# User's Manual

# Model OR8EFG
# KCl Filling type ORP Sensor

IM 12C07J01-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 12C07J01-01E
12th Edition

# INTRODUCTION

This manual covers the OR8EFG KCl Filling type ORP Sensor.

Other related items are described in the following manuals.

| Model | Title | IM No. |
|---|---|---|
| PH8HG | Guide-pipe Holder | IM 12B7M2-01E |
| PH8HF, PH8HFF | Flow-Through Type Holder | IM 12B07N01-01E |
| PH8HS, PH8HSF | Submersion Type Holder | IM 12B07M01-01E |
| HH350G | Well Bucket Type Holder | IM 19H1B1-01E |
| PB350G | Float Type Holder | IM 19H1E1-01E |
| PB360G | Vertical Type Float Holder | IM 19H1E2-01E |
| FLXA402 | 4-Wire Converter | IM 12A01F01-02EN<br>IM 12A01F02-01EN etc. |
| FLXA202, FLXA21 | 2-Wire Liquid Analyzer | IM 12A01A03-01EN |
| WTB10-PH□ | Terminal Box | IM 19D01B01-01E |
| OR8AX | Accessories for ORP Meter | IM 12C04W02-01E |

# For the safe use of this equipment

## 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.

## Safety, Protection, and Modification of the Product

- 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.

## Warning and Disclaimer

The product is provided on an "as is" basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA can not predict in advance.

# After-sales Warranty

- **Do not modify the product.**

- **During the warranty period, for repair under warranty consult the local sales representative or service office. Yokogawa will replace or repair any damaged parts. Before consulting 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 Electric did not supply.
  - Failure due to improper or insufficient maintenance by user.
  - Failure due to modification, misuse or outside-of-specifications operation 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 Electric will not bear responsibility when the 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.**

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# Model OR8EFG
# KCl Filling type ORP Sensor

IM 12C07J01-01E 12th Edition

# CONTENTS

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# 1. Specification

The Model OR8EFG KCl filling type ORP Sensor permits stable ORP measurement even for solutions having comparatively severe properties.

This sensor can be mounted on either an PH8HF flow-through holder or an PH8HS submersion holder, or its can be used alone suspended in the solution (a maximum depth of 3 meters).

## 1.1 Standard Specifications

Measurement: Oxidation-reduction potential of a solution

Measurement principle: Metallic electrode method

Measuring range: -1500 to 1500 mV

Installation: Mounting in PH8HS submersion holder
Mounting in PH8HG guide-pipe holder
Mounting in PH8HF flow-through holder

Note: If any of the following solutions are measured, install the sensor either in a flow-through or submersion holder.

- When the solution temperature exceeds 80°C.
- When the pH of the solution is 2 or less or 12 or greater.
- When a strong acid solution is to be measured
  (e.g., aqua regia, chromic acid, hypochlorous acid or perchloric acid, etc.).
- When the solution contains corrosive gases
  (e.g., ammonia, chlorine, hydrogen sulfide, etc).
- When the solution contains a small percentage of organic solvent or oil.

Solution temperature: -5 to 105°C
when mounted in PH8HG guide-pipe holder: -5 to 80°C
when mounted in PH8HS, PH8HF holder, see Table 1.

**Table 1. Process Temperature Range**

| Holder Type | Holder Material | Cleaner | Solution pH Range | Solution Temperature (°C) |
|---|---|---|---|---|
| Guide-pipe (PH8HG) | PVC | None | 2 to 12 | -5 to 50 |
| | PP | | | -5 to 80 |
| Submersion (PH8HS) | PP | None | 0 to 14 | -5 to 100 |
| | | Provided | | -5 to 80 |
| | SS (*2) | None | | -5 to 100 |
| | | Provided | | -5 to 80 |
| Flow-through (PH8HF) (*1) | PP | None | | -5 to 80 |
| | | Provided | | -5 to 80 |
| | SS (*2) | None | | -5 to 105 |
| | | Provided | | -5 to 80 |
| Suspension (HH350G) | SS (*2) | None, Provided | | -5 to 80 |
| Float (PB350G, PB360G) | PP, SS (*2) | None | | -5 to 50 |

**Note: PVC: Rigid Polyvinyl, PP: Polypropylene, SS: Stainless Steel.**

*1: For flow-through types, refer also to the solution temperature and pressure graph (in notes following Model and Suffix code table for flow-through type holders).

*2: Solutions with normal pH ranges of 3 to 14 are recommended for stainless steel (316 SS).

Solution pressure : Under atmospheric pressure to 10 kPa (General purpose)
(See Table 2 when using holder)
Atmospheric pressure to 500 kPa (Medium pressure tank)
(See Table 2 when using holder)

**Table 2. Process Pressure Range**

| Holder | Process Pressure Range |
|---|---|
| Submersion | Atmospheric pressure (Submersion depth: 3 m max.) |
| Guide-pipe Suspension Float | Atmospheric pressure (Submersion depth: 3 m max.) |
| Flow-through (*1) | Atmospheric pressure to 10 kPa<br>Atmospheric pressure to 500 kPa<br>when medium pressure reserve tank used. |

*1: For flow-through types, refer also to the solution temperature and pressure diagram of Holder IM.

Operating solution depth : 3 m water pressure (max.) under atmospheric pressure
Solution flow velocity : 2 m/s max.
Solution flow rate : 3 to 11 L/min
(when the sensor is installed in a flow-through type holder).

Wetted part materials:
- Body; Ryton (PPS resin), platinum-glass or gold-epoxy resin, titanium or Hastelloy C, Ceramics or Fluororesin (PTFE), Fluoro rubber (FKM) or Perfluoroelastomer (FFKM)
- Cable; Chlorinated polyethylene rubber (Cable sheath)
- KCl tube; Heat-resistant soft PVC (General purpose), Polyethylene (Medium pressure), Fluororesin (with /FEP)

Weight:
- Sensor; Approx. 0.4 kg (Body)
- KCl Tank; Approx. 0.3 kg (General purpose)
  Approx. 1 kg (Medium pressure)

KCl solution consumption: Pressurized with 10 kPa
3 mL/day (max.) (Junction for general use)
20 mL/day (max.) (PTFE junction)

CAUTION

Select the material of wetted parts with careful consideration of process characteristics. Inappropriate selection may cause leakage of process fluids, which greatly affects facilities. Considerable care must be taken particularly in the case of strongly corrosive process fluid such as hydrochloric acid, sulfuric acid, hydrogen sulfide, and sodium hypochlorite. If you have any questions about the wetted part construction of the product, be sure to contact Yokogawa.

