH : Water temperature input high limit action
	  ᗺᄃᆱL : Water temperature input low limit action
	  doᄂH : DO % saturation input high limit action
	  doᄂL : DO % saturation input low limit action
	  ᗺPᄃH : Oxygen partial pressure input high limit action
	  ᗺPᄃL : Oxygen partial pressure input low limit action
	 (Fig. 7.5-1)
	  ᄃᄃAP : Sensor cap replacement timer (Fig. 7.5-3) (p.27)
	  ᄂELF : Self-Check output (p.27)
	  ᄃLEᗺ : Cleansing output (Fig. 7.5-4) (p.27)
	  doHL : DO concentration input High/Low limits independent action (Fig.7.5-2) (p.27)
	  ᄃᆱHL : Water temperature input High/Low limits independent action (Fig.7.5-2) (p.27)
	  dᄂHL : DO % saturation input High/Low limits independent action (Fig.7.5-2) (p.27)
	  ᗺPHL : Oxygen partial pressure input High/Low limits independent action (Fig.7.5-2) (p.27)
	
	 • **EVT1 Action (Activated based on the indication value.)**
		No action

<table>
<tr><td colspan="2">DO concentration input high limit
Water temperature input high limit
DO % saturation input high limit
Oxygen partial pressure input high limit</td><td colspan="2">DO concentration input low limit
Water temperature input low limit
DO % saturation input low limit
Oxygen partial pressure input low limit</td></tr>
<tr><td colspan="2">If Medium Value is selected in [EVT1 hysteresis type]:

EVT1 ON sides
ON / OFF
EVT1 value</td><td colspan="2">If Medium Value is selected in [EVT1 hysteresis type]:

EVT1 ON sides
ON / OFF
EVT1 value</td></tr>
<tr><td colspan="2">If Reference Value is selected in [EVT1 hysteresis type]:

EVT1 OFF side*   EVT1 ON side*
ON / OFF
EVT1 value</td><td colspan="2">If Reference Value is selected in [EVT1 hysteresis type]:

EVT1 ON side*   EVT1 OFF side*
ON / OFF
EVT1 value</td></tr>
</table>

(Fig. 7.5-1)

 * Setting Example:
  If [EVT1 ON side (dFo1)] is set to 0, EVT1 output can be turned ON
  at the value set in [EVT1 value (ᄂᗺ1)].

  If [EVT1 OFF side (dFᄂ1)] is set to 0, EVT1 output can be turned OFF
  at the value set in [EVT1 value (ᄂᗺ1)].

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

EVT1 hysteresis   EVT1 hysteresis

ON

OFF

EVT1 High/Low limits   EVT1 value   EVT1 High/Low limits
independent lower side value   independent upper side value

(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.

ON

EVT1 output

OFF

Sensor cap replacement
timer remainder

0

Time

0

Sensor cap replacement   Sensor cap replacement
timer start   timer value has elapsed.
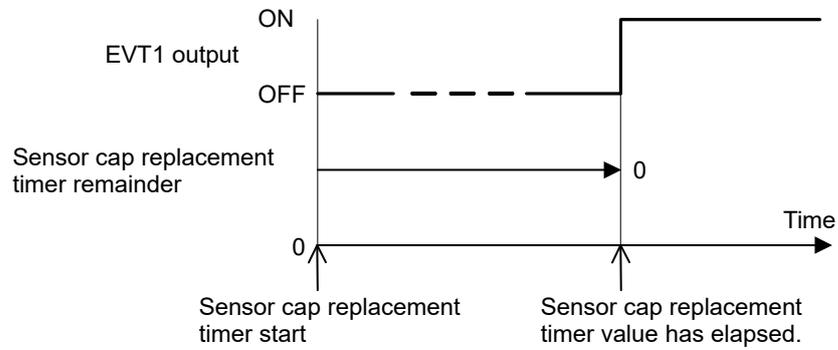
(Fig. 7.5-3)

• Self-check Output

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

Error Code	Description
$Err\ 1$	DO Sensor communication errors have occurred, 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)

• 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.

Ccy | Ctm | Cit | Ccy | Ctm | Cit | Ccy | Ctm | Cit

ON

OFF

Cleansing Stop | Cleansing Perform | Cleansing Stop | Cleansing Perform | Cleansing Stop | Cleansing Perform
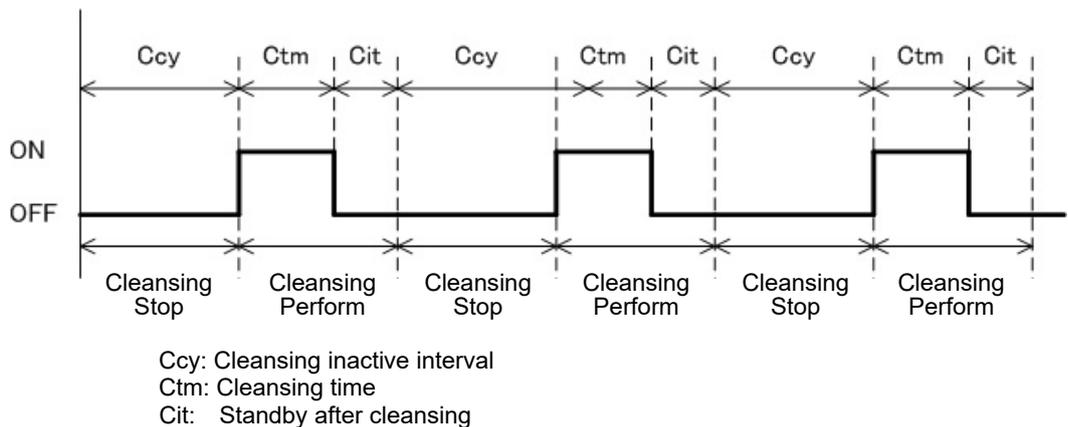
Ccy: Cleansing inactive interval
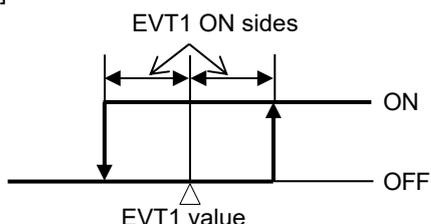Ctm: Cleansing time
Cit: Standby after cleansing

(Fig. 7.5-4)

Character	Setting Item, Function, Setting Range	Factory Default

`5ย 1`
`0.00`
	EVT1 value
	
	• Sets EVT1 value.
	• Not available for this setting item and all subsequent items if `----` (No action), `rcAP` (Sensor cap replacement timer), `5ELF` (Self-check output), or `cLEG` (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℃
	  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℃
		DO % saturation input: 0.0%
		Oxygen partial pressure input: 0.0 kPa

`dl F 1`
`5dl F`
	EVT1 hysteresis type
	• Selects EVT1 output hysteresis type (Medium or Reference Value).
	• Not available if `doHL` (DO concentration input High/Low limits independent action), `rmHL` (Water temperature input High/Low limits independent action), `d5HL` (DO % saturation input High/Low limits independent action) or `oPHL` (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type].
	• `cdl F`: Medium Value
	      Sets the same value for both ON and OFF sides in relation to EVT1 value.
	      Only ON side needs to be set.
	  `5dl F`: 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

`dFo 1`
`0.0 1`
	EVT1 ON side
	
	• Sets the span of EVT1 ON side.
	  If `cdl F` (Medium Value) is selected in [EVT1 hysteresis type], the span of ON/OFF side will be the same value.
	• Not available if `doHL` (DO concentration input High/Low limits independent action), `rmHL` (Water temperature input High/Low limits independent action), `d5HL` (DO % saturation input High/Low limits independent action) or `oPHL` (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℃
	  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℃
		DO % saturation input: 0.1%
		Oxygen partial pressure input: 0.1 kPa

`dFU 1`
`0.0 1`
	EVT1 OFF side
	
	• Sets the span of EVT1 OFF side.
	• Not available if `cdl F` (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℃
	  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℃
		DO % saturation input: 0.1%
		Oxygen partial pressure input: 0.1 kPa

Character	Setting Item, Function, Setting Range	Factory Default
o n ̄ 1 0	**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
o F ̄ 1 0	**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
o o n 1 0	**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
o o F 1 0	**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)** Actual EVT1 output — ON / OFF EVT1 output to which ON time and OFF time are set. — ON / OFF ON time / OFF time / ON time / OFF time / ON time ON time is turned OFF, caused by the actual EVT1 output turning OFF. (Fig. 7.5-5)	0 seconds
E _ L 1 0.00	**EVT1 High/Low limits independent lower side value** • Sets the lower side value of EVT1 High/Low limits independent action. • Available when doHL (DO concentration input High/Low limits independent action), r ̄ ̄ HL (Water temperature input High/Low limits independent action), d ̄ HL (DO % saturation input High/Low limits independent action) or ̄PHL (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℃ 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℃ DO % saturation input:　0.0% Oxygen partial pressure input: 0.0 kPa
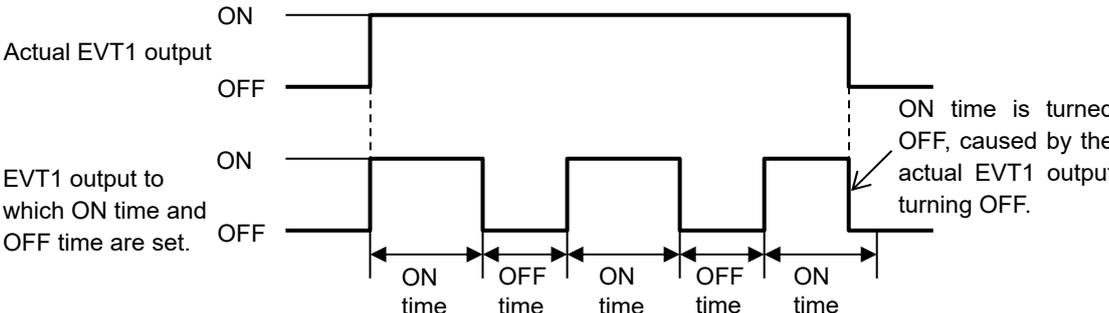
Character	Setting Item, Function, Setting Range	Factory Default
E_H1 *0.00*	**EVT1 High/Low limits independent upper side value**	DO concentration input:　0.00 mg/L Water temperature input:　0.0℃ DO % saturation input:　0.0% Oxygen partial pressure input: 0.0 kPa
	• Sets the upper side value of EVT1 High/Low limits independent action. • Setting range: 　DO concentration input:　0.00 to 20.00 mg/L 　Water temperature input:　0.0 to 50.0℃ 　DO % saturation input:　0.0 to 200.0% 　Oxygen partial pressure input: 0.0 to 150.0 kPa	
EHY1 *0.01*	**EVT1 hysteresis**	DO concentration input:　0.01 mg/L Water temperature input:　1.0℃ DO % saturation input:　0.1% Oxygen partial pressure input: 0.1 kPa
	• 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℃ 　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 $E.\mathcal{HT}.2$ Press the ⊙ key 5 times in Display Mode or Cleansing Output Mode.
② $ErF2$ Press the [SET/RESET] 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 (1 with 2), and refer to EVT1 Action Group (pp. 26 to 30).
(e.g.) $ErF1 \rightarrow ErF2$
       $\mathcal{H}B1\square \rightarrow \mathcal{H}B2\square$

7.7 EVT3 Action Group

Available when EVT☐ output (EVT option) is ordered.
To enter EVT3 Action Group, follow the procedure below.
① $E.\mathcal{HT}.3$ Press the ⊙ key 6 times in Display Mode or Cleansing Output Mode.
② $ErF3$ Press the [SET/RESET] 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 (1 with 3), and refer to EVT1 Action Group (pp. 26 to 30).
(e.g.) $ErF1 \rightarrow ErF3$
       $\mathcal{H}B1\square \rightarrow \mathcal{H}B3\square$

7.8 EVT4 Action Group

Available when EVT☐ output (EVT option) is ordered.
To enter EVT4 Action Group, follow the procedure below.
① $E.\mathcal{HT}.4$ Press the ⊙ key 7 times in Display Mode or Cleansing Output Mode.
② $ErF4$ Press the [SET/RESET] 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 (1 with 4), and refer to EVT1 Action Group (pp. 26 to 30).
(e.g.) $ErF1 \rightarrow ErF4$
       $\mathcal{H}B1\square \rightarrow \mathcal{H}B4\square$

7.9 EVT5 Action Group

Available when EVT☐ output (EVT option) is ordered.
To enter the EVT5 Action Group, follow the procedure below.
① $E.\mathcal{HT}.5$ Press the ⊙ key 8 times in Display Mode or Cleansing Output Mode.
② $ErF5$ Press the [SET/RESET] 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 (1 with 5), and refer to EVT1 Action Group (pp. 26 to 30).
(e.g.) $ErF1 \rightarrow ErF5$
       $\mathcal{H}B1\square \rightarrow \mathcal{H}B5\square$

7.10 EVT6 Action Group

Available when EVT☐ output (EVT option) is ordered.
To enter the EVT6 Action Group, follow the procedure below.
① $E.\mathcal{HT}.6$ Press the ⊙ key 9 times in Display Mode or Cleansing Output Mode.
② $ErF6$ Press the [SET/RESET] 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 (1 with 6), and refer to EVT1 Action Group (pp. 26 to 30).
(e.g.) $ErF1 \rightarrow ErF6$
       $\mathcal{H}B1\square \rightarrow \mathcal{H}B6\square$

7.11 Communication Group

To enter the Communication Group, follow the procedure below.

