

**Model DO70G  
Optical Dissolved Oxygen Sensor**

IM 12J05D04-01E

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# ◆ Introduction

The DO70G optical dissolved oxygen sensor uses the optical (fluorescence) measurement method to continuously measure oxygen dissolved in water

Topics and information that need your special attention in handling the product are given in the text of this manual along with cautionary notes, such as a warning or caution, depending on their importance. Strictly observe these items from the standpoint of safety and prevention of equipment damage. For a notation, such as a warning also indicated on the product, there is an alert mark in the manual.

## 1. Confirming the Specifications

The DO70G sensor cable should have the specified length. The crimp-on terminals are either pin-type or M4 ring-type.

Upon arrival of the purchased product, carefully unpack it and make sure the product has not been damaged during transportation.

Verify the model code on a name plate adhered on the packaging box. For details of the model code, see subsection 1.2.2.

## 2. Information Covered by This Manual

This manual covers all of the information on handling the DO70G optical dissolved oxygen sensor, such as instructions on installation, inspection, and maintenance and service.

Note : In this manual, descriptions of the basic system assumes that the DO402G Dissolved Oxygen Converter or FLXA402 4-Wire Converter is used.

Refer to the instruction manual for information on the converter connecting holders with the DO70G and how to connect sensor cables.

Note that the instruction manuals listed in the following table are for the associated equipment used with the EXA DO™ Dissolved Oxygen Metering System.

### Manuals for Associated Equipment Used with the EXA do Dissolved Oxygen Metering System

Model	Title of Manual	Manual No.
DO402G	Dissolved Oxygen Converter	IM 12J05D02-01E
FLXA402	4-Wire Converter	IM 12A01F01-02EN IM 12A01F05-01EN etc
DO70G	Optical Dissolved Oxygen Sensor	IM 12J05D04-01E (This manual)
DOX10	Power Supply Unit	IM 12J05S01-01E
PB350G	Angled Floating Ball Holder	IM 19H1E1-01E
PB360G	Vertical Floating Ball Holder	IM 19H1E2-01E
DOX8HS	Submersion Type Holder (Style B)	IM 19H1D2-01E

Note: Only the basic system of basic components are listed on the front panel.  
Refer to respective instruction manual for information on recorders, annunciators and other instruments.

An exclusive User's Manual might be attached to the products whose suffix codes or option codes contain the code "Z" (made to customers' specifications). Please read it along with this manual.

## ■ Trademark Notices

- EXA DO, FLXA are trademarks of Yokogawa Electric Corporation.
- All other company and product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.
- We do not use TM or ® mark to indicate those trademarks or registered trademarks in this user's manual.

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# ◆ Safety Precautions

## ■ Safety and Modification Precautions

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this instrument is used in a manner not specified in this user's manual, the protection provided by this instrument may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following safety symbols are used on the product as well as in this manual.



### **WARNING**

This symbol indicates that an operator must follow the instructions laid out in this manual in order to avoid the risks, for the human body, of injury, electric shock, or fatalities. The manual describes what special care the operator must take to avoid such risks.



### **CAUTION**

This symbol indicates that the operator must refer to the instructions in this manual in order to prevent the instrument (hardware) or software from being damaged, or a system failure from occurring.

### **CAUTION**

This symbol gives information essential for understanding the operations and functions.

### **NOTE**

This symbol indicates information that complements the present topic.

## ■ Notes on Handling User's Manuals

- Please hand over the user's manuals to your end users so that they can keep the user's manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
- No part of the user's manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user's manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user's manuals, please contact our sales representative or your local distributor.

## ■ Product Disposal:

The instrument should be disposed of in accordance with local and national legislation/regulations.