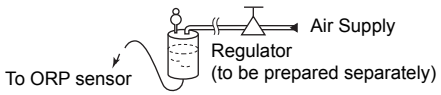
# 1.2 Model and Suffix codes

## ORP Sensor

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **OR8EFG** | ..... | ..... | KCl Filling Type ORP Sensor |
| Electrode | **-AU** | ..... | Gold |
| | **-PT** | ..... | Platinum |
| Cable Length and KCl Tube Length | **-03** | ..... | 3 m |
| | **-05** | ..... | 5 m |
| | **-07** | ..... | 7 m |
| | **-10** | ..... | 10 m |
| | **-15** | ..... | 15 m |
| | **-20** | ..... | 20 m |
| KCl Reserve Tank (*1) | **-TT1** | ..... | For general purpose (250 mL solution inlet) |
| | **-TT2** | ..... | For medium pressure (*2) |
| | **-TN1** | ..... | For maintenance (for -TT1) |
| | **-TN2** | ..... | For maintenance (for -TT2) |
| Measuring System | **-N** | ..... | For OR200,OR400 (*3) |
| | **-E** | ..... | For FLXA402,PH202,FLXA202,FLXA21 (*4) |
| | **-F** | ..... | For FLXA202,FLXA21 (*5) |
| | **-B** | ..... | For OR100 (*6) |
| | **-G** | ..... | For FLXA402, PH450G,PH202/TB (*7) |
| Style | ***A** | ..... | Style A |
| Option | Special junction | **/TF** | PTFE junction (*8) |
| | O-ring | **/PF** | Perfluoroelastomer (FFKM) (*9) |
| | Tube Material | **/FEP** | KCl tube: Fluororesin (*10) |
| | Degreasing treatment | **/DG1** | Oil-free finish wetted part |
| | Material Certificate | **/MC1** | With a material certificate of Solution Ground Tip |

*1: 2-inch pipe mounting bracket is supplied with -TT1, -TT2.
Only a supply tube, but no KCl solution, is supplied with -TN1 and -TN2.
Since a KCl solution is not supplied with -TT2, arrange it from among accessories or auxiliary parts.

*2: Prepare an air pressure regulator as shown in the diagram below when the medium-pressure reserve tank is used.
To ORP Sensor, Regulator, (to be prepared separately)




*3: Mark band is shown by alphanumeric and fork terminals are used.
*4: Mark band is shown by numeral and pin terminals are used.
When terminal box is used, select WTB10-PH1.
*5: The tag which indicated the color, the sign, and the number is attached to the cable of a sensor.
*6: Mark band is shown by numeral and M3 ring terminals are used. When terminal box is used, select WTB10-PH3.
*7: Mark band is shown by numeral and M4 ring terminals are used. When terminal box is used, select WTB10-PH5.
*8: Choose when using in the heavily contaminated application.
*9: Choose Perfluoroelastomer (FFKM) when this is used in organic solvent, high alkali or high temperature solution.
*10: If you select -TT2 or -TN2 and use it in a place with strong ultraviolet rays, be sure to select this.

## Accessories

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| **OR8AX** | ..... | ..... | Accessories for ORP meter (*1) |
| Style | ***A** | ..... | Style A |
| Option (*2) | | **/STD** | Sensor stand (with mounting bracket for 2-inch pipe) |
| | | **/KCLL** | KCl solution (one 250 mL polyethylene bottle) |
| | | **/KCLP** | KCl powder (three bags, 250 mL solution each) |
| | | **/TMP** | Thermometer (0 to 100°C) |

*1: Including the following:
Two 200 mL polyethylene cups
One cleaning bottle
One pack of quinhydrone reagent powder (three bags, 250 mL solution each)
One 250 mL polyethylene bottle

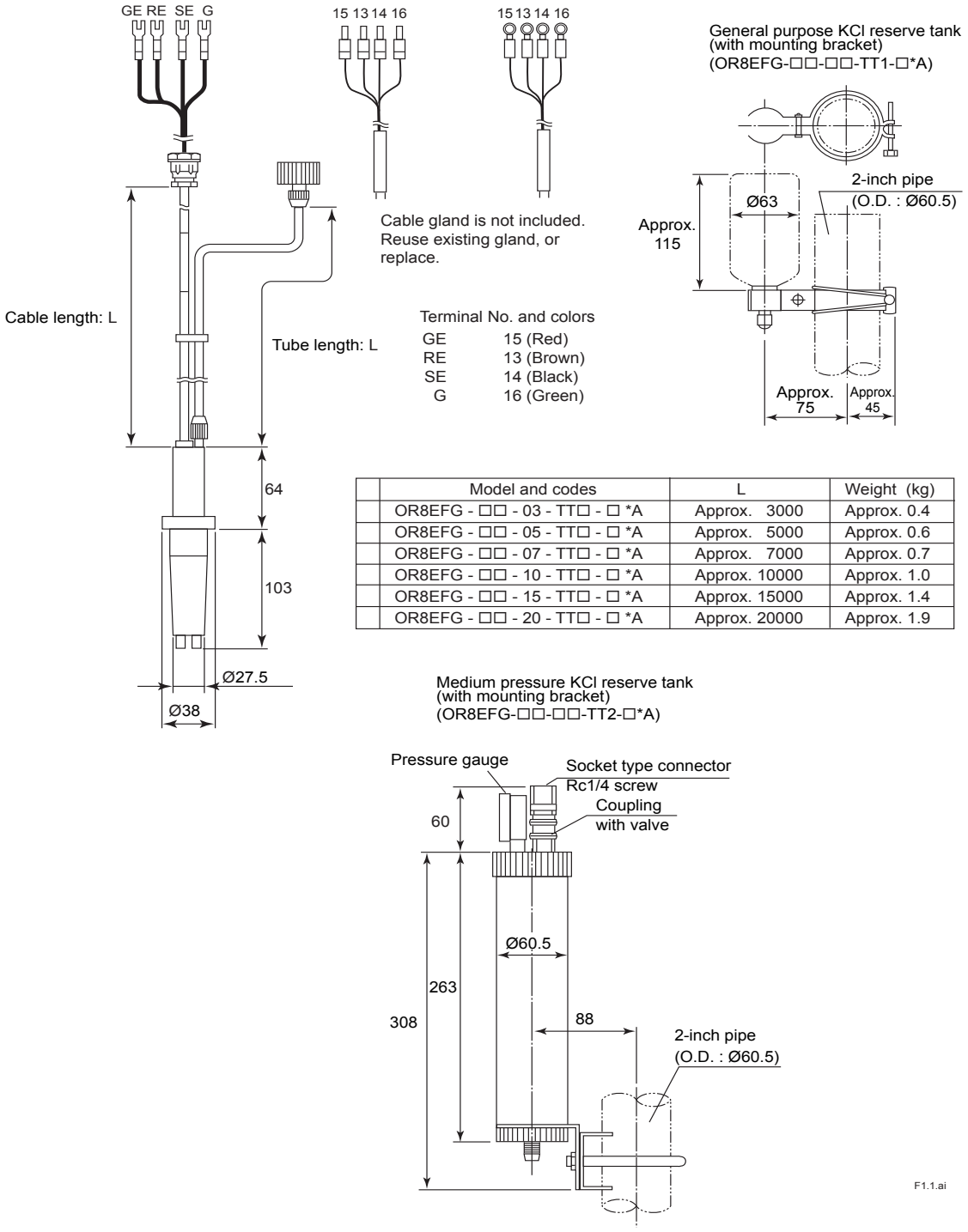
*2: Either /KCLL or /KCLP is required for OR8EFG-□□-□□-TT2.