① c.o�π̄ᴨ   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 cπ̄�5L   Press the [SET/RESET] key.
           The unit enters the Communication Group, and "Communication protocol" will appear.

Character	Setting Item, Function, Setting Range	Factory Default

cπ̄�5L
noπ̄L
	Communication protocol
	• Selects the communication protocol.
	• noπ̄L : Shinko protocol
	  π̄odA : MODBUS ASCII mode
	  π̄odr : MODBUS RTU mode
		Shinko protocol

cπ̄no ☐☐☐0	**Instrument number** • Sets the instrument number. (The instrument numbers should be set one by one when multiple instruments are connected.) • Setting range: 0 to 95	0

cπ̄5P
☐☐96
	Communication speed
	• Selects a communication speed equal to that of the host computer.
	• ☐☐96 : 9600 bps
	  ☐192 : 19200 bps
	  ☐384 : 38400 bps
		9600 bps

cπ̄Fr
7EUn
	Data bit/Parity
	• Selects data bit and parity.
	• 8non : 8 bits/No parity
	  7non : 7 bits/No parity
	  8EUn : 8 bits/Even
	  7EUn : 7 bits/Even
	  8odd : 8 bits/Odd
	  7odd : 7 bits/Odd
		7 bits/Even

cπ̄5r ☐☐☐1	**Stop bit** • Selects the stop bit. • ☐☐☐1 : 1 bit ☐☐☐2 : 2 bits	1 bit

7.12 Cleansing Group

To enter the Cleansing Group, follow the procedure below.

① $cLEG$ 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 $cLtm$ Press the SET/RESET key.
The unit enters the Cleansing Group, and "Cleansing time" will appear.

Character	Setting Item, Function, Setting Range	Factory Default
$cLtm$ ☐☐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)
$cLit$ ☐☐☐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
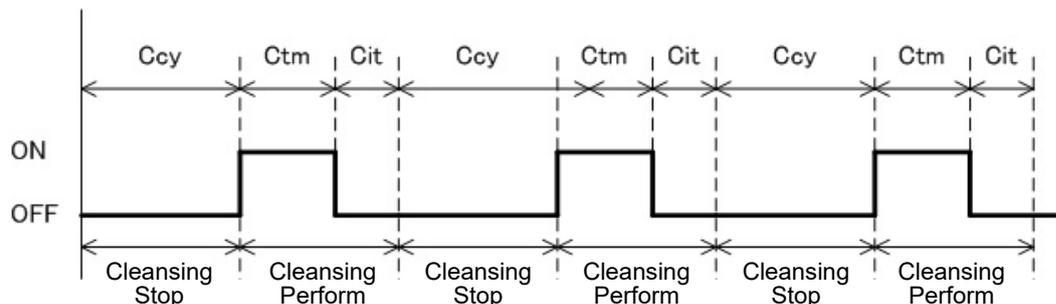
Ccy: Cleansing inactive interval
Ctm: Cleansing time
Cit: Standby after cleansing

(Fig. 7.12-1)

• If $cLEG$ (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 $cLEG$ (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 ⌐⌐.E.⌐   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 ᒪ◻cㅌ   Press the ⌷SET/RESET⌷ key.

    The unit enters the Basic Function Group, and the "Set value lock" will appear.

Character	Setting Item, Function, Setting Range	Factory Default
ᒪ◻cㅌ ⸏⸏⸏⸏	**Set value lock**	Unlock
	• Locks the set values to prevent setting errors. • ⸏⸏⸏⸏ (Unlock): All set values can be changed. 　ᒪ◻c ¦ (Lock 1): None of the set values can be changed. 　ᒪ◻c2 (Lock 2): Only EVT1 to EVT6 values can be changed. 　ᒪ◻c3 (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. 　　　　　　　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.)	
ᒪ¦ ⎍⌐ ⸏⸏⸏⸏	**Auto-light function**	Disabled
	• Selects Auto-light Enabled/Disabled. • ⸏⸏⸏⸏: Disabled 　⎍ˢE□: Enabled	
⌐¦ ⎍E 00.00	**Indication time**	00.00 (Remains lit)
	• 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)	
¦ E⌐⌐ ◻FF□	**EVT output when input errors occur**	Disabled
	• 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]: 　　d◻_H (DO concentration input high limit action) 　　d◻_ᒪ (DO concentration input low limit action) 　　⎍⌐⎍H (Water temperature input high limit action) 　　⎍⌐⎍ᒪ (Water temperature input low limit action) 　　d◻ˢH (DO % saturation input high limit action) 　　d◻ˢᒪ (DO % saturation input low limit action) 　　⎍P⌐H (Oxygen partial pressure input high limit action) 　　⎍P⌐ᒪ (Oxygen partial pressure input low limit action) • Selection item: ◻⌐□: Enabled 　　　　　　　　◻FF□: Disabled	
ˢH ¦□ □365	**EVT1 value**	365 days
	• Sets EVT1 value (Sensor cap replacement timer). 　Available when ⌐c AP (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 1095 days	

Character	Setting Item, Function, Setting Range	Factory Default
on⌐ 1 ▢▢▢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 ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 9999 seconds	0 seconds
oF⌐ 1 ▢▢▢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 ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT1 type]. • Setting range: 0 to 9999 seconds	0 seconds
4A2▢ ▢365	**EVT2 value** • Sets EVT2 value (Sensor cap replacement timer). Available when ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 1095 days	365 days
on⌐ 2 ▢▢▢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 ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 9999 seconds	0 seconds
oF⌐ 2 ▢▢▢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 ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT2 type]. • Setting range: 0 to 9999 seconds	0 seconds
4A3▢ ▢365	**EVT3 value** • Sets EVT3 value (Sensor cap replacement timer). • Available when EVT▢ output (EVT option) is ordered. Available when ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT3 type]. • Setting range: 0 to 1095 days	365 days
on⌐ 3 ▢▢▢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 ⌐c⌐P (Sensor cap replacement timer) is selected in [EVT3 type]. • Setting range: 0 to 9999 seconds	0 seconds
oF⌐ 3 ▢▢▢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 ⌐c⌐P (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
4U4□ □365	**EVT4 value** • Sets EVT4 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when ⌐⊏AP (Sensor cap replacement timer) is selected in [EVT4 type]. • Setting range: 0 to 1095 days	365 days

on⌐4 □□□0	**EVT4 ON delay time**
	 • Sets EVT4 ON delay time.
	   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.
	 • Available when EVT□ output (EVT option) is ordered.
	   Available when ⌐⊏AP (Sensor cap replacement timer) is selected in [EVT4 type].
	 • Setting range: 0 to 9999 seconds
		0 seconds

oF⌐4 □□□0	**EVT4 OFF delay time**
	 • Sets EVT4 OFF delay time.
	   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.
	 • Available when EVT□ output (EVT option) is ordered.
	   Available when ⌐⊏AP (Sensor cap replacement timer) is selected in [EVT4 type].
	 • Setting range: 0 to 9999 seconds
		0 seconds

4U5□ □365	**EVT5 value** • Sets EVT5 value (Sensor cap replacement timer). • Available when EVT□ output (EVT option) is ordered. Available when ⌐⊏AP (Sensor cap replacement timer) is selected in [EVT5 type]. • Setting range: 0 to 1095 days	365 days

on⌐5 □□□0	**EVT5 ON delay time**
	 • Sets EVT5 ON delay time.
	   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.
	 • Available when EVT□ output (EVT option) is ordered.
	   Available when ⌐⊏AP (Sensor cap replacement timer) is selected in [EVT5 type].
	 • Setting range: 0 to 9999 seconds
		0 seconds

oF⌐5 □□□0	**EVT5 OFF delay time**
	 • Sets EVT5 OFF delay time.
	   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.
	 • Available when EVT□ output (EVT option) is ordered.
	   Available when ⌐⊏AP (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
ЧЦБ☐ ☐365	**EVT6 value** • Sets EVT6 value (Sensor cap replacement timer). • Available when EVT☐ output (EVT option) is ordered. Available when $\lceil c R P$ (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 1095 days	365 days
on⌐6 ☐☐☐0	**EVT6 ON delay time** • Sets EVT6 ON delay time. 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. • Available when EVT☐ output (EVT option) is ordered. Available when $\lceil c R P$ (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 9999 seconds	0 seconds
oF⌐6 ☐☐☐0	**EVT6 OFF delay time** • Sets EVT6 OFF delay time. 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. • Available when EVT☐ output (EVT option) is ordered. Available when $\lceil c R P$ (Sensor cap replacement timer) is selected in [EVT6 type]. • Setting range: 0 to 9999 seconds	0 seconds
⌐E⌐ñ ☐365	**Sensor cap replacement timer remainder** • 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 ⴄＥＬＦ   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 [SET/RESET] key.
          The unit enters the Self-Check Group, and "LED all lit mode" will appear.

Every time the [SET/RESET] 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.

```
┌─────────────────────────────┐
│  Self-Check Group           │
└─────────────────────────────┘
        │ [SET/RESET]
        ▼
┌─────────────────────────────┐
│  LED all lit mode           │
└─────────────────────────────┘
        │ [SET/RESET]
        ▼
┌─────────────────────────────┐
│  LED individual lit mode    │
└─────────────────────────────┘
        │ [SET/RESET]
        ▼
┌─────────────────────────────┐
│  Key input mode             │
└─────────────────────────────┘
        │ [SET/RESET]
        ▼
┌─────────────────────────────┐
│  Output mode                │
└─────────────────────────────┘
        │ [SET/RESET]
        ▼
┌─────────────────────────────┐
│  Input mode                 │
└─────────────────────────────┘
        │ [SET/RESET]
```
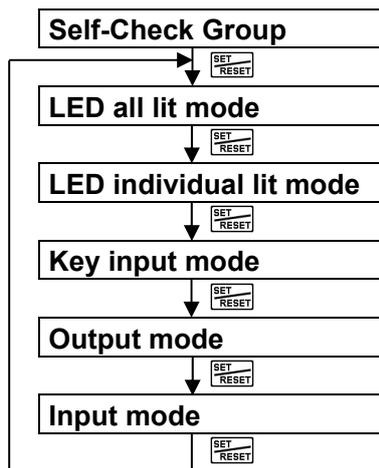
Following is a description of each mode.

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

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Mode	Description
Key input mode	Characters allocated to each key are indicated. The DO Display indicates $ℎEY$, and the Temperature Display indicates the following characters. If 2 or more keys are pressed simultaneously, db will be indicated.

Temperature Display	Key Input
$nonE$	When no key is pressed
UP	When the △ key is pressed
$down$	When the ▽ key is pressed
db	When 2 or more keys are pressed simultaneously

Mode	Description
Output mode	Each EVT output is turned ON. Transmission output 1 and 2 output 20 mA DC. The DO Display indicates $oUͲ$, and the Temperature Display indicates the following characters. Every time the △ key is pressed, each output is turned ON sequentially after being checked.

Temperature Display	Output
oFF	All EVT outputs OFF Transmission output 1 and 2: 4 mA DC
$EUͲ1$	EVT1 output ON
$EUͲ2$	EVT2 output ON
$EUͲ3$	EVT3 output ON
$EUͲ4$	EVT4 output ON
$EUͲ5$	EVT5 output ON
$EUͲ6$	EVT6 output ON
$Ͳ ro1$	Transmission output 1: 20 mA DC
$Ͳ ro2$	Transmission output 2: 20 mA DC

Mode	Description
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.