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## ◆ After-sales Warranty

- Do not modify the product.
- During the warranty period, for repair under warranty carry or send the product to the local sales representative or service office. Yokogawa will replace or repair any damaged parts and return the product to you.
- Before returning a product for repair under warranty, provide us with the model name and serial number and a description of the problem. Any diagrams or data explaining the problem would also be appreciated.
- If we replace the product with a new one, we won't provide you with a repair report.
- Yokogawa warrants the product for the period stated in the pre-purchase quotation. Yokogawa shall conduct defined warranty service based on its standard. When the customer site is located outside of the service area, a fee for dispatching the maintenance engineer will be charged to the customer.
- In the following cases, customer will be charged repair fee regardless of warranty period.
  - Failure of components which are out of scope of warranty stated in instruction manual.
  - Failure caused by usage of software, hardware or auxiliary equipment, which Yokogawa did not supply.
  - Failure due to improper or insufficient maintenance by user.
  - Failure due to abuse, misuse or modification which Yokogawa does not authorize.
  - Failure due to power supply (voltage, frequency) being outside specifications or abnormal.
  - Failure caused by any usage out of scope of recommended usage.
  - Any damage from fire, earthquake, storms and floods, lightning, disturbances, riots, warfare, radiation and other natural changes.
- Yokogawa does not warrant conformance with the specific application at the user site. Yokogawa will not bear direct/indirect responsibility for damage due to a specific application.
- Yokogawa will not bear responsibility when user configures the product into systems or resells the product.
- Maintenance service and supplying repair parts will be covered for five years after the production ends. For repair for this product, please contact the nearest sales office described in this instruction manual.



# Model DO70G Optical Dissolved Oxygen Sensor

IM 12J05D04-01E 6th Edition

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# 1. General

Do not drop the sensor. Please handle it with care.

## 1.1 Features

- **Long stability**

The sensor will be ready for measurement approximately 10 minutes after turning on the power.

The sensor can be used continuously and stably for a long time thanks to the stain-resistant sensor cap and the measurement method which is less susceptible to disturbance. It also is hardly influenced by air bubbles in the measurement liquid.

- **Highly reliable measurement system with low maintenance**

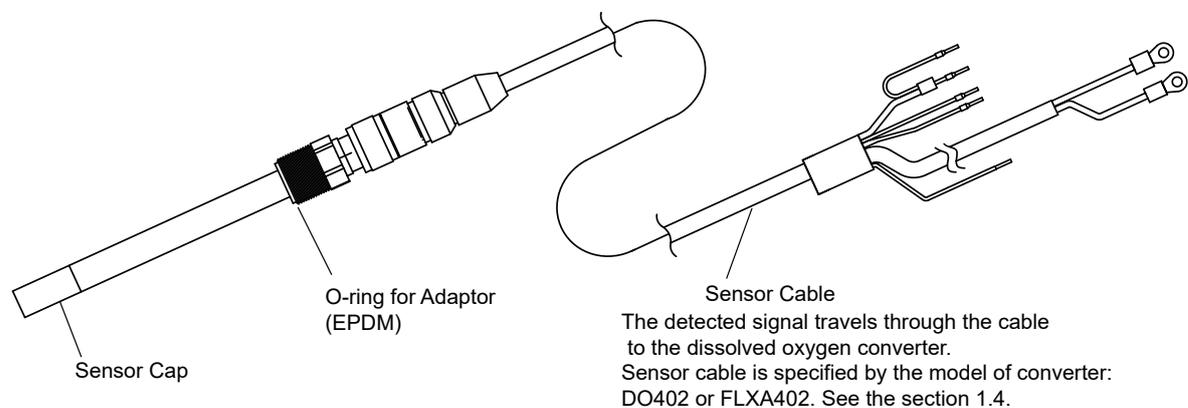
The sensor withstands a pressure of up to 500 kPa. It can be assembled into the submersion type, angled floating ball, or vertical floating ball holders.

In the submersion type holder, the sensor can be automatically cleaned with jet-sprayed water or air at regular intervals. By selecting a suitable holder and cleaning device for applications, a highly reliable, low-maintenance measurement system can be built with this sensor.

- **Easy maintenance**

The sensor cap ages with time and eventually comes to the end of its service life. Before this happens, replace it with a new one. The sensor cap is easily replaced

## 1.2 Components



### CAUTION

Do not loosen the sensor cap except in time of replacement.

## 1.3 Standard Specifications

### Object of Measurement:

Concentration of oxygen dissolved in sewage and drainage (water);  
cannot be used with organic solvents.