## Consumables

| Part Name | | Part Number | Remarks |
|---|---|---|---|
| Indicator electrode | Platinum | K9142TS | One for OR8EFG |
| | | K8022GP | One for OR8EFG/PF |
| | Gold | K9142TT | One for OR8EFG |
| | | K8022GQ | One for OR8EFG/PF |
| Junction | General purpose | K9142TH | One for OR8EFG |
| | | K9319QA | One for OR8EFG/PF |
| | Fluororesin (PTFE) | K9142HW | One for OR8FEG/TF |
| | | K9319QB | One for OR8FEG/TF/PF |
| | Ceramics | K9142UH | One for OR8FEG/CJ |
| | | K9142UL | One for OR8FEG/CJ/PF |
| KCl solution (3.3mol/L) | | K9084LP | Six 250 mL polyethylene bottles |
| KCl powder (for OR8EFG) | | K9020XU | 8 bags, each for preparation of 250mL |
| Reagent for check | Quinhydrone | K9024EC | 3 bags, each for preparation of 250mL |
| | Iron | K9024ED | 3 bags, each for preparation of 250mL |

# 1.3 External Dimensions

("-B", "-N": Fork terminal) ("-E": Pin terminal) ("-G", "-F": Ring terminal) Unit: mm




| | Model and codes | L | Weight (kg) |
|---|---|---|---|
| | OR8EFG - □□ - 03 - TT□ - □ *A | Approx. 3000 | Approx. 0.4 |
| | OR8EFG - □□ - 05 - TT□ - □ *A | Approx. 5000 | Approx. 0.6 |
| | OR8EFG - □□ - 07 - TT□ - □ *A | Approx. 7000 | Approx. 0.7 |
| | OR8EFG - □□ - 10 - TT□ - □ *A | Approx. 10000 | Approx. 1.0 |
| | OR8EFG - □□ - 15 - TT□ - □ *A | Approx. 15000 | Approx. 1.4 |
| | OR8EFG - □□ - 20 - TT□ - □ *A | Approx. 20000 | Approx. 1.9 |

**Figure 1.1 OR8EFG Filling type ORP Sensor**

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# 2. Installation

## 2.1 Preparation for Installation

### 2.1.1 Unpacking and Inspection

The Model OR8EFG ORP Sensor is well packed so as to prevent damage during shipment.
After removing the sensor from its shipping container, visually check the sensor for damage.

**NOTE**

1. When delivered, the "indicator electrode" and the "liquid junction" are packed separate from the sensor body.
2. So that the "liquid junction" does not dry out do not take unpack its at this time.

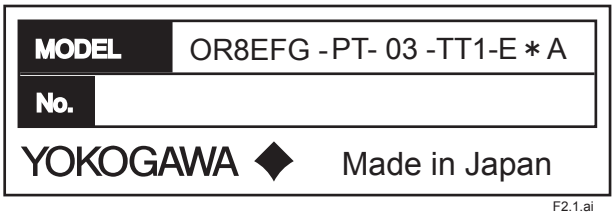



**Figure 2.1 An Example of Model Number Entering to Nameplate**

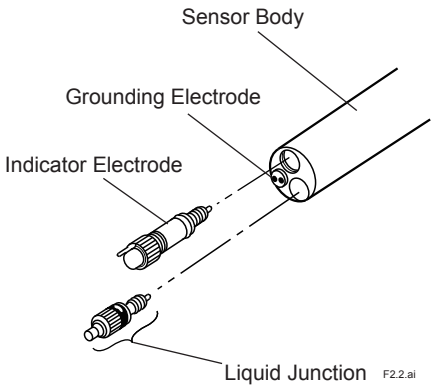



**Figure 2.2 Names of OR8EFG ORP Sensor Components**

### 2.1.2 Mounting Indicator Electrode

Mount the indicator electrode on the sensor body as per the following procedure:

(1) Peel off the seal covering to the electrode mounting hole on the sensor body.

(2) Take the indicator electrode out of its bag and check to confirm that there is no dirt or scratches on the O-ring that might affect the seal.

(3) Mount the indicator electrode in the sensor body. Insert the electrode in the electrode mounting hole and screw the electrode clockwise until the O-ring fits tightly in the hole.

**NOTE**

Be careful not to allow water droplets to flow into the electrode mounting hole. If water gets into the hole, wipe it dry, or insulation resistance may be affected.

### 2.1.3 Mounting Liquid Junction

The liquid junction is mounted in the sensor body when the KCl solution is poured into the sensor body. Refer to Section 2.2.

### 2.1.4 Installing Holder

Usually, the ORP Sensor is suspended in a guide pipe or installed in a flow-through or submersion holder. First install the holder.

### 2.1.5 Installing Associated Instruments

Make sure that the associated instrument (a ORP transmitter/converter or a junction terminal box) to which the ORP Sensor cable is connected has already been installed.

## 2.2 Requirements for mounting the ORP Sensor

### 2.2.1 In case of installing the PH8HG Guide-pipe Holder

To install the sensor in the guide pipe, proceed as follows:

(1) Connect the sensor cable to the associated instrument correctly by referring to Section 2.3 provided later.

(2) Mount the liquid junction in the sensor body. Peel off the seal attached to the liquid junction mounting hole in the sensor body. Screw the liquid junction gently two or three turns into the hole.

(3) If specified, a reserve tank containing 250 mL KCl solution and mounting hardware to hold this tank are supplied with the OR8EFG ORP Sensor. Attach the holding hardware to the pipe (2-inch). Connect the reserve tank to the KCl solution supply tube of the sensor. Remove the cap from the tank and screw the tube connector securely into the tank.

(4) Supply KCl solution to the sensor (see Figure 2.3). First, mount the reserve tank on the mounting hardware with the tube connection part directed downwards. Then, using the pin supplied with the tank, make several holes it its top (see Figure 2.3). Stand the sensor upside down at a lower position than the reserve tank as shown in Figure 2.3 so that KCl solution flows from the tank into the sensor. When the KCl solution fills the sensor and overflows from the liquid junction mounting hole, securely screw the liquid junction into the mounting hole.

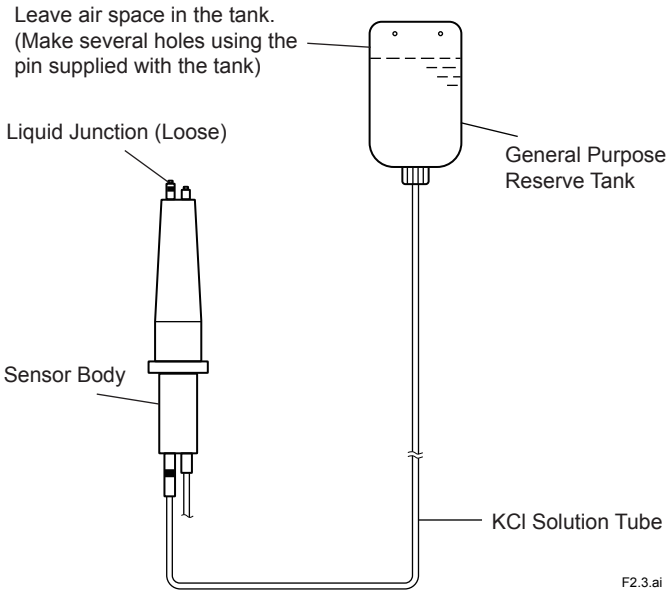


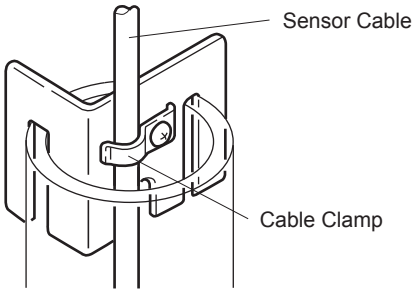

**Figure 2.3 Supplying KCl Solution to Sensor Body**

(5) Attach the "stopper" supplied with the guide pipe to the sensor cable.