DO Display	Temperature Display
do	DO concentration measured value
$UͲ nP$	Water temperature measured value
$doℎͲ$	DO % saturation measured value
$UPr5$	Oxygen partial pressure measured value
$ncAP$	Sensor cap serial number

If a communication error has occurred, or if the DO Sensor is not connected, the Temperature Display indicates $Err1$.

If the DO Sensor cap is not attached, or it is incorrectly attached, the Temperature Display indicates $Err2$.

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.

$$ncAP \longleftrightarrow \begin{array}{c} 12 \\ 3456 \end{array}$$

7.15 Data Clear Group

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

① *c.L.r*☐   Press the ⭕ key 10 times in Display Mode or Cleansing Output Mode.

         If EVT☐ output (EVT option) is ordered, press the ⭕ key 14 times in Display Mode or Cleansing Output Mode.

② *cL𐍈L*   Press the ⌧ key.

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

Character	Setting Item, Function, Setting Range	Factory Default
cL𐍈L	**Data clear selection**	Calibration value
cAL☐	• Selects either Calibration value or Set value to clear. • *cAL*☐ : Calibration value *SET*☐ : Set value	
cLr☐	**Data clear Stop/Perform**	Data clear Stop
no☐	• Selects Data clear Stop/Perform. • *no*☐ : Data clear Stop *YES*☐ : Data clear Perform	

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).
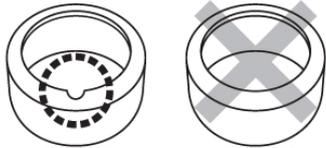
Calibration cap   Storage cap
(Fig. 8.1.1-1)

(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 $Loc\ 1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) is selected in [Set value lock (p.34)]
• When $cLEG$ (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
$Err0$	Non-volatile IC memory error
$Err1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.
$Err2$	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.

Approx. 2 cm

(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 occured, 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	$\boxminus$ $\iota\boxminus$

(5) Press the SET/RESET 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	$\boxminus$ $\iota\boxminus$

(6) Wait at least 10 seconds to stabilize the DO concentration measured value.

(7) Press the SET/RESET 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	cAL
Temperature Display	Good

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

(8) Press the SET/RESET 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 SET/RESET key.

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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 $Loc\ 1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) is selected in [Set value lock (p.34)]
• When $cLEG$ (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
$Err0$	Non-volatile IC memory error
$Err\ 1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.
$Err2$	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.

↕ Approx. 2 cm

(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 occured, 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	$H2O$

(6) Press the ⌷SET/RESET⌷ 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	⌷-2-⌷

(7) Wait at least 10 seconds to stabilize the DO concentration measured value.

(8) Press the ⌷SET/RESET⌷ 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	cAL⌷
Temperature Display	nEYr

(9) 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.

(10) 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.
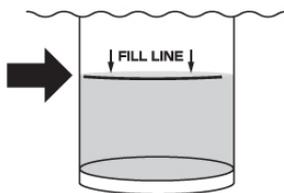
(Fig. 8.1.3-2)

(11) 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.

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

(13) Press the ⌷SET/RESET⌷ 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	⌷-2-⌷

(14) Wait at least 10 seconds to stabilize the DO concentration measured value.

(15) 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	$cAL\square$
Temperature Display	$Good$

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

(16) 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 $Err3$.

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 $Loc1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) is selected in [Set value lock (p.34)]
• When $cLEG$ (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
$Err0$	Non-volatile IC memory error
$Err1$	DO Sensor communication errors have occurred, or DO Sensor is not connected.
$Err2$	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.
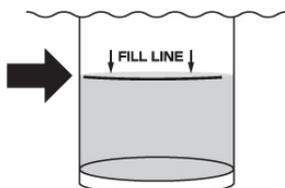
(Fig. 8.1.4-1)

(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	$cAd\Gamma$
Temperature Display	Concentration desired value

(6) Set the concentration desired value (7.77) with the △ or ▽ key, and press the SET/RESET key.
   The following will be indicated.

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

(7) Press the SET/RESET 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	$cAL\square$
Temperature Display	$Good$

Concentration option calibration is completed.

(8) Press the SET/RESET 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 SET/RESET 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 $Loc\ 1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) is selected in [Set value lock (p.34)]
• When $cLEG$ (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	$AJ\Xi\ 1$
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: ±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	$AJ4\ 1$
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: ±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 $Loc\ 1$ (Lock 1), $Loc\ 2$ (Lock 2) or $Loc\ 3$ (Lock 3) is selected in [Set value lock (p.34)]
• When $cLEG$ (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 SET/RESET 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	$AJZ2$
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: ±5.00% of Transmission output 2 span

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

Display	Indication Contents
DO Display	$AJ42$
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: ±5.00% of Transmission output 2 span

Transmission output 2 adjustment is completed.

(6) Press the SET/RESET 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	□ *100* [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.

DO Concentration / Temperature Display Mode
↓△
DO % Saturation / Temperature Display Mode
↓△
Oxygen Partial Pressure / Temperature Display Mode
↓△
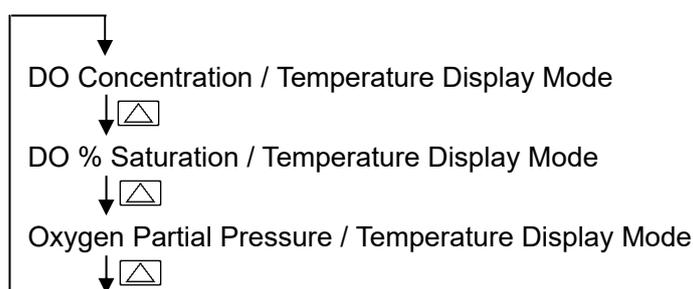
9.2 Outside Measurement Range

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), urnH (Water temperature input high limit action), urnL (Water temperature input low limit action), do5H (DO % saturation input high limit action), do5L (DO % saturation input low limit action), uPrH (Oxygen partial pressure input high limit action), uPrL (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]: 	If Reference Value is selected in [EVT1 hysteresis type]:
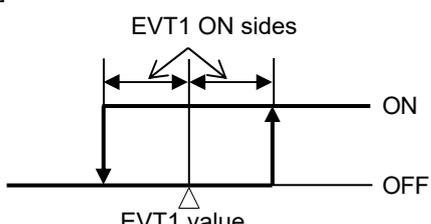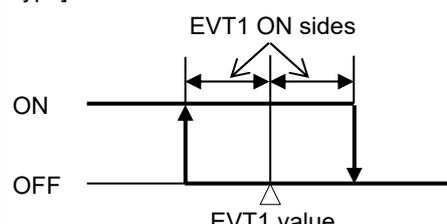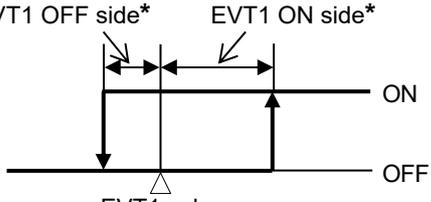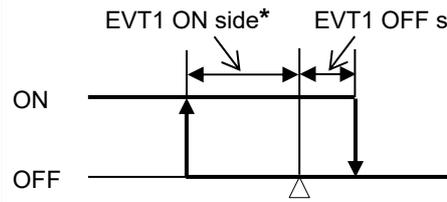
(Fig. 9.5-1)

* Setting Example:

If [EVT1 ON side (dFo1)] is set to 0, EVT1 output can be turned ON at the value set in [EVT1 value (EU1)].

If [EVT1 OFF side (dFU1)] is set to 0, EVT1 output can be turned OFF at the value set in [EVT1 value (EU1)].

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

⌐oHL (DO concentration input High/Low limits independent action),

⌐ᾱHL (Water temperature input High/Low limits independent action),

d�5HL (DO % saturation input High/Low limitsindependent action),

⌐PHL (Oxygen partial pressure input High/Low limits independent action)

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

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
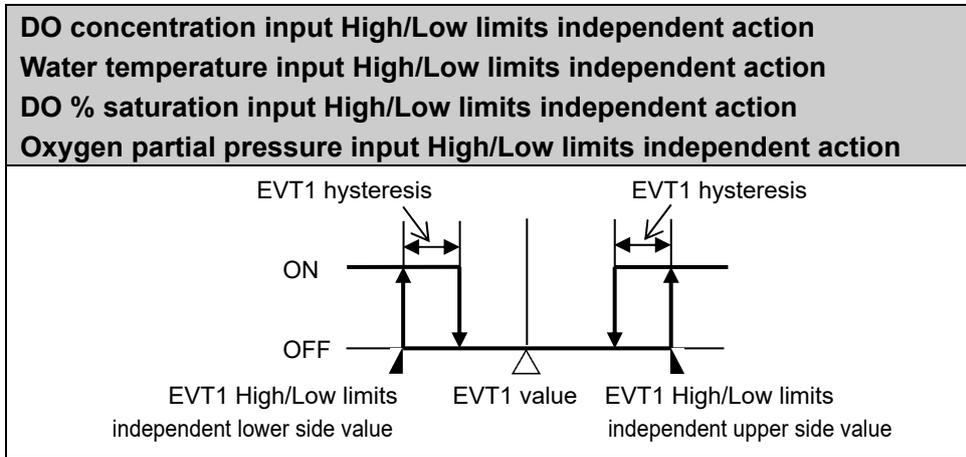
(Fig. 9.5-2)

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)**
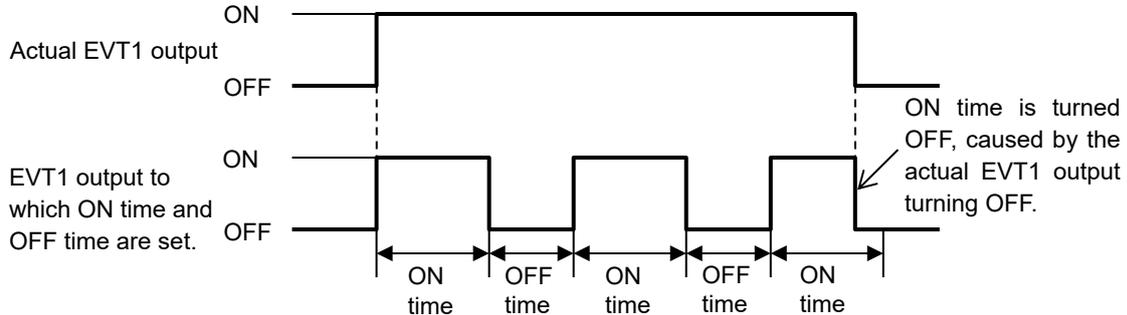
(Fig. 9.5-3)

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 oFF (Disabled) is selected: EVT output is turned OFF when input errors occur.

• If on (Enabled) is selected: EVT output is maintained when input errors occur.

9.6 Sensor Cap Replacement Timer Output

When $\Gamma_{\mathtt{C}}\mathtt{RP}$ (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 $\Gamma_{\mathtt{C}}\mathtt{RP}$ 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
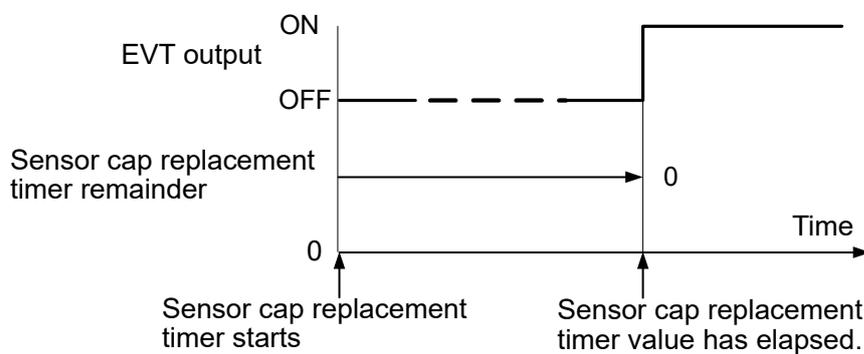
(Fig. 9.6-1)

(*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, $\Gamma_{\mathtt{C}}\mathtt{RP}$ and the Outside measurement range value will be displayed alternately.