Principle of Measurement: Optical (fluorescence) measurement method

Measurement Range: 0 to 25 mg/L

Note: The measurement range must be entered through the dissolved oxygen converter.

Temperature of Measurement water: 0 to 50 °C

Flow rate: 2 m/sec or less

Pressure: 0 to 500 kPa

Resistance Temperature Detector (RTD): 22k NTC

### Construction:

Sensor unit: Stainless steel (316L SS)

O-ring: Ethylene Propylene Rubber (EPDM)

Permeable membrane: Silicone resin

Cable shielding: Heat-resistant flexible PVC

### Sensor Cable:

For code -03E, -05E, -10E

Length; 3 m, 5 m, 10 m

Terminal shape;  
pin (for converter),  
M4 Ring (for power supply unit)

For code -05D, -10D, -15D, -20D

Length; 5 m, 10 m, 15 m, 20 m

Terminal shape; pin

### Weight:

Sensor; Approx. 0.1 kg

Cable;  
For -□□E: Approx. 0.1 kg/m + 0.1 kg  
For -□□D: Approx. 0.8 kg/m + 0.8 kg

### Power supply

DO402G; from DOX10 Power Supply Unit

FLXA402; from FLXA402

- The DOX10 may not be used depending on the relevant standard of your region. Use a power supply that meets the following specifications.
  - Use a power supply that is appropriate for the relevant standard in your region.
  - Use a power supply with an output voltage in the range of 24 V DC  $\pm$  10% and power consumption of 1 W or higher.
  - For wiring the DO70G, connect the input and output cables of the 24 V power supply by separating them by a minimum spatial distance of 3 mm and creepage distance of 6 mm.

**[Characteristics] (when converter is combined with DO70G)**

Repeatability: 0.1 mg/L or 3% FS, whichever is greater  
 Temperature Compensation Error: Within ±3% FS for a ±5°C change in the range of 0 to 40°C  
 Response Time: Within 2 minutes (90% response at the time of the sensor's immersion in 2 wt% sodium sulfite solution after the immersion in air-saturated water)

## 1.4 Model and Suffix Codes

### ● DO70G Optical Dissolved Oxygen Sensor

Model	Suffix Code	Option Code	Description
DO70G	.....	.....	Optical dissolved oxygen sensor
Insert length	-120	.....	120 mm
Type	-E	.....	Always -E
Cable length	-00N	.....	No cable
	-03E	.....	3 m (*1)
	-05E	.....	5 m (*1)
	-10E	.....	10 m (*1)
	-05D	.....	Digital 5 m (*2)
	-10D	.....	Digital 10 m (*2)
	-15D	.....	Digital 15 m (*2)
	-20D	.....	Digital 20 m (*2)
-	-N	.....	Always -N
Option	Adaptor	/S3	Submersion type holder (stainless steel)
		/PP	Submersion type holder (polypropylene)
	Tag plate	/FPP	Float holder (polypropylene)
		/SCT	Stainless steel tag plate

\*1: The power cable is +1.5m. (Refer to "DIMENSION")  
 For connection to DO402G  
 \*2: For connection to FLXA402

### ● DOX8W Calibration Set (optional)

[Style: S2]

Mode	Suffix Code	Option Code	Description
DOX8W	.....	.....	Calibration set
-	*A	.....	Always *A

This is necessary if the span calibration is to be done using a saturated dissolved oxygen solution. It is not necessary for air calibration.

<Contents>

Air pump, stirrer, stirring element, bubbler, clamp, beaker

Note: The calibration set can be used in common regardless of the type of holder.