Fix the sensor cable so that the sensor tip projects 20 to 30 mm out from the pipe end when the ORP Sensor is suspended in the guide pipe as shown in Figure 2.4.

## NOTE

If the sensor tip does not project out from the pipe end, the measured value may not respond promptly to the ORP variations of the measured solution. This may cause problems for ORP measurement and control. On the other hand, if the sensor tip projects too far from the pipe end, the force on the sensor may damage the sensor cable from scraping it against the pipe.




Attaching "Stopper"

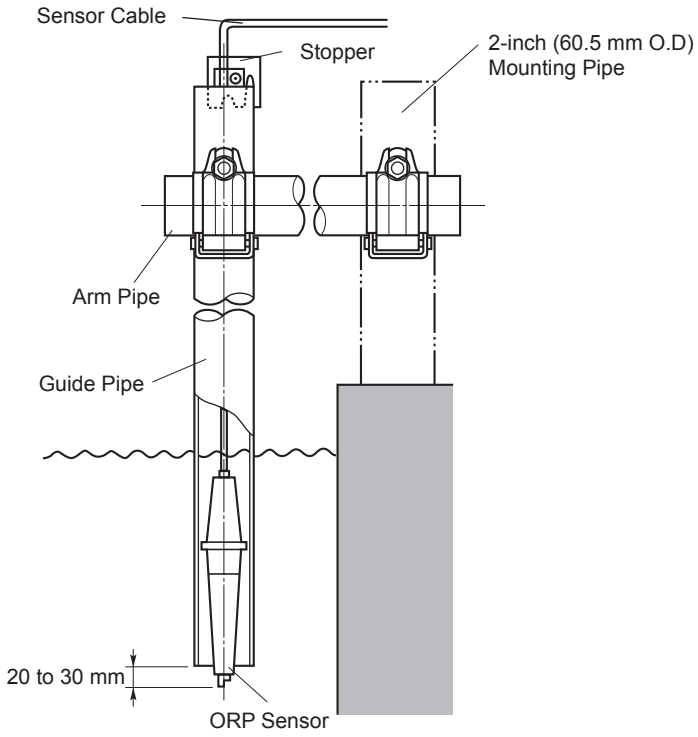


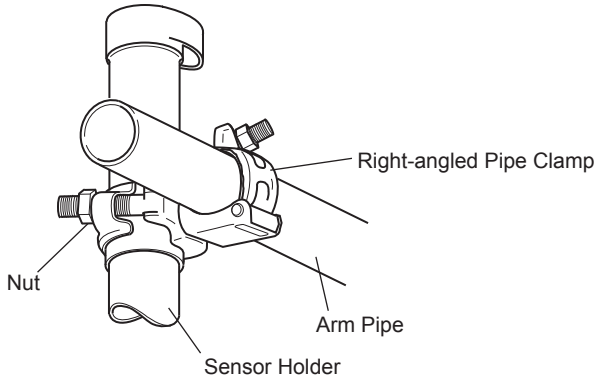

**Figure 2.4 Mounting Sensor in Guide Pipe**

## 2.2.2 Installing Sensor in PH8HS Submersion Holder

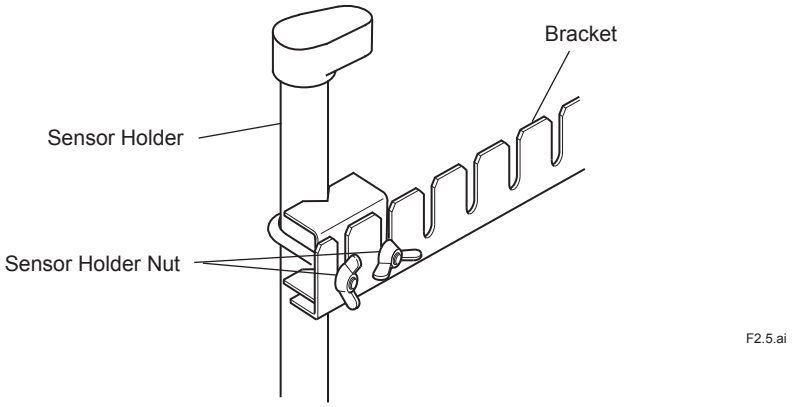
To install the sensor in the submersion holder, proceed as follows:

(1) Pass the sensor cable through the sensor holder. If the submersion holder remains installed, remove the sensor holder in any case.

- For a pipe-mounting submersion holder without a cleaner, loosen the sensor holder nut to remove the holder.




Removal of Sensor Holder (Arm Pipe used with option /MS1 or /MS2)




Removal of Sensor Holder (Stainless Bracket used with option /MS3 or /MS4)

**Figure 2.5 Removal of Sensor Holder (for Pipe Mounting Sensor without Cleaner)**

- For a flange mounting submersion holder without a cleaner, remove the sensor holder by loosening the two bolts securing the sensor holder to the flange (see Figure 2.6).

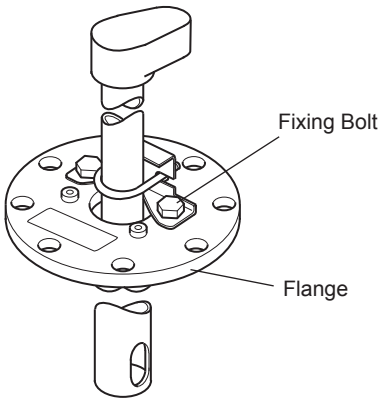



**Figure 2.6 Removal of Sensor Holder (for Flange Mounting Sensor without Cleaners)**

- To remove the submersion sensor holder with cleaner, whether using pipe mounting or flange mounting type, first loosen the screw of the clamp that retains the cleaner holder and slide up the sensor holder to take it off.

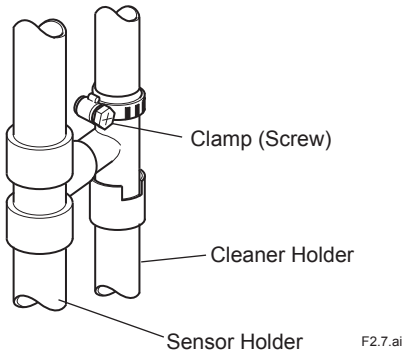



**Figure 2.7 Removal of Sensor Holder (with Cleaner)**

(2) Pass the cable and KCl solution supply tube through the sensor holder as follows:

First, as shown in Figure 2.8, remove the protector screwed into the tip of the sensor holder.