9.7 Cleansing Output

If $cLEC$ (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**

Ccy: Cleansing inactive interval
Ctm: Cleansing time
Cit: Standby after cleansing
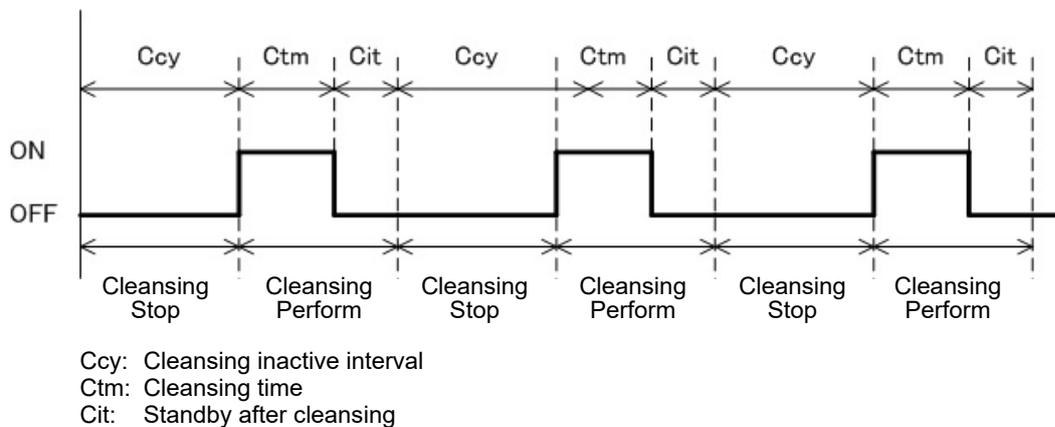
(Fig. 9.7-1)

• If $cLEC$ (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 oFF (None) is selected in [Cleansing inactive interval], or if any item except $cLEC$ (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 $cLEC$ (Cleansing output) is selected in any of [EVT1 to EVT6 types (pp. 26, 31)], and if oFF (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
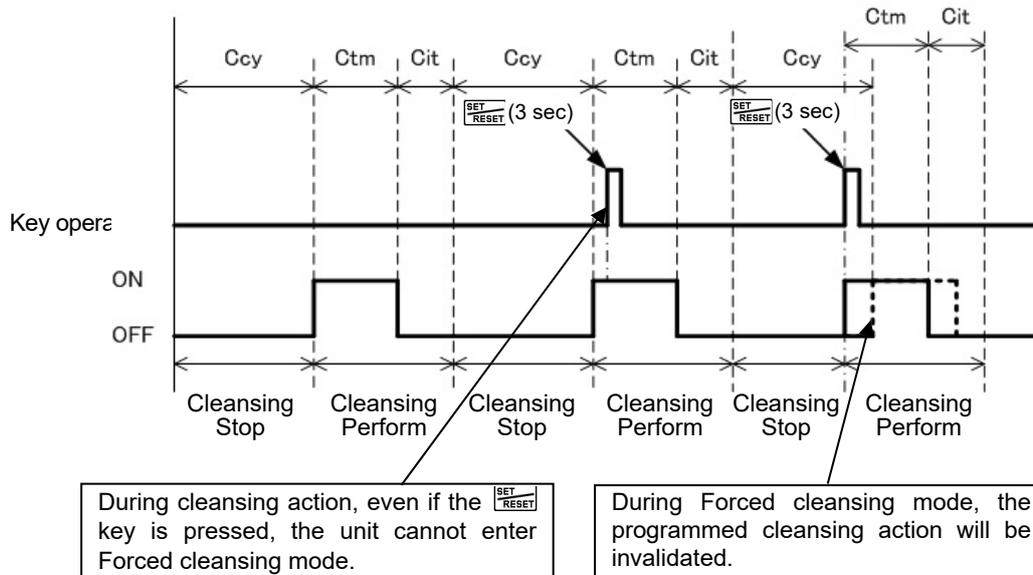
Ccy: Cleansing inactive interval
Ctm: Cleansing time
Cit: Standby after cleansing

(Fig. 9.8-1)

10. Communication

10.1 System Configuration Example

• When using the USB Communication Cable CMC-001-3 (sold separately)
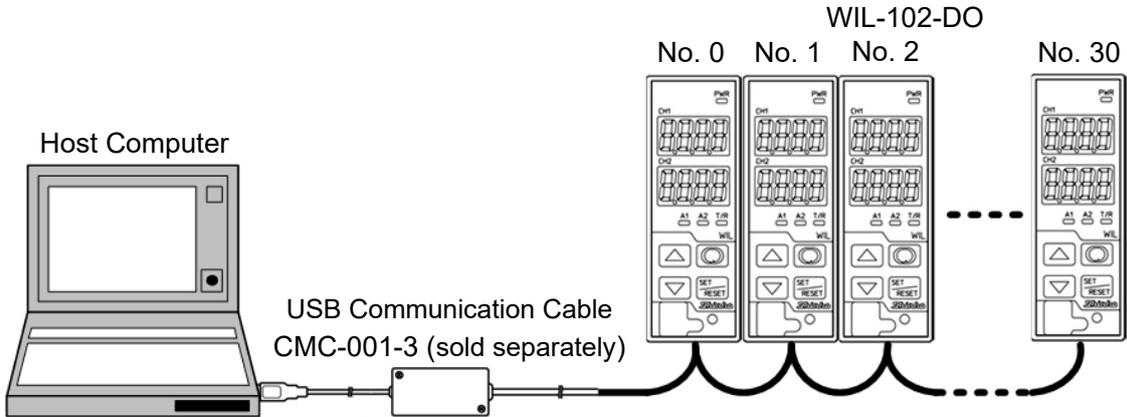
(Fig. 10.1-1)

• When using the Communication Converter IF-400 (sold separately)
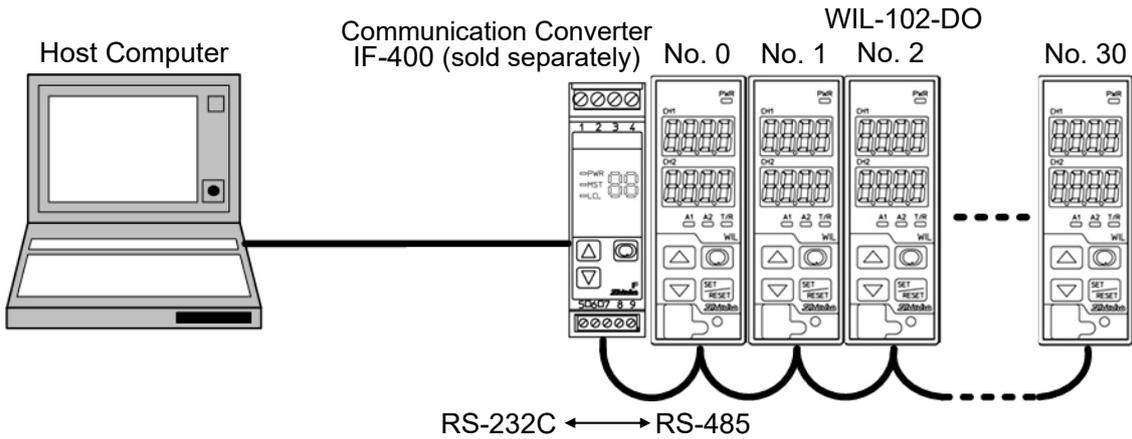
(Fig. 10.1-2)

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 `c.o.m̄.m̄` 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 `c.m̄.5.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
`c.m̄.5.L` `n.o.m̄.L`	**Communication protocol** • Selects communication protocol. • `n.o.m̄.L` : Shinko protocol `m̄.o.d.A` : MODBUS ASCII mode `m̄.o.d.r` : MODBUS RTU mode	Shinko protocol

`c.m̄.n.o` `☐☐☐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

`c.m̄.5.P` `☐☐96`	**Communication speed** • Selects a communication speed equal to that of the host computer. • `☐☐96` : 9600 bps `☐192` : 19200 bps `☐384` : 38400 bps	9600 bps
`c.m̄.F.r` `7.E.8.n`	**Data bit/Parity** • Selects data bit and parity. • `8.n.o.n` : 8 bits/No parity `7.n.o.n` : 7 bits/No parity `8.E.8.n` : 8 bits/Even `7.E.8.n` : 7 bits/Even `8.o.d.d` : 8 bits/Odd `7.o.d.d` : 7 bits/Odd	7 bits/Even
`c.m̄.5.r` `☐☐☐1`	**Stop bit** • Selects the stop bit. • `☐☐☐1` : 1 bit `☐☐☐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).

Master   Slave

Command

Data

Command

Acknowledgement

Command

Negative Acknowledgement

Command
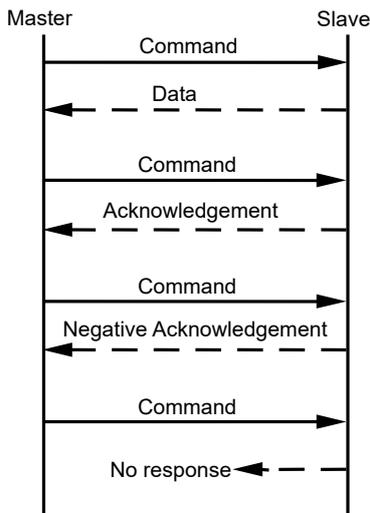
No response

(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)

(Fig. 10.4.3-1)

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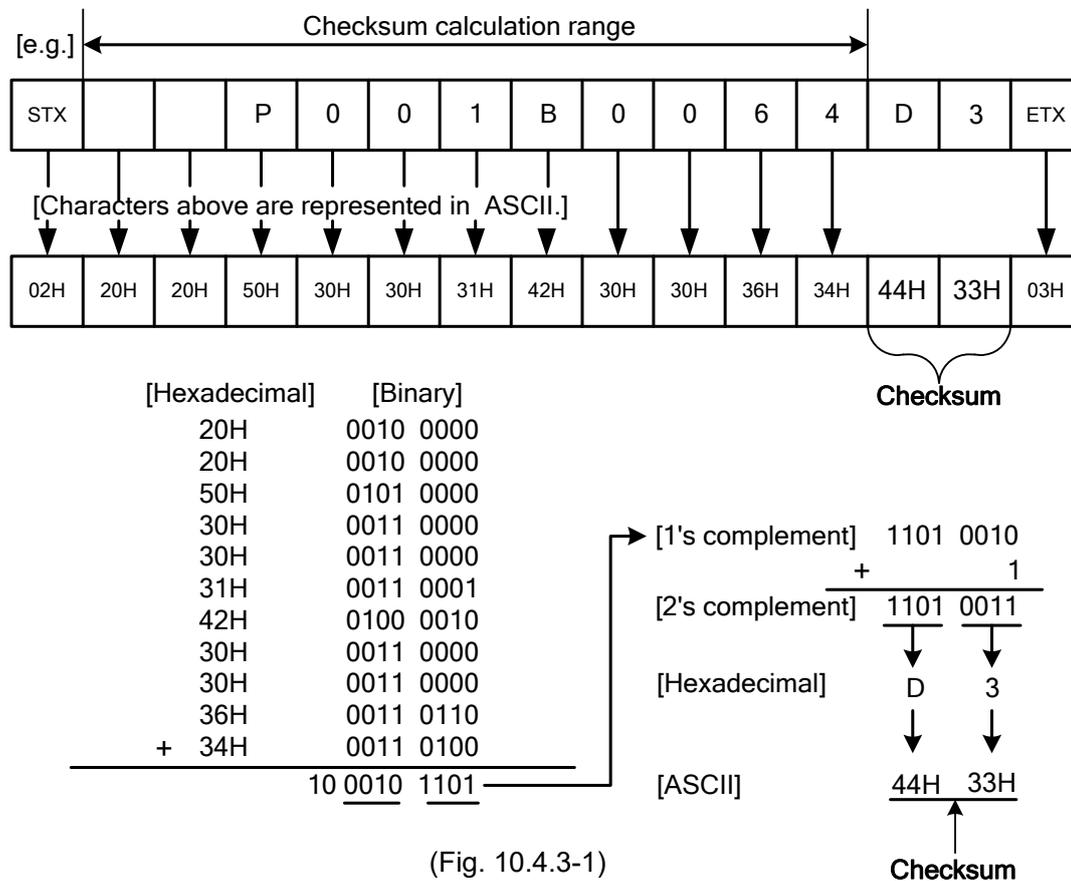
10.5 MODBUS Protocol

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 μs.