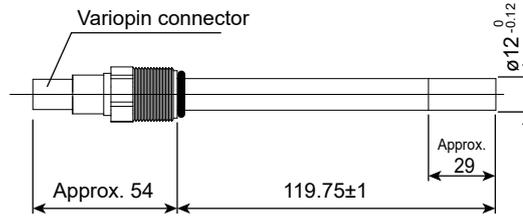
### ● Maintenance Parts

Please refer to 4.3 Maintenance Parts

# 1.5 External View and Dimensions

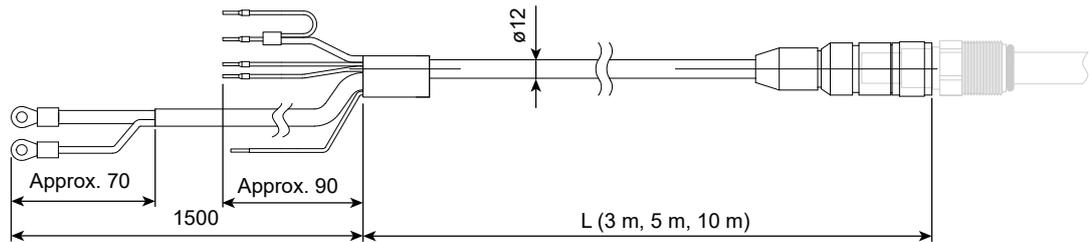
## ● DO70G Sensor

No cable type

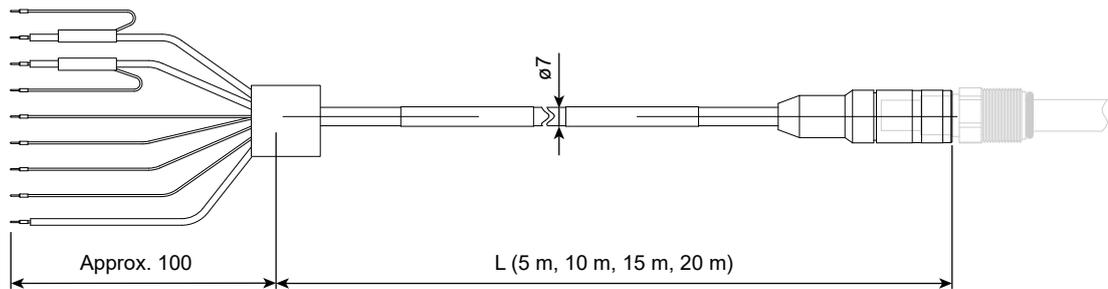


Unit: mm

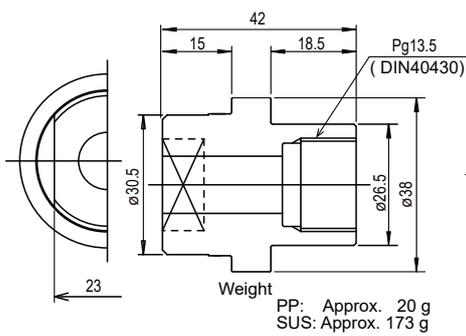
Cable length (code): -03E, -05E, -10E



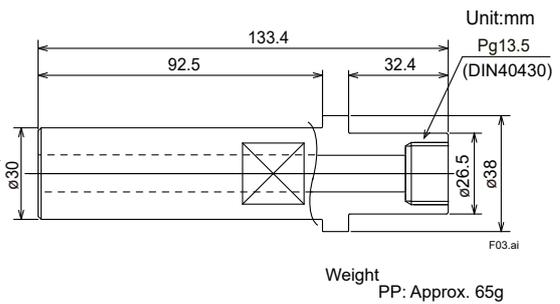
Cable length (code): -05D, -10D, -15D, -20D



## ● Adaptor (/S3, /PP)



## Adaptor (/FPP)



## 2. Installing the Sensor and Connecting the Cable

### 2.1 Preparing for Installation

Protection caps are mounted at both ends of the D70G to prevent the sensor cap or sensor plugs from being damaged. When installing the sensor, remove these protection caps.