After removing it, take away the sponge (material for transportation, not necessary after remove). Pass the sensor cable and KCl solution supply tube through the O-ring and attach it to the flange of the sensor.

Next, open the waterproof cap cover and insert the sensor cable and KCl solution supply tube into the sensor holder pipe.

When passing the sensor cable through the sensor holder, if dirt or water droplets adhere to the inside of the holder, cover the terminal processing part with a plastic bag or take measures to prevent the decrease in the insulation resistance. Pull out the ends of the sensor cable and the KCl solution supply tube downward through the facing-downward hole of the waterproof cap.

Follow the procedure above when “-ST” is specified, however, DO NOT insert KCl solution supply tube into the sensor holder pipe.

For details to install the sensor onto a holder, refer to relevant IMs.

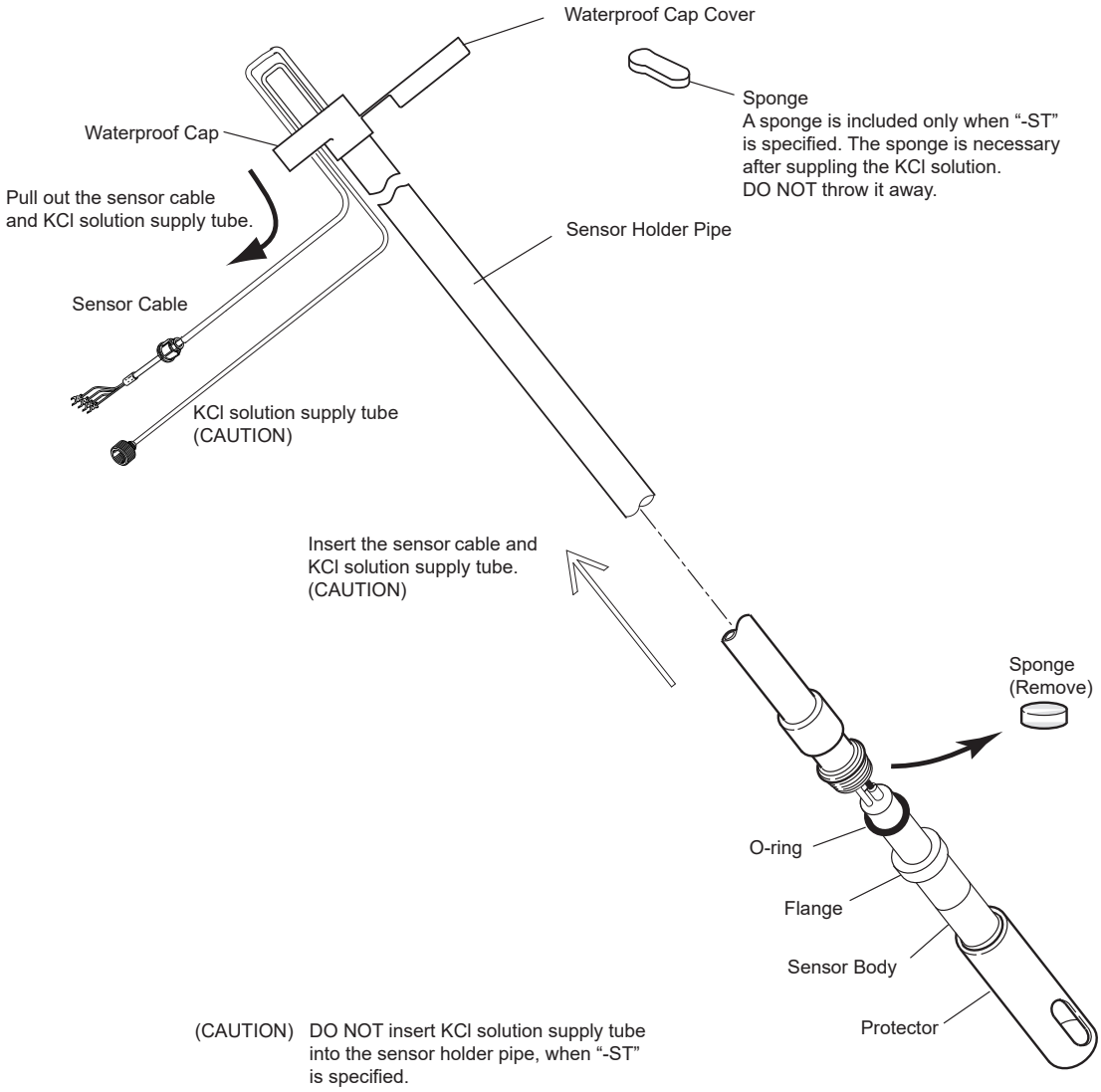



**Figure 2.8 Assembling into the sensor holder**

(3) Connect the sensor cable to the associated instrument correctly by referring to Section 2.3.

(4) Mount the liquid junction in the sensor body. Peel off the seal attached to the liquid junction mounting hole on the sensor body. Screw the liquid junction gently two or three turns into the hole.

(5) If specified, a reserve tank containing 250 mL KCl solution and mounting hardware to hold this tank are supplied with the OR8EFG ORP Sensor. Attach the mounting hardware to the pipe (2-inch). Connect the reserve tank to the KCl solution supply tube of the sensor. Remove the cap from the tank and screw the tube connector securely into the tank.

(6) Supply KCl solution to the sensor. First, mount the reserve tank on the mounting hardware with the tube connection part directed downwards. Then, using the pin supplied with the tank make several holes in its top (see Figure 2.3). Stand the sensor upside down at a position lower than the reserve tank as shown in Figure 2.3 so that KCl solution flows from the tank into the sensor. When the KCl solution fills the sensor and overflows from the liquid junction mounting hole, securely screw the liquid junction into the mounting hole.

Be careful not to leave air inside the sensor body. For "-ST", rotate the sensor to an upright position, loosen the cap holding the KCl solution supply tube, and remove the cap and KCl solution supply tube from the sensor.

(7) Screw the protector to fix the sensor to the holder. In this case, remove the protective cap and secure the protector so that the flange of the sensor compresses the O-ring firmly. about the installation method.

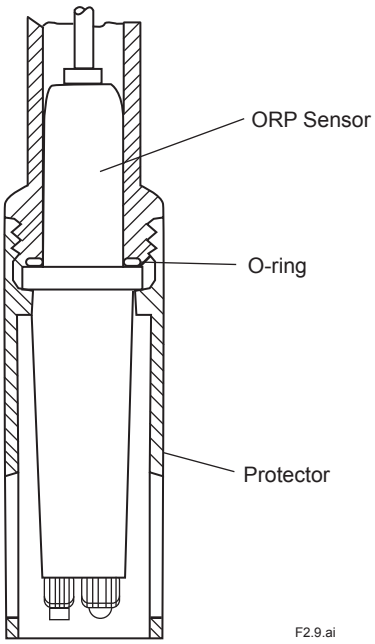



**Figure 2.9 Installing Sensor in Submersion Holder**

(8) For "-ST" only, open the waterproof cap cover on the top of the holder and pour the KCl solution into the holder (Note)

After replenishing the KCl solution, put the attached sponge (to prevent dust from entering the holder) back into the waterproof cap.