If an interval lasts longer than 1.5-character transmission times or 750 μs, 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 [0080H]	Amount of data [0001H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)	(30H 30H 38H 30H)	(30H 30H 30H 31H)	(37H 42H)	(0DH 0AH)
1	2	2	4	4	2	2

• Response message from the slave in normal status [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 [02H] (30H 32H)	Data [0064H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 33H)		(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 [02H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(38H 33H)	(30H 32H)	(37H 41H)	(0DH 0AH)
1	2	2	2	2	2

② **Setting [Slave address 1, Data item 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 [001BH]	Data [0064H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 31H 42H)	(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 [001BH]	Data [0064H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(30H 36H)	(30H 30H 31H 42H)	(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	Slave address	Function code	Exception code [03H]	Error check LRC	Delimiter
(3AH)	(30H 31H)	(38H 36H)	(30H 33H)	(37H 36H)	(0DH 0AH)
1	2	2	2	2	2

RTU Mode

Numerals written below the command represent 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: 1st-point calibration (100% saturation calibration) start 0002H: 2nd-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	

0000　0000　0000　0000
2^{15}　　　　to　　　　2^0

2^0 digit: Outside measurement range of DO concentration (high limit)
　　　　　　　　0: Normal　　　1: Error

2^1 digit: Outside measurement range of DO concentration (low limit)
　　　　　　　　0: Normal　　　1: Error

2^2 digit: Outside measurement range of DO % saturation (high limit)
　　　　　　　　0: Normal　　　1: Error

2^3 digit: Outside measurement range of DO % saturation (low limit)
　　　　　　　　0: Normal　　　1: Error

2^4 digit: Outside measurement range of Oxygen partial pressure (high limit)
　　　　　　　　0: Normal　　　1: Error

2^5 digit: Outside measurement range of Oxygen partial pressure (low limit)
　　　　　　　　0: Normal　　　1: Error

2^6 digit: Communication errors have occurred or DO Sensor is not connected.
　　　　　　　　0: Normal　　　1: Error

2^7 digit: DO Sensor cap is not attached, or it is incorrectly attached.
　　　　　　　　0: Normal　　　1: Error

2^8 digit: Calibration error　　0: Normal　　　1: Error

2^9 digit: Unit status flag　　0: Display Mode　1: Setting mode

2^{10}, 2^{11} digits: Calibration mode status flag

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^{12}, 2^{13} digits: Calibration status flag

2^{13}	2^{12}	Status
0	0	Standby
0	1	During 1st-point calibration (100% saturation calibration)
1	0	During 2nd-point calibration (0-point calibration)
1	1	During concentration option calibration

2^{14} digit: DO Sensor internal memory deletion　　0: No　1: Yes
2^{15} digit: Change in key operation　0: No　1: Yes

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	Status flag 2	

For register 0093H (Status flag 2):

```
0000  0000  0000  0000
2^15          to          2^0
```

2^0 digit: Outside measurement range of temperature (high limit)
    0: Normal   1: Error

2^1 digit: Outside measurement range of temperature (low limit)
    0: Normal   1: Error

2^2 digit: EVT1 output   0: OFF   1: ON
2^3 digit: EVT2 output   0: OFF   1: ON
2^4 digit: EVT3 output   0: OFF   1: ON
2^5 digit: EVT4 output   0: OFF   1: ON
2^6 digit: EVT5 output   0: OFF   1: ON
2^7 digit: EVT6 output   0: OFF   1: ON

2^8, 2^9 digits: Transmission output 1 adjustment status flag

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^{10}, 2^{11} digits: Transmission output 2 adjustment status flag

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^{12}, 2^{13} digits: Cleansing status flag

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^{14}, 2^{15} digits: Not used (Always 0)

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).
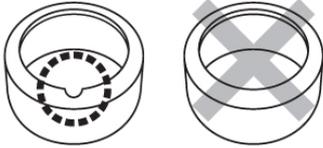
Calibration cap   Storage cap
(Fig. 10.7.1-1)

(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 previsously 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.

Approx. 2 cm

FILL LINE
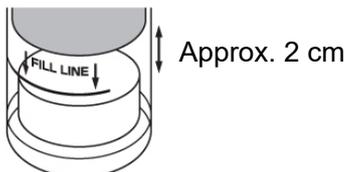
(Fig. 10.7.2-1)

(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 occured, 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 2^{11}, 2^{10} 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 2^{13}, 2^{12} 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 2^{13}, 2^{12} 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 2^8 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.

Approx. 2 cm
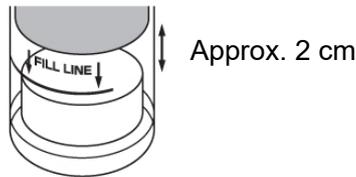
(Fig. 10.7.3-1)

(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 occured, 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 2^{11}, 2^{10} 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 2^{13}, 2^{12} 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 2^{13}, 2^{12} 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.
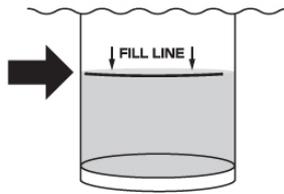
(Fig. 10.7.3-2)

(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 2^{13}, 2^{12} 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 2^{13}, 2^{12} 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 2^8 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.
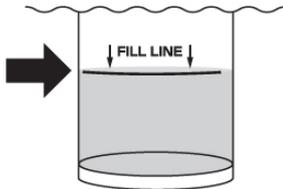
(Fig. 10.7.4-1)

(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 2^{11}, 2^{10} 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 2^{13}, 2^{12} 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 2^{13}, 2^{12} 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 2^8 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 2^9, 2^8 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: ±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 2^9, 2^8 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: ±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 2^{11}, 2^{10} 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: ±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 2^{11}, 2^{10} 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: ±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) 2^{15}: Change in key operation] to 1 (Yes).

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

(1) Reading method 1

① On the monitoring software side, check that [0083H (Status flag 1) 2^{15}: Change in key operation] has been set to 1 (Yes), then read all set values.

② Clear the [0083H (Status flag 1) 2^{15}: Change in key operation], by setting Data item 007FH (Key operation change flag clearing) to 0001H (Clear change flag).

If [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) 2^{15}: Change in key operation] cannot be cleared.

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

③ Read all set values again after acknowledgement is returned.

(2) Reading method 2

① On the monitoring software side, check that [0083H (Status flag 1) 2^{15}: 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℃	0.1℃
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 ±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☐ output (Contact output)		
Action	ON/OFF control action	
EVT☐ ON side EVT☐ OFF side	DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ DO % saturation input: 0.0 to 40.0% Oxygen partial pressure input: 0.0 to 30.0 kPa	
EVT☐ High/Low limits independent upper side value, EVT☐ 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℃ DO % saturation input: 0.0 to 200.0% Oxygen partial pressure input: 0.0 to 150.0 kPa	
EVT☐ hysteresis	DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ DO % saturation input: 0.1 to 20.0% Oxygen partial pressure input: 0.1 to 15.0 kPa	
Type	Selectable by keypad operation • 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 cosϕ=0.4)
	Electrical life	100,000 cycles
EVT☐ ON delay time	0 to 9999 seconds	
EVT☐ OFF delay time	0 to 9999 seconds	
Output ON Time/ OFF Time when EVT☐ Output ON	If ON time and OFF time are set, the output can be turned ON/OFF in a configured cycle when EVT☐ 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 Γ⊏ΠP are alternately indicated on the DO Display.	

	Self-check output	The selected EVT output is turned ON for the following errors.			
		$Err1$	DO Sensor communication errors have occurred, 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)		
		$Err4$	DO Sensor internal memory deletion. Displayed when Quality ID3 is received from the DO Sensor.		

	Cleansing output	**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'. **Forced Cleansing Mode:** By pressing the [SET/RESET] 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 [SET/RESET] 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.

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.)
Communicationl 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	
	Insulation Resistance: 10 MΩ minimum, at 500 V DC
Dielectric strength	Power terminal – ground (GND): 1.5 kV AC for 1 minute Input terminal – ground (GND): 1.5 kV AC for 1 minute Input terminal – power terminal: 1.5 kV AC for 1 minute
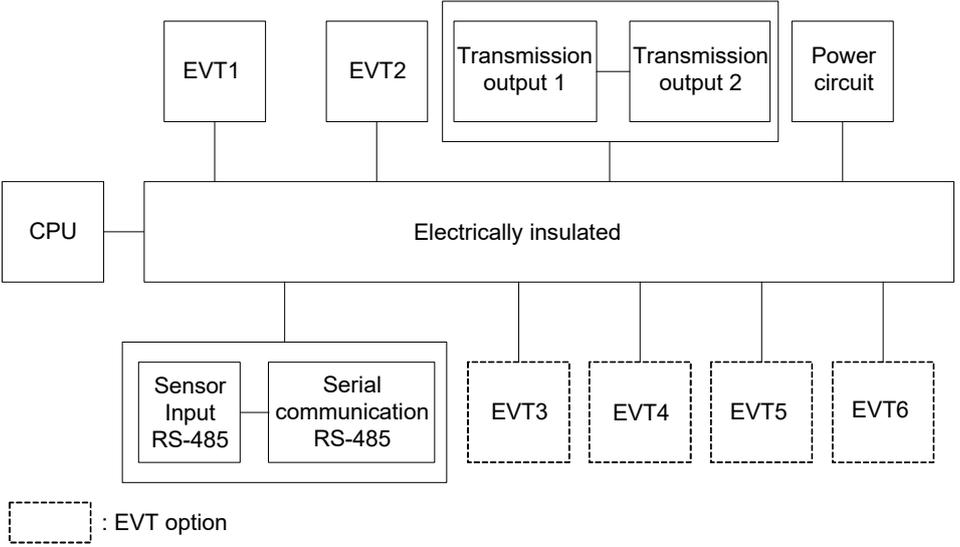
Attached Function

Set value lock	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.
Outside measurement range	If inputs (DO concentration, DO % saturation, Oxygen partial pressure, Temperature) are outside the measurement 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.

Power failure countermeasure	The setting data is backed up in the non-volatile IC memory.
Self-diagnosis	The CPU is monitored by a watchdog timer, and if an abnormal status occurs, the WIL-102-DO is switched to warm-up status.
Warm-up Indication	For approx. 8 seconds after the power is switched ON, characters below are indicated on the DO Display and Temperature Display.

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

Display sleep function	If no operation occurs for the duration of the previously set indication time, the displays will go off. 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.
Auto-light function	Automatically measures and controls brightness of the DO Display, Temperature Display and action indicators.

Error indication	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

Other

Power consumption	Approx. 10 VA
Ambient temperature	0 to 50℃
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℃
Measuring water temperature	0 to 50℃ (Not freezing)
Material	ABS
External dimensions	Approx. ϕ44 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	Occur-rence
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.	_USE_ (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 △, ▽ keys.	$Loc\,1$ (Lock 1) is selected in [Set value lock (p. 34)].	Select ⌐⌐⌐⌐ (Unlock).
Settings are impossible except EVT□ value. The values do not change by △, ▽ keys	$Loc2$ (Lock 2) is selected in [Set value lock (p. 34)].	Select ⌐⌐⌐⌐ (Unlock).
Unable to enter Forced cleansing mode.	$cLEG$ (Cleansing output) is not selected in any of [EVT1 to EVT6 types (pp. 26, 31)].	Select $cLEG$ (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.	$Loc\,1$ (Lock 1), $Loc2$ (Lock 2) or $Loc3$ (Lock 3) has been selected in [Set value lock (p.34)].	Select ⌐⌐⌐⌐ (Unlock).
	$cLEG$ (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
Tr.o 1	Transmission Output 1 Group
Tr.o2	Transmission Output 2 Group
E.Ur. 1	EVT1 Action Group
E.Ur.2	EVT2 Action Group
E.Ur.3	EVT3 Action Group (*)
E.Ur.4	EVT4 Action Group (*)
E.Ur.5	EVT5 Action Group (*)
E.Ur.6	EVT6 Action Group (*)
c.o.n.n	Communication Group
c.L.E.G	Cleansing Group
o.r.E.r	Basic Function Group
4.E.L.F	Self-Check Group
c.L.r	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 (*) ☐-1☐	**DO concentration 1-point calibration mode**		
Measured value (*) ☐-2☐	**DO concentration 2-point calibration mode**		
cAdT 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
ᴿᴶᴱ 1 ▯0.00	**Transmission output 1 Zero adjustment**	0.00 mg/L	
	Setting range: ±5.00% of Transmission output 1 span		
ᴿᴶ4 1 ▯0.00	**Transmission output 1 Span adjustment**	0.00 mg/L	
	Setting range: ±5.00% of Transmission output 1 span		