#### ■ Attaching/Detaching the sensor cable

##### Attachment

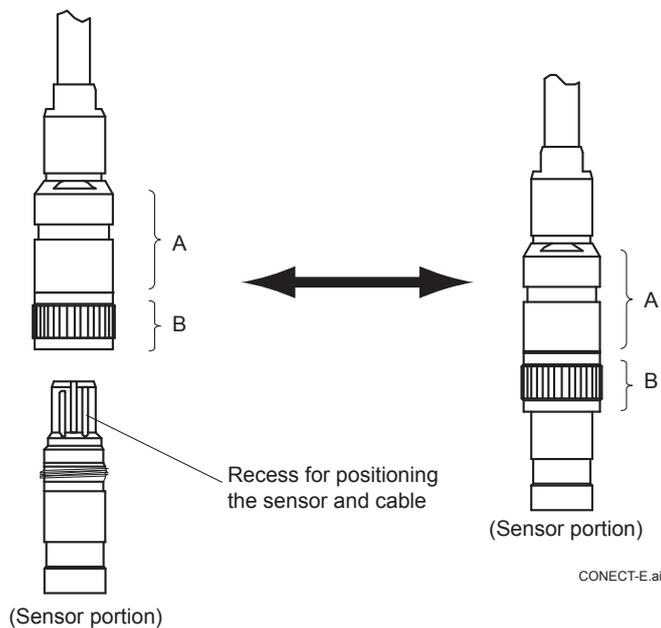
- Rotating the sensor connector so that its recessed portions will agree with the salient portions inside the cable connector, insert the sensor connector into the cable connector.

Note: A weak pressure is sufficient for inserting it. If a strong pressure is needed to insert it, the connection position will be incorrect. Check the position and re-try.

- After inserting the sensor connector completely, grip the portion "A", and rotate the cap nut ("B" portion) clockwise until the nut cannot rotate.

##### Detachment

- Gripping the portion "A", and rotate the cap nut ("B" portion) un-clockwise.
- After loosening the nut completely, grip and pull the plastic portion of the sensor from the cable connector.



## ■ Assembling the Adaptor

An adaptor (optional) is necessary to assemble DO70G into the DOX8HS submersion type holder, PB350G angled floating ball holder, or PB360G vertical floating ball holder.

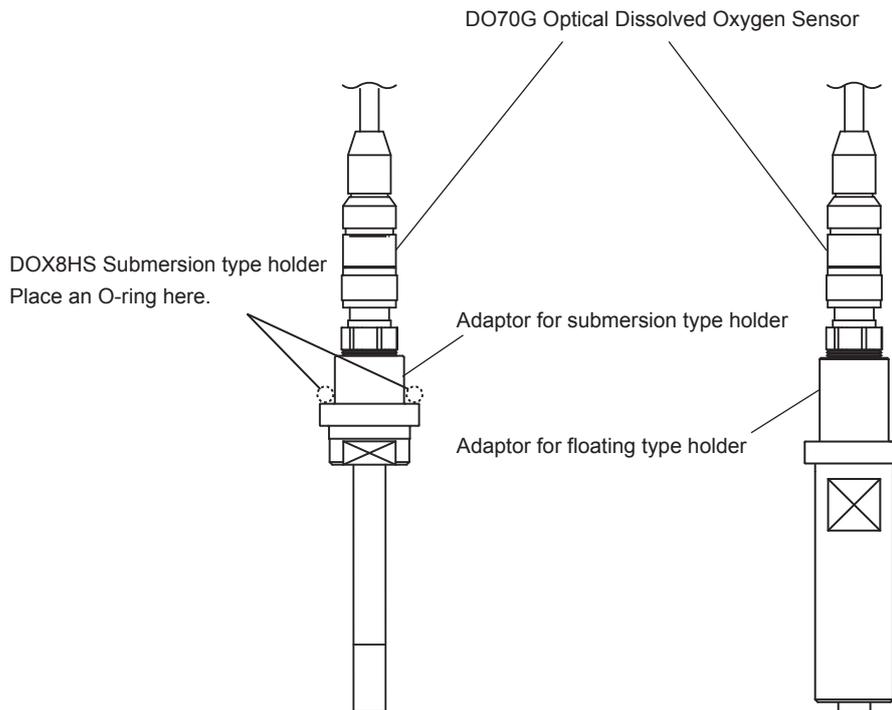


Figure 2.1 Assembling the Adaptor

## 2.2 Installation

The DO70G optical dissolved oxygen sensor can be assembled into the PB350G angled floating ball holder, PB360G vertical floating ball holder, or DOX8HS submersion type holder. The assembly is submerged to the optimum point to obtain precise measurements.