(Note) Make sure that the water level of the KCl solution in the holder pipe is at least 20 cm higher than the that of the measurement solution.
Also, replenish the KCl solution before its water level becomes lower than the level of the sample + 20 cm.

(9) Close the waterproof cap, and attach the holder to the arm pipe, flange or cleaner holder completely.

## 2.2.3 Installing Sensor in Flow-through Holder

To install the sensor in a flow-through holder, proceed as follows:

(1) Connect the sensor cable to the associated instrument. First, remove the sensor fixing nut and pass the sensor cable through the nut.

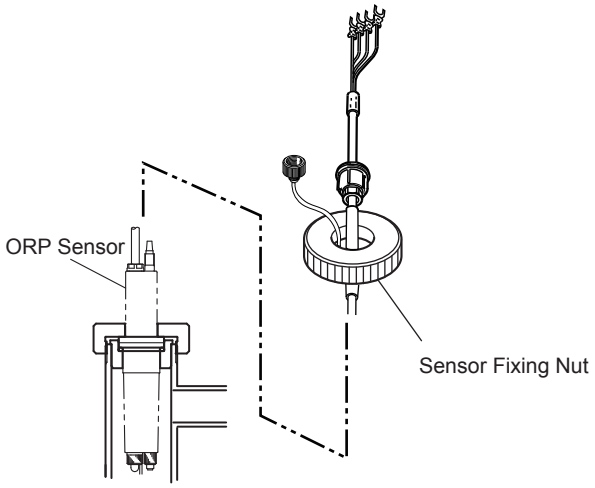



**Figure 2.10 Preparation for Sensor Cable Connection**

Properly connect the sensor cable by referring to Section 2.3.

(2) Mount the liquid junction on the sensor body. Peel off the seal covering the liquid junction mounting hole in the sensor body. Screw the liquid junction softly into the hole by turning it for two or three turns.

(3) If specified, a reserve tank containing 250 mL solution and mounting hardware to hold this tank, or a medium pressure reserve tank are supplied with the OR8EFG ORP Sensor.

Attach the mounting hardware for general purpose reserve tank to a pipe (2-inch). Connect the general purpose reserve tank to the KCl solution supply tube of the sensor. Remove the cap from the tank and screw the tube connector securely into the tank.

When using a medium pressure reserve tank, attach it to a pipe (2-inch) and perform air piping to supply pressure for reserve tank as shown in Figure 2.11. Connect the KCl supply tube of the sensor to this reserve tank.

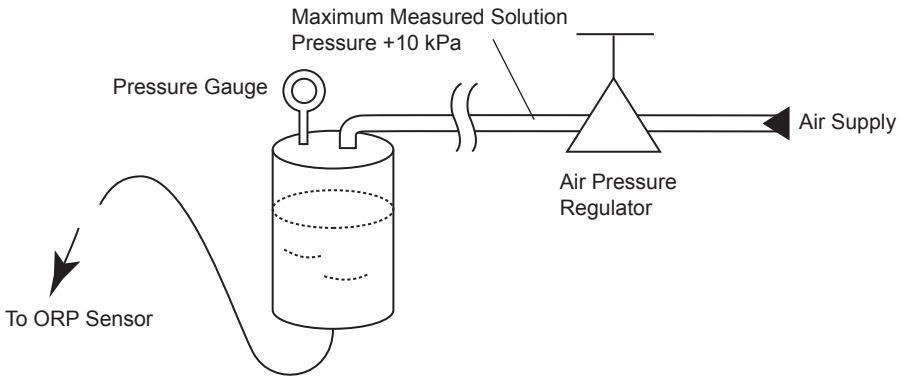



**Figure 2.11 Air Piping for Pressurizing Medium Pressure Reserve Tank**

(4) Supply KCl solution to the sensor.

## When a general purpose reserve tank is used.

First, mount the reserve tank on the holding hardware with the tube connection part directed downwards. Then, using the pin supplied with the tank, make several holes in its top (see Figure 2.3). Stand the sensor upside down at a position lower than the reserve tank as shown in Figure 2.3 so that KCl solution flows from the tank into the sensor. When the KCl solution fills the sensor and overflows from the liquid junction mounting hole, securely screw the liquid junction into the mounting hole.

## When a reserve tank for medium pressure is used.

Fill the reserve tank with KCl solution (*1). Loosen the nut on the reserve tank upside and remove the cap — the pressure gauge is mounted — and pour about 250 mL or KCl solution into the tank. Stand the sensor upside down at a position lower than the reserve tank so that solution flows from the tank into the sensor. When the KCl solution fills the sensor and overflows from the liquid junction mounting hole, securely screw the liquid junction into the mounting hole. Remount the cap of the reserve tank. Tighten the nut securely.

*1: Use 3.3 mol/L KCl solution. If KCl powder (ordered separately) are supplied with the PH8AX accessories, dissolve one bag (60 g) of KCl powder in pure water to make exactly 250 mL of solution.

(5) Connect the ORP Sensor to its holder. Remove the protective cap from the sensor. Also remove the protective foam piece (for shipping - this is not necessary after installing the sensor) from the holder. Be sure that the liquid junction and indicator electrode are mounted properly. Insert the sensor tip into the holder and tighten the sensor fixing nut securely (see Figure 2.10).

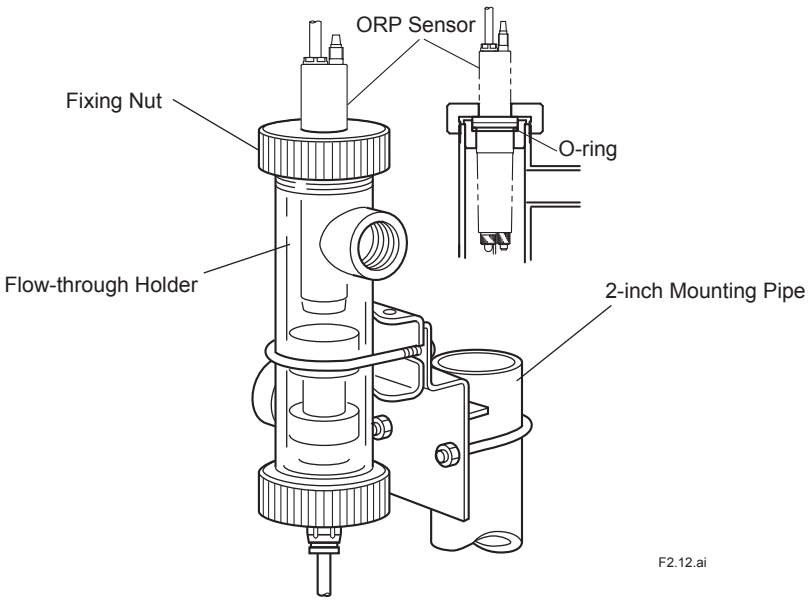



**Figure 2.12 Installing Sensor in Flow-through Holder**

# 2.3 ORP Sensor Cable Wiring Procedure

## 2.3.1 Processing of Cable Inlet Hole

Open the cable inlet hole in terminal box using the supplied punch tool. The location of the cable inlet hole is shown by the circle-shaped groove under the case. The end of the supplied punch tool is put in the center of this circle and it is tapped with appropriate force. You can punch out the hole along the groove.