Transmission Output 2 Adjustment

Character	Setting Item, Setting Range	Factory Default	Data
ᴿᴶᴱ2 ▯0.00	**Transmission output 2 Zero adjustment**	0.00 mg/L	
	Setting range: ±5.00% of Transmission output 2 span		
ᴿᴶ42 ▯0.00	**Transmission output 2 Span adjustment**	0.00 mg/L	
	Setting range: ±5.00% of Transmission output 2 span		

DO Concentration Input Group

Character	Setting Item, Setting Range	Factory Default	Data
dFcᴦ ▯▯60	**Signal output response time**	60 seconds	
	Setting range: 5 to 600 seconds		
4ᴿLᴦ ▯▯▯0	**Salinity correction**	0 PSU	
	Setting range: 0 to 42 PSU		
4ᴱᴿL ▯▯▯0	**Altitude correction**	0 m	
	Setting range: 0 to 5000 m		

Transmission Output 1 Group

Character	Setting Item, Setting Range	Factory Default	Data
ᴦᴦo 1 do▯▯	**Transmission output 1 type**	DO concentration transmission	
	do▯▯ : DO concentration transmission ῦᴦᴍP : Water temperature transmission do4ᴦ : DO % saturation transmission ῦPᴦ4 : Oxygen partial pressure transmission		
ᴦᴦH 1 20.00	**Transmission output 1 high limit**	20.00 mg/L	
	Setting range: Transmission output 1 low limit to Measurement range high limit		
ᴦᴦL 1 ▯0.00	**Transmission output 1 low limit**	0.00 mg/L	
	Setting range: Measurement range low limit to Transmission output 1 high limit		
ᴦᴦc 1 bᴱFH	**Transmission output 1 status when calibrating**	Last value HOLD	
	bᴱFH: Last value HOLD (Retains the last value before calibrating DO concentration, and outputs it.) 4ᴱᴦH: Set value HOLD (Outputs the value set in [Transmission output 1 value HOLD when calibrating].) PᴴH▯: Measured value (Outputs the measured value when calibrating DO concentration.)		
ᴦᴦ4 1 ▯0.00	**Transmission output 1 value HOLD when calibrating**	0.00 mg/L	
	Setting range: Measurement range low limit to Measurement range high limit		

Transmission Output 2 Group

Character	Setting Item, Setting Range	Factory Default	Data

⌐⊓o2
do☐☐
	Transmission output 2 type
	   do☐☐ : DO concentration transmission
	   ū⅂⌐P : Water temperature transmission
	   do4⌐ : DO % saturation transmission
	   ūPⅎ4 : Oxygen partial pressure transmission
		DO concentration transmission	

⌐⌐H2
20.00
	Transmission output 2 high limit
	   Setting range:
	    Transmission output 2 low limit to Measurement range high limit
		20.00 mg/L	

⌐⌐L2
☐0.00
	Transmission output 2 low limit
	   Setting range:
	    Measurement range low limit to Transmission output 2 high limit
		0.00 mg/L	

⌐⌐c2
bEFH
	Transmission output 2 status
	when calibrating
	   bEFH: Last value HOLD (Retains the last value before calibrating DO
	       concentration, and outputs it.)
	   4E⅂H: Set value HOLD (Outputs the value set in [Transmission output
	       2 value HOLD when calibrating].)
	   PɥH☐: Measured value (Outputs the measured value when calibrating
	       DO concentration.)
		Last value HOLD	

⌐⌐42
☐0.00
	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
ЕГF I ⁻⁻⁻⁻	**EVT1 type** ⁻⁻⁻⁻ : No action do_H : DO concentration input high limit action do_L : DO concentration input low limit action ьГᾱH : Water temperature input high limit action ьГᾱL : Water temperature input low limit action doьH : DO % saturation input high limit action doьL : DO % saturation input low limit action ᾱPᴦH : Oxygen partial pressure input high limit action ᾱPᴦL : Oxygen partial pressure input low limit action ГсAP : Sensor cap replacement timer ьELF : Self-check output сLЕᴳ : Cleansing output doHL : DO concentration input High/Low limits independent action ГᾱHL : Water temperature input High/Low limits independent action dьHL : DO % saturation input High/Low limits independent action ᾱPHL : Oxygen partial pressure input High/Low limits independent action	No action	
ьᴮ I ᴼ.00	**EVT1 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
di F I ьdi F	**EVT1 hysteresis type** (*2) сdi F : Medium Value ьdi F : Reference Value	Reference Value	
dFо I ᴼ.0 I	**EVT1 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
dFᴴ I ᴼ.0 I	**EVT1 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If ⁻⁻⁻⁻ (No action), ГсAP (Sensor cap replacement timer), ьELF (Self-check output) or сLЕᴳ (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), ГᾱHL (Water temperature input High/Low limits independent action), dьHL (DO % saturation input High/Low limits independent action) or ᾱPHL (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT1 type].

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

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Character	Setting Item, Setting Range	Factory Default	Data
o n ⌐ 1 ☐☐☐0	**EVT1 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
o F ⌐ 1 ☐☐☐0	**EVT1 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
o o n 1 ☐☐☐0	**Output ON Time when EVT1 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
o o F 1 ☐☐☐0	**Output OFF Time when EVT1 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E _ L 1 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E _ H 1 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E H Y 1 ☐0.01	**EVT1 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If ⌐oHL (DO concentration input High/Low limits independent action), ⌐⌐HL (Water temperature input High/Low limits independent action), ⌐⌐HL (DO % saturation input High/Low limits independent action) or ⌐PHL (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
ЄⲄF2 ⎕⎕⎕⎕	**EVT2 type** ⎕⎕⎕⎕ : No action do_H : DO concentration input high limit action do_L : DO concentration input low limit action ⱢⲄῆH : Water temperature input high limit action ⱢⲄῆL : Water temperature input low limit action do4H : DO % saturation input high limit action do4L : DO % saturation input low limit action ⱵPⲄH : Oxygen partial pressure input high limit action ⱵPⲄL : Oxygen partial pressure input low limit action ⲄcAP : Sensor cap replacement timer 4ЄLF : Self-check output cLЄⱢ : Cleansing output doHL : DO concentration input High/Low limits independent action ⲄῆHL : Water temperature input High/Low limits independent action d4HL : DO % saturation input High/Low limits independent action ⱵPHL : Oxygen partial pressure input High/Low limits independent action	No action	
4Ⱶ2⎕ ⎕0.00	**EVT2 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
di F2 4di F	**EVT2 hysteresis type** (*2) cdi F : Medium Value 4di F : Reference Value	Reference Value	
dFo2 ⎕0.01	**EVT2 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
dFU2 ⎕0.01	**EVT2 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If ⎕⎕⎕⎕ (No action), ⲄcAP (Sensor cap replacement timer), 4ЄLF (Self-check output) or cLЄⱢ (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), ⲄῆHL (Water temperature input High/Low limits independent action), d4HL (DO % saturation input High/Low limits independent action) or ⱵPHL (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT2 type].

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

Character	Setting Item, Setting Range	Factory Default	Data
on⌐2 ▯▯▯0	**EVT2 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
oF⌐2 ▯▯▯0	**EVT2 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
oon2 ▯▯▯0	**Output ON Time when EVT2 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF2 ▯▯▯0	**Output OFF Time when EVT2 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E_L2 ▯0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E_H2 ▯0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
EHY2 ▯0.01	**EVT2 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If doHL (DO concentration input High/Low limits independent action), ⌐ōHL (Water temperature input High/Low limits independent action), d⅄HL (DO % saturation input High/Low limits independent action) or ōPHL (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
EᴦF3 ⃞⃞⃞⃞	**EVT3 type** ⃞⃞⃞⃞ : No action do_H : DO concentration input high limit action do_L : DO concentration input low limit action ᴜᴦᴬH : Water temperature input high limit action ᴜᴦᴬL : Water temperature input low limit action do4H : DO % saturation input high limit action do4L : DO % saturation input low limit action ᴜPᴦH : Oxygen partial pressure input high limit action ᴜPᴦL : Oxygen partial pressure input low limit action ᴦcᴬP : Sensor cap replacement timer 4ELF : Self-check output cLEᴳ : Cleansing output doHL : DO concentration input High/Low limits independent action ᴦᴬHL : Water temperature input High/Low limits independent action d4HL : DO % saturation input High/Low limits independent action ᴜPHL : Oxygen partial pressure input High/Low limits independent action	No action	
4ᴬ3⃞ ⃞0.00	**EVT3 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
dI F3 4dI F	**EVT3 hysteresis type** (*2) cdI F : Medium Value 4dI F : Reference Value	Reference Value	
dFo3 ⃞0.01	**EVT3 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
dFU3 ⃞0.01	**EVT3 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If ⃞⃞⃞⃞ (No action), ᴦcᴬP (Sensor cap replacement timer), 4ELF (Self-check output) or cLEᴳ (Cleansing output) is selected in [EVT3 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), ᴦᴬHL (Water temperature input High/Low limits independent action), d4HL (DO % saturation input High/Low limits independent action) or ᴜPHL (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT3 type].

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

Character	Setting Item, Setting Range	Factory Default	Data
onГ3 ☐☐☐0	**EVT3 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
oFГ3 ☐☐☐0	**EVT3 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
oon3 ☐☐☐0	**Output ON Time when EVT3 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF3 ☐☐☐0	**Output OFF Time when EVT3 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E_L3 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E_H3 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
EHY3 ☐0.01	**EVT3 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If doHL (DO concentration input High/Low limits independent action), ГmHL (Water temperature input High/Low limits independent action), dЧHL (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
$ETF4$ `----`	**EVT4 type** `----` : No action do_H : DO concentration input high limit action do_L : DO concentration input low limit action $urmH$: Water temperature input high limit action $urmL$: Water temperature input low limit action $do4H$: DO % saturation input high limit action $do4L$: DO % saturation input low limit action $uPrH$: Oxygen partial pressure input high limit action $uPrL$: Oxygen partial pressure input low limit action $rcAP$: Sensor cap replacement timer $5ELF$: Self-check output $cLEG$: Cleansing output $doHL$: DO concentration input High/Low limits independent action $rmHL$: Water temperature input High/Low limits independent action $d4HL$: DO % saturation input High/Low limits independent action $uPHL$: Oxygen partial pressure input High/Low limits independent action	No action	
584 `0.00`	**EVT4 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
$diF4$ $5diF$	**EVT4 hysteresis type** (*2) $cdiF$: Medium Value $5diF$: Reference Value	Reference Value	
$dFo4$ `0.01`	**EVT4 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
$dFU4$ `0.01`	**EVT4 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If `----` (No action), $rcAP$ (Sensor cap replacement timer), $5ELF$ (Self-check output) or $cLEG$ (Cleansing output) is selected in [EVT4 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), $rmHL$ (Water temperature input High/Low limits independent action), $d4HL$ (DO % saturation input High/Low limits independent action) or $uPHL$ (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT4 type].

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

Character	Setting Item, Setting Range	Factory Default	Data
onᴦ4 000000	**EVT4 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
oFᴦ4 000000	**EVT4 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
oon4 000000	**Output ON Time when EVT4 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF4 000000	**Output OFF Time when EVT4 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E_L4 00.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E_H4 00.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
EH44 00.01	**EVT4 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If doHL (DO concentration input High/Low limits independent action), ᴦ̄ᴀHL (Water temperature input High/Low limits independent action), d4HL (DO % saturation input High/Low limits independent action) or ᵿPHL (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
`EᵣF5` `----`	**EVT5 type** `----` : No action `do_H` : DO concentration input high limit action `do_L` : DO concentration input low limit action `ᴗᵣᴹH` : Water temperature input high limit action `ᴗᵣᴹL` : Water temperature input low limit action `do5H` : DO % saturation input high limit action `do5L` : DO % saturation input low limit action `ᴗPᵣH` : Oxygen partial pressure input high limit action `ᴗPᵣL` : Oxygen partial pressure input low limit action `ᵣcAP` : Sensor cap replacement timer `5ELF` : Self-check output `cLEᴳ` : Cleansing output `doHL` : DO concentration input High/Low limits independent action `ᵣᴹHL` : Water temperature input High/Low limits independent action `d5HL` : DO % saturation input High/Low limits independent action `ᴗPHL` : Oxygen partial pressure input High/Low limits independent action	No action	
`5A5` `0.00`	**EVT5 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
`dl F5` `5dl F`	**EVT5 hysteresis type** (*2) `cdl F` : Medium Value `5dl F` : Reference Value	Reference Value	
`dFo5` `0.01`	**EVT5 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
`dFU5` `0.01`	**EVT5 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If `----` (No action), `ᵣcAP` (Sensor cap replacement timer), `5ELF` (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), `ᵣᴹHL` (Water temperature input High/Low limits independent action), `d5HL` (DO % saturation input High/Low limits independent action) or `ᴗPHL` (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT5 type].