This section explains how to select the measurement point and sensor holder.

### 2.2.1 Selecting the Measurement Point

Normally, a location that meets the following requirements may be selected as the measurement point.

- **The measured value is representative among the values available for the solution under measurement (SUM).**

Avoid choosing a location where the solution is unevenly distributed, since heavy hunting may result in the measured value. Also, avoid locations where bubbles occur frequently.

- **The temperature and flowrate comply with the operating conditions required of the sensor and holder.**

Note that, if a measured solution running at a high flow rate contains particles of sand, the permeable membrane of the sensor may be damaged.

## 2.2.2 Selecting the Sensor Holder

Each holder or fitting where the DO70G Optical Dissolved Oxygen Sensor is assembled has the following characteristics.

Choose a holder that suits the liquid to be measured and the measurement location.

### [PB350G Angled Floating Ball Holder and PB360G Vertical Floating Ball Holder]

The fitting is designed to contain the sensor in a sphere that floats on a liquid. This fitting is immune to large variations in the liquid level. Since the wet part is smooth and less susceptible to catching flocs, the sensor does not trap rubbish that mixes in with the SUM (Related description: See Subsection 3.2.3). The float is supported by an arm and does not move away from the measurement point even if the SUM is flowing.

When using this holder the membrane damage detector function in the converter can be activated.

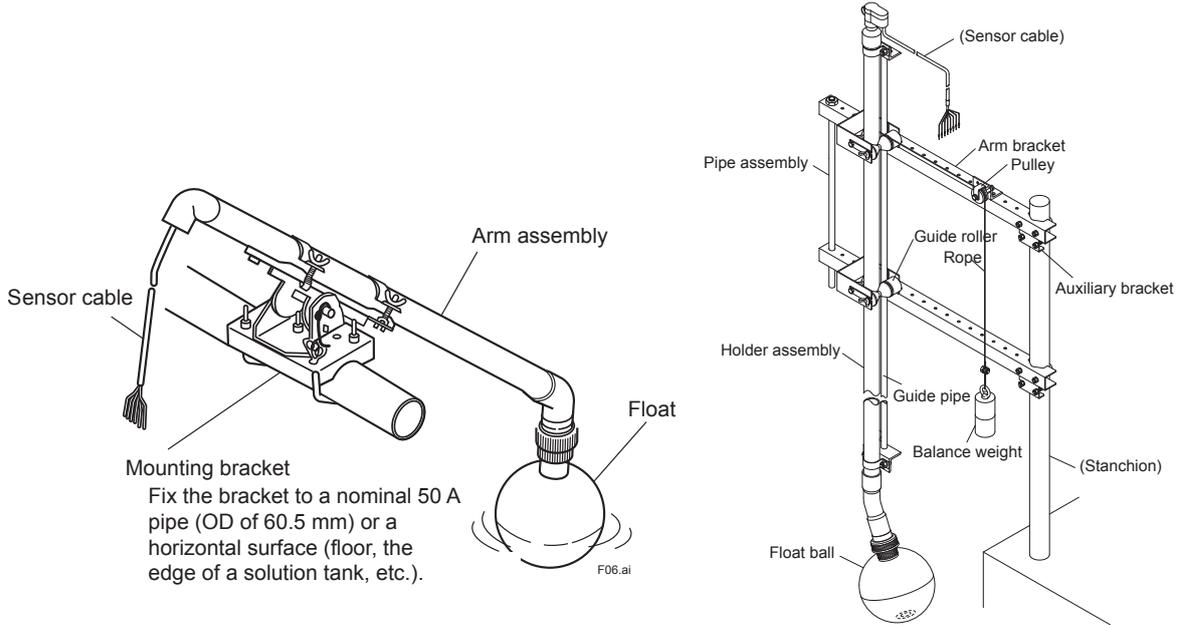


Figure 2.2 Suspension of Dissolved Oxygen Sensor Using PB350G Angled Floating Ball Holder

### DOX8HS (Style B) Submersion Type Holder

The holder holds the sensor at an angle of 45°. Consequently, bubbles will not stick to the sensor the tip. Any pollutants in the SUM can be automatically cleaned off at regular intervals using a jet-spray water (air) cleaner.