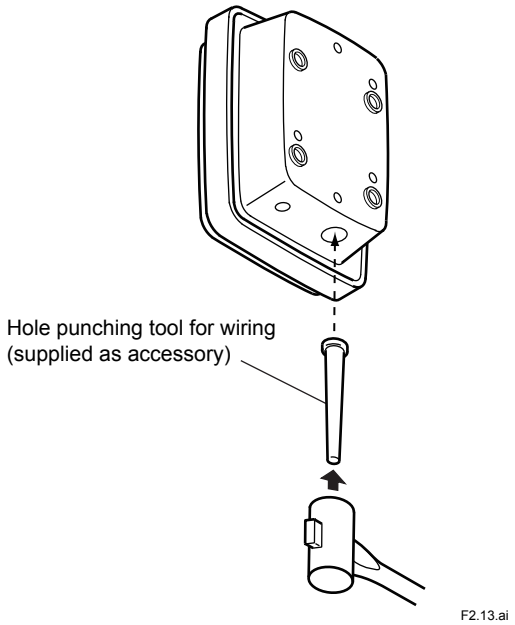



**Figure 2.13 How to punch out the wiring hole**

## 2.3.2 Connecting Sensor Cable

(1) Loosen two screws which are at front of terminal box and detach the cover.

(2) After detaching the nut from the cable gland of sensor cable, pull the cable into the terminal box from sensor cable inlet hole.

(3) Connect the sensor cable to the terminals.

After passing the cable through the nut, check the symbol on each core wire, then connect each core wire to the corresponding terminal.

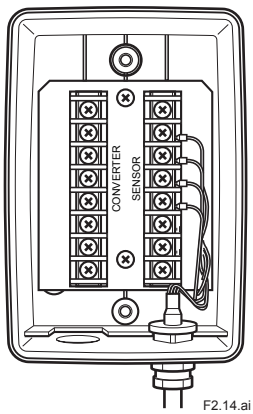



**Figure 2.14 Connecting Sensor Cable (In case of the OR8TBG)**

(4) Mount the cable gland in the cable inlet hole.

Put the nut in place, and screw it onto the main body sufficiently. At this time, loosen the cap so that the cable is not twisted. After fixing the main body, tighten the cap to keep moisture out of the equipment. However if the cap is screwed up too tight, the cable will be damaged.

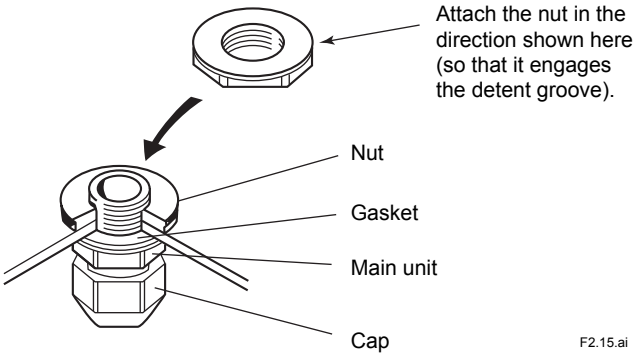



**Figure 2.15 Cable Gland**

(5) After completing the cable connections, replace the box cover securely, thus preventing moisture from getting into the case.

## 2.3.3 Connecting Sensor Cable to Two-wire ORP Transmitter

To connect the sensor cable to the two-wire ORP Transmitter, proceed as follows:

(1) Loosen the four screws that tighten the transmitter cover. Then remove the transmitter cover.

(2) Connect the sensor cables to the relevant terminals of the transmitter:

First, remove the nut from the cable gland. Insert the cable into the right opening for the wiring. Then pass the cable through the nut, Connect the individual cable conductors to the relevant terminals correctly by referring to the markings on the individual conductors.

For details, refer to relevant IMs.

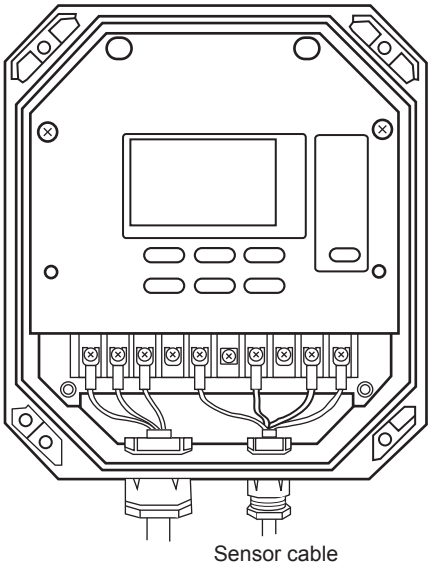



**Figure 2.16 Connecting Sensor Cable to Two-wire ORP Transmitter**

(3) Install the cable gland in the wiring hole as follows:

Pass the tip of the cable gland into the opening and completely tighten the gland with the nut inside the case.

After tightening the gland, secure the cap properly to prevent moisture from getting into the case.

Caution: Do not overly tighten the cap. Otherwise, the cable may be damaged.

(4) After completing the cable connections, replace the transmitter cover securely, thus preventing moisture from getting into the case.

## 2.3.4 Connecting Sensor Cable to Four-wire ORP Converter

To connect the sensor cable to a Four-wire ORP Converter, proceed as follows:

(1) Loosen the four screws that tighten the converter cover. Then open the converter cover.

(2) Connect the sensor cables to the relevant terminals of the converter:

First, remove the nut from the cable gland. Insert the cable into the right opening for the wiring. Then pass the cable through the nut, Connect the individual cable conductors to the relevant terminals correctly by referring to the markings on the individual conductors.

For details, refer to relevant IMs.

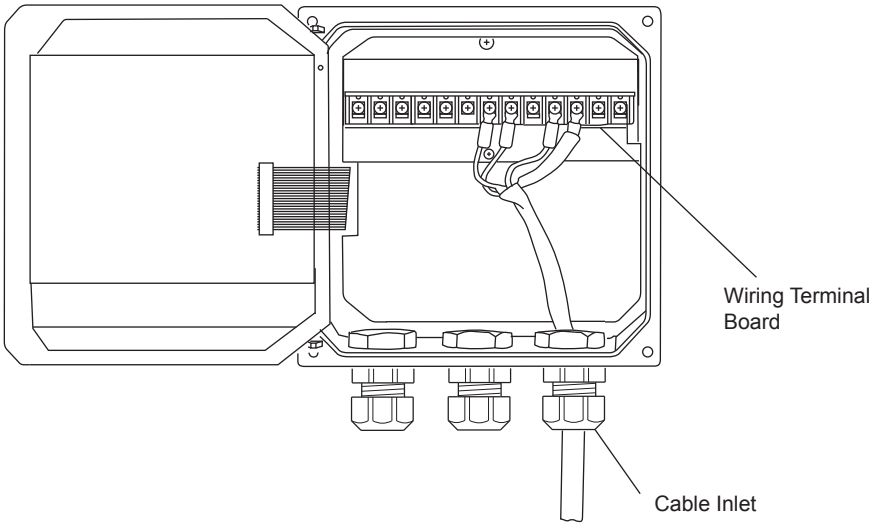



**Figure 2.17 Connecting Sensor Cable to Four-wire ORP Converter**

(3) Install the cable gland in the wiring hole as follows:

Pass the tip of the cable gland into the opening and completely tighten the gland with the nut inside the case.