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

Character	Setting Item, Setting Range	Factory Default	Data
on⌐5 ☐☐☐0	**EVT5 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
oFⲘ5 ☐☐☐0	**EVT5 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
oon5 ☐☐☐0	**Output ON Time when EVT5 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF5 ☐☐☐0	**Output OFF Time when EVT5 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E_L5 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E_H5 ☐0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
EHY5 ☐0.01	**EVT5 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If doHL (DO concentration input High/Low limits independent action), ⌐ⲘHL (Water temperature input High/Low limits independent action), d५HL (DO % saturation input High/Low limits independent action) or ⌐PHL (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
$E\Gamma F6$ ⊡⊡⊡⊡	**EVT6 type** ⊡⊡⊡⊡ : No action do_H : DO concentration input high limit action do_L : DO concentration input low limit action $\it{irnH}$: Water temperature input high limit action $\it{irnL}$: Water temperature input low limit action $do4H$: DO % saturation input high limit action $do4L$: DO % saturation input low limit action $iPrH$: Oxygen partial pressure input high limit action $iPrL$: Oxygen partial pressure input low limit action ΓcRP : Sensor cap replacement timer $4ELF$: Self-check output $cLEG$: Cleansing output $doHL$: DO concentration input High/Low limits independent action ΓnHL : Water temperature input High/Low limits independent action $d4HL$: DO % saturation input High/Low limits independent action $iPHL$: Oxygen partial pressure input High/Low limits independent action	No action	
$4H6$ ⊡ ⊡0.00	**EVT6 value** (*1) DO concentration input: 0.00 to 20.00 mg/L Water temperature input: 0.0 to 50.0℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
$di F6$ $4di F$	**EVT6 hysteresis type** (*2) $cdi F$: Medium Value $4di F$: Reference Value	Reference Value	
$dFo6$ ⊡0.01	**EVT6 ON side** (*2) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	
$dFU6$ ⊡0.01	**EVT6 OFF side** (*3) DO concentration input: 0.00 to 4.00 mg/L Water temperature input: 0.0 to 10.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*1) If ⊡⊡⊡⊡ (No action), ΓcRP (Sensor cap replacement timer), $4ELF$ (Self-check output) or $cLEG$ (Cleansing output) is selected in [EVT6 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), ΓnHL (Water temperature input High/Low limits independent action), $d4HL$ (DO % saturation input High/Low limits independent action) or $iPHL$ (Oxygen partial pressure input High/Low limits independent action) is selected in [EVT6 type].

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

Character	Setting Item, Setting Range	Factory Default	Data
onΓ6 0	**EVT6 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
oFΓ6 0	**EVT6 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
oon6 0	**Output ON Time when EVT6 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
ooF6 0	**Output OFF Time when EVT6 Output ON** Setting range: 0 to 9999 seconds	0 seconds	
E_L6 0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
E_H6 0.00	**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℃ 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℃ DO % saturation input: 0.0% Oxygen partial pressure input: 0.0 kPa	
EHY6 0.01	**EVT6 hysteresis** DO concentration input: 0.01 to 2.00 mg/L Water temperature input: 1.0 to 5.0℃ 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℃ DO % saturation input: 0.1% Oxygen partial pressure input: 0.1 kPa	

(*) If doHL (DO concentration input High/Low limits independent action), ΓﾗHL (Water temperature input High/Low limits independent action), dﾗHL (DO % saturation input High/Low limits independent action) or ﾛPHL (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

c̄ā4L
noāL
	Communication protocol
	  noāL : Shinko protocol
	  āodA : MODBUS ASCII mode
	  ādr : MODBUS RTU mode
		Shinko protocol	

c̄āno 0	**Instrument number** 0 to 95	0	

c̄ā4P
96
	Communication speed
	  96 : 9600 bps
	  192 : 19200 bps
	  384 : 38400 bps
		9600 bps	

c̄āFr
7EЯn
	Data bit/Parity
	  Bnon : 8 bits/No parity
	  7non : 7 bits/No parity
	  BEЯn : 8 bits/Even
	  7EЯn : 7 bits/Even
	  Bodd : 8 bits/Odd
	  7odd : 7 bits/Odd
		7 bits/Even	

c̄ā4r
1
	Stop bit
	  1 : 1 bit
	  2 : 2 bits
		1 bit	

Cleansing Group

Character	Setting Item, Setting Range	Factory Default	Data
cLFā 30	**Cleansing time** Setting range: 10 to 120 seconds	30 seconds	
cLc4 oFF	**Cleansing inactive interval** oFF (None), 10 to 240 minutes	OFF (None)	
cLIr 0	**Standby after Cleansing** Setting range: 0 to 60 seconds	0 seconds	

Basic Function Group

Character	Setting Item, Setting Range	Factory Default	Data

Lock
---- 	
	Set value lock
	  ---- (Unlock): All set values can be changed.
	  Loc1 (Lock 1): None of the set values can be changed.
	  Loc2 (Lock 2): Only EVT1 to EVT6 values can be changed.
	  Loc3 (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	

LIGr
---- 	
	Auto-light function
	  ---- : Disabled
	  U4E : Enabled
		Disabled	

rIāE
00.00
	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
$1 Err$ oFF	**EVT output when input errors occur** on : Enabled oFF : Disabled	Disabled	
$4y1$ 365	**EVT1 value** Setting range: 0 to 1095 days	365 days	
$on\Gamma1$ 0	**EVT1 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma1$ 0	**EVT1 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
$4y2$ 365	**EVT2 value** Setting range: 0 to 1095 days	365 days	
$on\Gamma2$ 0	**EVT2 ON delay time** Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma2$ 0	**EVT2 OFF delay time** Setting range: 0 to 9999 seconds	0 seconds	
$4y3$ 365	**EVT3 value** (*) Setting range: 0 to 1095 days	365 days	
$on\Gamma3$ 0	**EVT3 ON delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma3$ 0	**EVT3 OFF delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$4y4$ 365	**EVT4 value** (*) Setting range: 0 to 1095 days	365 days	
$on\Gamma4$ 0	**EVT4 ON delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma4$ 0	**EVT4 OFF delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$4y5$ 365	**EVT5 value** (*) Setting range: 0 to 1095 days	365 days	
$on\Gamma5$ 0	**EVT5 ON delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma5$ 0	**EVT5 OFF delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$4y6$ 365	**EVT6 value** (*) Setting range: 0 to 1095 days	365 days	
$on\Gamma6$ 0	**EVT6 ON delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$oF\Gamma6$ 0	**EVT6 OFF delay time** (*) Setting range: 0 to 9999 seconds	0 seconds	
$rE\Gamma m$ 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**	
tEY	**Key input mode**	
nonE	**Temperature Display**	**Key Input**
	nonE	When no key is pressed
	UP	When the △ key is pressed
	doun	When the ▽ key is pressed
	db	When 2 or more keys are pressed simultaneously
oUt	**Output mode**	
oFF	**Temperature Display**	**Output**
	oFF	All EVT outputs: OFF, Transmission output 1 and 2: 4 mA DC
	EYT 1	EVT1 output ON
	EYT 2	EVT2 output ON
	EYT 3	EVT3 output ON
	EYT 4	EVT4 output ON
	EYT 5	EVT5 output ON
	EYT 6	EVT6 output ON
	rro 1	Transmission output 1: 20 mA DC
	rro2	Transmission output 2: 20 mA DC
do	**Input mode**	
Measured value	**DO Display**	**Temperature Display**
	do	DO concentration measured value
	urmP	Water temperature measured value
	do4t	DO % saturation measured value
	oPr4	Oxygen partial pressure measured value
	ncAP	Sensor cap serial number

Data Clear Group

Character	Setting Item, Setting Range	Factory Default	Data
cL4L	**Data clear selection**	Calibration value	
cAL	*cAL* : Calibration value *4Et* : Set value		
cLr	**Data clear Stop/Perform**	Data clear Stop	
no	*no* : Data clear Stop *4E4* : Data clear Perform		

Error Codes

The following error codes are indicated on the Temperature Display.

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 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
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

14. Key Operation Flowchart

POWER ON

Display Mode or Cleansing Output Mode (*1)

| Meas.value (*2) Meas.value (*3) | **DO Concentration / Temp. Display Mode** | △ | Meas.value (*2) Meas.value (*3) | **DO % Saturation/ Temp. Display Mode** | △ | Meas.value (*2) Meas.value (*3) | **Oxygen Partial Pressure / Temp. Display Mode** | △ |

▽+◯ (3 sec) →

| Meas.value (*2) `□□1□` | **DO Concentration 1-point Calib. Mode** | SET/RESET | Meas.value (*4) `□□1□` | 1-point calibration (100% saturation calib.) | SET/RESET |

◯ (P.41)

| Meas.value (*2) `□-2□` | **DO Concentration 2-point Calib. Mode** | SET/RESET | Meas.value (*4) `□-2□` | 1st-point calibration (*5) (100% saturation calib.) | SET/RESET |
| | | | Meas.value (*4) `□-2□` | 2nd-point calibration (0-point calibration) | SET/RESET |

◯ (P.43)

| `cAdr` C.Desired value | **Concentration Option Calibration Mode** | SET/RESET | Meas.value (*4) `□□□□` | **Concentration Option Auto Calibration** | SET/RESET |

◯ (P.45)

SET/RESET (3 sec) →

| Meas.value (*2) Meas.value (*3) | **Forced Cleansing Mode** (P.54) | Automatically proceeds after cleansing action. |

△+SET/RESET (3 sec) →

| `AJ=1` `□0.00` | **Transmission output 1 Zero adjust.** (P.47) | SET/RESET | `AJ41` `□0.00` | **Transmission output 1 Span adjust.** (P.47) | SET/RESET |

◯

▽+SET/RESET (3 sec) →

| `AJ=2` `□0.00` | **Transmission output 2 Zero adjust.** (P.48) | SET/RESET | `AJ42` `□0.00` | **Transmission output 2 Span adjust.** (P.48) | SET/RESET |

◯

◯

`Fnc□` `□□□□`	**DO Concentration Input Group**	◯	`Tro1` `□□□□`	**Transmission Output 1 Group**	◯	`Tro2` `□□□□`	**Transmission Output 2 Group**	◯ → ①
SET/RESET			SET/RESET			SET/RESET		
`dFcr` `□□60`	Signal output response time (P.23)		`Tro1` `do□□`	Transmission output 1 type (P.24)		`Tro2` `do□□`	Transmission output 2 type (P.25)	
SET/RESET		↑◯	SET/RESET		↑◯	SET/RESET		↑◯
`5ALr` `□□□0`	Salinity correction (P.23)		`TrH1` `20.00`	Transmission output 1 high limit (P.24)		`TrH2` `20.00`	Transmission output 2 high limit (P.25)	
SET/RESET		↑◯	SET/RESET		↑◯	SET/RESET		↑◯
`5EAL` `□□□0`	Altitude correction (P.23)		`TrL1` `□0.00`	Transmission output 1 low limit (P.24)		`TrL2` `□0.00`	Transmission output 2 low limit (P.25)	
SET/RESET			SET/RESET		↑◯	SET/RESET		↑◯
			`Trc1` `bEFH`	Trans. output 1 status when calibrating (P.24)		`Trc2` `bEFH`	Trans. output 2 status when calibrating (P.25)	
			SET/RESET		↑◯	SET/RESET		↑◯
			`Tr41` `□0.00`	Trans. output 1 value HOLD when calibrating (P.24)		`Tr42` `□0.00`	Trans. output 2 value HOLD when calibrating (P.25)	
			SET/RESET			SET/RESET		②

● **About Setting Item**

| `dFcr` `□□□5` | 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.

| `E.Ac.3` `□□□□` | **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 SET/RESET key.