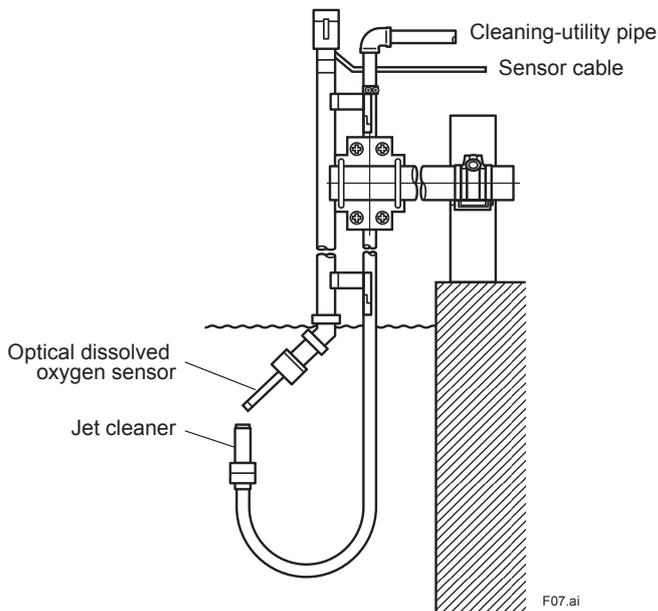


Figure 2.3 Suspension of Optical Dissolved Oxygen Sensor Using DOX8HS Submersion Type Holder (with Jet Cleaner)

## 2.2.3 Installing the Sensor in the Holder

For details on how to install the sensor in the holder, see the appropriate instruction manual for each holder.

### CAUTION

Do not contaminate or wet the tip of the sensor cable when assembling the sensor.

If you will not begin wiring the sensor cable immediately, take the protective measures necessary to prevent the assembly from being damaged.

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## 2.3 Connecting the Sensor Cable

Sensor cable to connect to DO70G is defined by the model of converter to be used.

For information on sensor cable to connect DO70G to DO402G, refer to the user's manual for DO402G Dissolved Oxygen Converter instruction manual (IM 12J05D02-01E) or the one for DOX10 (IM 12J05S01-01E).

For the connection with FLXA402, read a user's manual for FLXA402 4-Wire Converter (IM12A01F01-02EN) and select an appropriate sensor cable.

### NOTE

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A jumper cable is placed to connect converter terminals 13 and 17.

When a standard optical sensor (DO70G) is to be connected, the cable is not used, so disconnect it.

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## 3. Setting and Calibrating the Converter

See the DO402G Dissolved Oxygen Converter user's manual (IM 12J05D02-01E).

For information on sensor cable to connect DO70G to DO402G, refer to the user's manual IM 12J05D02-01E for DO402G Dissolved Oxygen Converter instruction manual and IM 12J05S01-01E for DOX10.

For the connection with FLXA402, read a user's manual IM12A01F05-01EN etc. for FLXA402 4-Wire Converter.



## 4. Maintenance

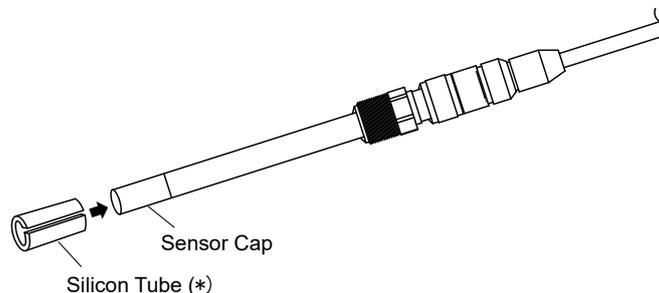
### 4.1 Routine Inspection

#### ■ Cleaning of Sensor (Sensor Cap)

A visual inspection of the sensor cap must be made whenever the sensor is calibrated. Any dirt on the sensor cap adversely affects your measurements.