EVT1 Action Group	EVT2 Action Group (*6)	EVT3 Action Group (*7)
E.ur.1	E.ur.2	E.ur.3
ErF1 — EVT1 type (P.26)	ErF2 — EVT2 type (P.26)	ErF3 — EVT3 type (P.26)
SV1 — EVT1 value (P.28)	SV2 — EVT2 value (P.28)	SV3 — EVT3 value (P.28)
diF1 — EVT1 hysteresis type (P.28)	diF2 — EVT2 hysteresis type (P.28)	diF3 — EVT3 hysteresis type (P.28)
dFo1 — EVT1 ON side (P.28)	dFo2 — EVT2 ON side (P.28)	dFo3 — EVT3 ON side (P.28)
dFU1 — EVT1 OFF side (P.28)	dFU2 — EVT2 OFF side (P.28)	dFU3 — EVT3 OFF side (P.28)
onr1 — EVT1 ON delay time (P.29)	onr2 — EVT2 ON delay time (P.29)	onr3 — EVT3 ON delay time (P.29)
oFr1 — EVT1 OFF delay time (P.29)	oFr2 — EVT2 OFF delay time (P.29)	oFr3 — EVT3 OFF delay time (P.29)
oon1 — Output ON time when EVT1 output ON (P.29)	oon2 — Output ON time when EVT2 output ON (P.29)	oon3 — Output ON time when EVT3 output ON (P.29)
ooF1 — Output OFF time when EVT1 output ON (P.29)	ooF2 — Output OFF time when EVT2 output ON (P.29)	ooF3 — Output OFF time when EVT3 output ON (P.29)
E_L1 — EVT1 H/L independent lower side value (P.29)	E_L2 — EVT2 H/L independent lower side value (P.29)	E_L3 — EVT3 H/L independent lower side value (P.29)
E_H1 — EVT1 H/L independent upper side value (P.30)	E_H2 — EVT1 H/L independent upper side value (P.30)	E_H3 — EVT1 H/L independent upper side value (P.30)
EHY1 — EVT1 hysteresis (P.30)	EHY2 — EVT2 hysteresis (P.30)	EHY3 — EVT3 hysteresis (P.30)

● **Key Operation**

· △, ◯, SET/RESET: Press the △, ◯ or SET/RESET 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.

· SET/RESET(3 sec), ◯(3 sec): Press the SET/RESET or ◯ key for 3 seconds. The unit will proceed to the next setting item, illustrated by an arrow.

· △+SET/RESET(3 sec): Press and hold the △ and SET/RESET keys (in that order) together for 3 seconds. The unit will proceed to the next mode.

· ▽+SET/RESET(3 sec): Press and hold the ▽ and SET/RESET 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 SET/RESET 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 (1) with EVT2 character (2). 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 (1) with EVT3 character (3). Refer to EVT1 Action Group (pp. 26 to 30).

③→

EVT4 Action Group (*8)	EVT5 Action Group (*9)	EVT6 Action Group (*10)
EVT4 type (P.26)	EVT5 type (P.26)	EVT6 type (P.26)
EVT4 value (P.28)	EVT5 value (P.28)	EVT6 value (P.28)
EVT4 hysteresis type (P.28)	EVT5 hysteresis type (P.28)	EVT6 hysteresis type (P.28)
EVT4 ON side (P.28)	EVT5 ON side (P.28)	EVT6 ON side (P.28)
EVT4 OFF side (P.28)	EVT5 OFF side (P.28)	EVT6 OFF side (P.28)
EVT4 ON delay time (P.29)	EVT5 ON delay time (P.29)	EVT6 ON delay time (P.29)
EVT4 OFF delay time (P.29)	EVT5 OFF delay time (P.29)	EVT6 OFF delay time (P.29)
Output ON time when EVT4 output ON (P.29)	Output ON time when EVT5 output ON (P.29)	Output ON time when EVT6 output ON (P.29)
Output OFF time when EVT4 output ON (P.29)	Output OFF time when EVT5 output ON (P.29)	Output OFF time when EVT6 output ON (P.29)
EVT4 H/L independent lower side value (P.29)	EVT5 H/L independent lower side value (P.29)	EVT6 H/L independent lower side value (P.29)
EVT4 H/L independent upper side value (P.30)	EVT5 H/L independent upper side value (P.30)	EVT6 H/L independent upper side value (P.30)
EVT4 hysteresis (P.30)	EVT5 hysteresis (P.30)	EVT6 hysteresis (P.30)

→⑤

④←   ⑥

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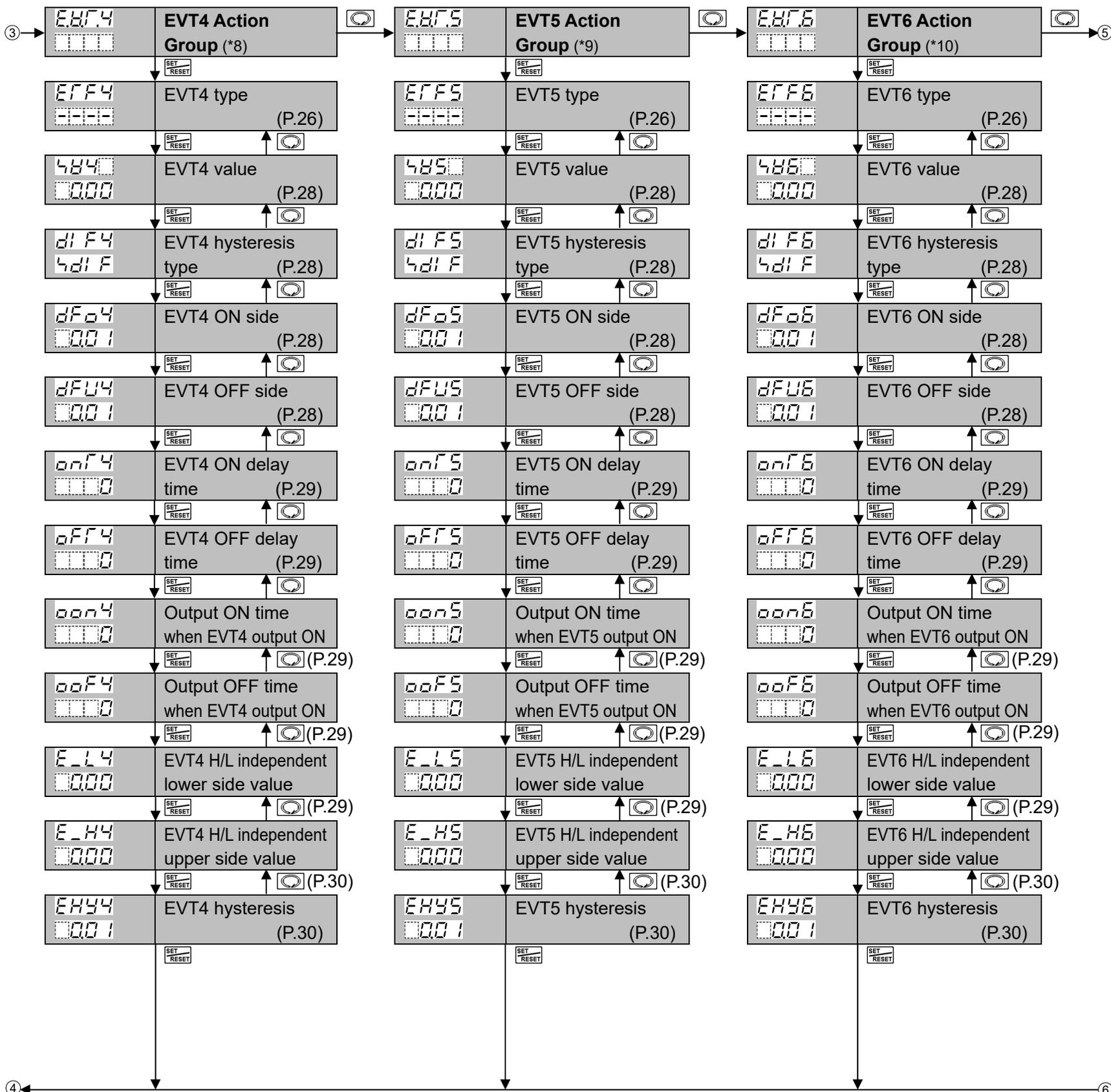 Substitute EVT1 character (1) with EVT5 character (5). Refer to EVT1 Action Group (pp. 26 to 30).
(*10) Action, indication condition and setting range of the EVT6 Action Group are the same EVT1 Action Group.
  Substitute EVT1 character (1) with EVT6 character (6). Refer to EVT1 Action Group (pp. 26 to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

⑤→

cคฑ̄	**Communication Group**	▢

cñ̄чL noñL	Communication protocol (P.32)

cñ̄no ⃞⃞⃞0	Instrument number (P.32)

cñ̄чP ⃞96	Communication speed (P.32)

cñ̄Fr 7E8n	Data bit/Parity (P.32)

cñ̄чr ⃞⃞⃞1	Stop bit (P.32)

cL.E.C	**Cleansing Group**	▢

cLΓñ ⃞30	Cleansing time (P.33)

cLcУ oFF⃞	Cleansing inactive interval (P.33)

cLI Γ ⃞⃞⃞0	Standby after cleansing (P.33)

oΓ.E.r	**Basic Function Group**	▢ |→⑦

→⑧
→⑨

Lock ----	Set value lock (P.34)

LI Gr ----	Auto-light function (P.34)

ΓIñE 00.00	Indication time (P.34)

I Err oFF⃞	EVT output when input errors occur (P.34)

ч8 I⃞ ⃞365	EVT1 value (P.34)

onΓ I ⃞⃞⃞0	EVT1 ON delay time (P.35)

oFΓ I ⃞⃞⃞0	EVT1 OFF delay time (P.35)

ч82⃞ ⃞365	EVT2 value (P.35)

onΓ2 ⃞⃞⃞0	EVT2 ON delay time (P.35)

oFΓ2 ⃞⃞⃞0	EVT2 OFF delay time (P.35)

ч8З⃞ ⃞365	EVT3 value (P.35)

⑥←   →⑩

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⑦ ──→ `५.E.L.F` **Self-Check Group** ⟲ → `c.L.r` **Data Clear Group** ⟲

SET/RESET

⑧ ←───────────────────────────────
⑨ ──────────────────────── ⟲

`८.८.८.८` `८.८.८.८`	LED all lit mode (P.38)	
`- - - -` `- - - -`	LED individual lit mode (P.38)	
`ㄴE५` `nonE`	Key input mode (P.39)	
`oUГ` `oFF`	Output mode (P.39)	
`do` Measured value (*11)	Input mode (P.39)	

`onГ 3` `0` — EVT3 ON delay time (P.35)

`oFГ3` `0` — EVT3 OFF delay time (P.35)

`५८4` `365` — EVT4 value (P.36)

`onГ4` `0` — EVT4 ON delay time (P.36)

`oFГ4` `0` — EVT4 OFF delay time (P.36)

`५८5` `365` — EVT5 value (P.36)

`onГ5` `0` — EVT5 ON delay time (P.36)

`oFГ5` `0` — EVT5 OFF delay time (P.36)

`५८6` `365` — EVT6 value (P.37)

`onГ6` `0` — EVT6 ON delay time (P.37)

`oFГ6` `0` — EVT6 OFF delay time (P.37)

`rEГ๓` `365` — Sensor cap replacement timer remainder (P.37)

⟲ (3 sec)

`cL५L` `cAL` — Data clear selection (P.40)

`cLr` `no` — Data clear Stop/Perform (*12) (P.40)

⑩ ←──

(*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.)

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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)

Temper-ature (℃)	Amount of saturated DO (mg/L)	Temper-ature (℃)	Amount of saturated DO (mg/L)	Temper-ature (℃)	Amount of saturated DO (mg/L)	Temper-ature (℃)	Amount of saturated DO (mg/L)
1	14.22	11	11.03	21	8.92	31	7.43
2	13.83	12	10.78	22	8.74	32	7.31
3	13.46	13	10.54	23	8.58	33	7.18
4	13.11	14	10.31	24	8.42	34	7.07
5	12.77	15	10.08	25	8.26	35	6.95
6	12.45	16	9.87	26	8.11	36	6.84
7	12.14	17	9.67	27	7.97	37	6.73
8	11.84	18	9.47	28	7.83	38	6.62
9	11.56	19	9.28	29	7.69	39	6.52
10	11.29	20	9.09	30	7.56	40	6.41

JIS K 0102-2016

*****   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.
OVERSEAS DIVISION

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