If the dirt is spread over the sensor cap, dip the sensor cap into clean water and gently wipe the dirt off with a soft cloth or lint-free paper. If the dirt does not come off easily, apply a neutral detergent to the sensor cap so it can be easier to remove the dirt. Wash the sensor cap with clean water.

Before every calibration, check that the sensor cap is not loose. If it is loose, retighten it. When you retighten or replace the sensor cap, use an attached silicon tube and so forth.



(\*): When you attach or detach the sensor cap, use an attached silicon tube and so forth.

### 4.2 Inspection If Failure Occurs

When the sensor cap ages and comes to the end of its service life, troubles such as failed span adjustment may occur. DO402G Dissolved Oxygen Converter or FLXA402 4-Wire Converter detects these failures.

If a sensor error code appears on the display, follow one of the procedures below.

1. Clean the sensor (sensor cap), by following the direction of 4.1 above.
2. Replace the sensor cap and the attached O-ring together with new ones.
3. Replace DO70G sensor unit with a new one if resistance temperature detector (RTD) fails or the error still occurs even after the procedure 1 or 2 above is applied.

When DO402G is connected, troubles may be found by measuring the resistance value of RTD.

Another possibility is that the error may be caused by defects of RTD.

A 22k NTC resistance temperature detector (RTD) is incorporated in the DO70G sensor.

This RTD indicates a resistance value of about 22 k $\Omega$  at 25°C. Check the RTD by measuring the resistance value between the white wiring and the green wiring. If the resistance value differs greatly from the 22 k $\Omega$ , the sensor must be replaced.

For further information on the error code, refer to the user's manual IM 12J05D02-01E for DO402G Dissolved Oxygen Converter, IM 12A01F03-01EN for FLXA402 4-Wire Converter Operation of Converter.

## 4.3 Maintenance Parts

Part Name	Part No.	Remarks
Sensor cap (O-ring is attached)	K9679AN	Please shade the light during safe keeping. The recommendable exchange cycle of a sensor cap is 1 time in 6 to 12 months.
Zero adjusting reagent	L9920BR	Sodium sulfite( $\text{Na}_2\text{SO}_3$ ) 500 g Calibration must be carried out at a predetermined interval (the frequency of calibration varies depending on the operating conditions). Calibration must also be performed when, for example, the sensor cap is replaced. Approximately 20 grams of the reagent is needed to prepare 1 liter of the calibration solution for zero adjustment.
O-Ring (EPDM)	K9691KB	For Adaptor Mounting
Adaptor	K9148NA K9148NB K9679CA	For submersion type holder (stainless steel) (/S3) For submersion type holder (polypropylene) (/PP) For float type holder (polypropylene) (/FPP)
Sensor cable	K9679BA K9679BB K9679BC K9679BD K9679BE K9679BF K9679BG	3 m (cable length -03E) for connection with DO402G 5 m (cable length -05E) for connection with DO402G 10 m (cable length -10E) for connection with DO402G 5 m (Cable length: -05D) for connection with FLXA402 10 m (Cable length: -10D) for connection with FLXA402 15 m (Cable length: -15D) for connection with FLXA402 20 m (Cable length: -20D) for connection with FLXA402

Note: It is recommended to keep some sensor caps for spare.

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# Revision Information

- Title : Model DO70G Optical Dissolved Oxygen Sensor
- Manual No. : IM 12J05D04-01E

**Jan. 2020/6th Edition**

Changed Style of DOX8W [Style: S2] (thermometer was removed) (P. 1-3)

**Dec. 2018/5th Edition**

Revised overall.

**Apr. 2017/4th Edition**

Revised overall.

Added a maintenance part on the list.(page 4-2)

Deleted CMPL

**Jul. 2017/3rd Edition**

Added "Trademark Notices", "Product Disposal", and Model name (pages i, ii, 1-5)

**Dec. 2015/2nd Edition**

P1-3, P3-5: Added comments of "DOX10 is unusable depending on a use area";

P1-2: Changed of description;

P3-6: Added of NOTE;

P5-1: Added of description and figure;

P5-3: The recommendation exchange cycle of the Sensor cap was added to the Remarks (Table 5.1);

**Feb. 2012/1st Edition**

Newly published

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