After tightening the gland, secure the cap properly to prevent moisture from getting into the case.

Caution: Do not overly tighten the cap. Otherwise, the cable may be damaged.

(4) After completing the cable connections, close the converter cover securely, thus preventing moisture from getting into the case.

# 3. Maintenance on operation

## 3.1 Operation and Periodic Maintenance

### 3.1.1 Calibrating ORP Sensor Using Checking Solutions

Dirt attached to the liquid junction or sensitive parts (platinum electrodes) may have an adverse effect on electromotive force and response characteristics, so ORP sensors require periodic cleaning for good operating conditions. ORP sensors should be checked and calibrated if the following conditions are met.

(1) Sensor checks

- If a new ORP sensor is used or the existing sensor has been unused for an extended period of time.
- When an ORP sensor sensitive part (platinum electrode) or a liquid junction is cleaned.

(2) Calibration

- If sensor electromotive force is outside the allowable ranges.
- If the measured value by the ORP sensor is adjusted to the measured value by other sensors.

For more detailed information on the calibration procedures, see the separate Instruction

Manuals "Two-wire Liquid Analyzer" (publication no. IM 12A01A03-01EN) and "Four-wire pH/ORP Converter" (publication no. IM 12B07C05-01E).

### 3.1.2 Pressurizing Reserve Tank

When the ORP Sensor with medium pressure reserve tank is used, apply air pressure to the reserve tank before flowing the measured solution through the holder.
Set the air pressure a little higher than the maximum pressure of the measured solution during the operation.
The flow rate of the KCl solution from the liquid junction is 3 mL/day or less (20 mL/day or less when PTFE junction is used) when the pressure difference between air and measured solution is 10 kPa and the flow rate increases in proportion to the pressure difference. Therefore, it is important to minimize the consumption of the KCl solution by minimizing the pressure variation of the measured solution and making sure that the air pressure is not set too high.

## 3.1.3 Replenishment of KCl Solution

When the KCl solution in the tank seems to be nearly exhausted while using a ORP Sensor with general type reserve tank, replace the reserve tank with new one (provided separately as spare part). Instead of tank replacement, when a KCl solution prepared using KCl powder is used for replenishment, use 3.3 mol/L solution by dissolving 246 g of KCl powder in pure water to make exactly one liter of solution. When pouring the solution into the tank, be careful that KCl solution does not overflow from the vent holes of the tank.
When a ORP Sensor with a medium pressure reserve tank is used, replenish the KCl solution when the KCl solution in the tank seems to be nearly exhausted. Carry out replenishment of KCl solution as follows:

(1) Close the valves to shut off the (low of measured solution (see Figure 3.1) - first in the inlet then the outlet valves in the flow-through type holder.

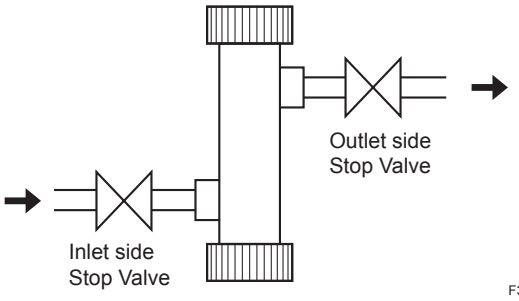



**Figure 3.1 Process Piping of Flow-through Type Holder.**

(2) Remove the socket connector on the reserve tank and stop the air pressurizing the tank (see Figure 3.2).

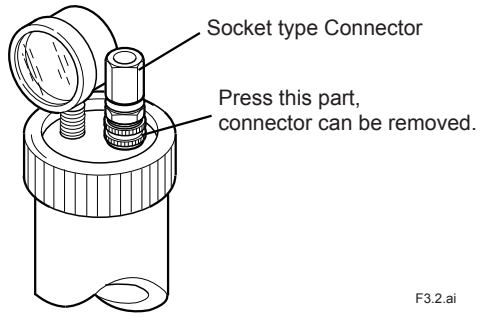



**Figure 3.2 Socket Type Connector.**

(3) Remove the nut fixing the reserve tank cap and remove the cap.

(4) Refill the tank with 3.3 mol/L KCl solution (see Figure 3.3).
The maximum solution level 30 to 40 mm lower than the top.

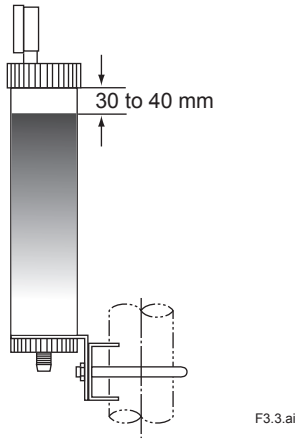



**Figure 3.3 Maximum KCl Replenishment Level**

(5) Retighten the nut to fix the cap in position.

(6) Open the valve and let the measured solution flow through the holder.

## 3.1.4 Cleaning Indicator Electrode and Liquid Junction

Staining of a indicator electrode or liquid junction can cause measurement errors. Therefore, if he measured solutions tend to stain the electrode, the indicator electrode and liquid junction must be cleaned periodically - depending on the degree of staining. if the ORP Sensor is installed in a holder with a cleaner, the sensor is continuously (for an ultrasonic cleaner) or intermittently (for a jet or brush cleaner) cleaned automatically.

Because of this, sensor cleaning is not usually required. However, if the sensor characteristics are affected by chemical staining, for example, when the sensor is used for ORP measurement of a highly alkaline solution, carry out acid washing.

To clean the indicator electrode or liquid junction, proceed as follows:

- **Stains due to suspended Solids, Sticky Materials, Microbes or the like**

  Using soft tissue paper, wipe the stains off the indicator electrode or liquid junction. In addition, clean off remaining stains by rinsing with water.

- **Stains due to Oily Materials**

  Wash off stains by submerging in a neutral detergent solution in a beaker, etc, (for from several tens of minutes to several hours depending on the degree of staining).

- **Chemical Stains such as due to Metallic Adsorption**

  Place the indicator electrode or liquid junction in a diluted hydrochloric acid solution (1 to 2%) for several minutes (acid washing).

# 3.2 Replacing Consumable Parts

## 3.2.1 Replacing Liquid Junction

Even after washing the liquid junction, if normal measurement cannot be made, replace the liquid junction.

When replacing the liquid junction, fill the sensor with KCl solution to just before the solution overflows through the liquid junction mounting hole. Use a 3.3 mol KCl solution (a higher concentration of KCl or KCl powder) for this application.

After the replacement of the liquid junction, confirm that the KCl solution percolates through the liquid junction. However, the visual verification of whether the KCl solution is percolating, is sometimes not possible due to indivisual difference. In this case, check Impedance2 to judge that the liquid junction is functioning properly. Normally the Impedance2 is 50 kΩ or less in pH7 standard solution or pH4 standard solution. Read the user's manual of each converter for checking Impedance2.

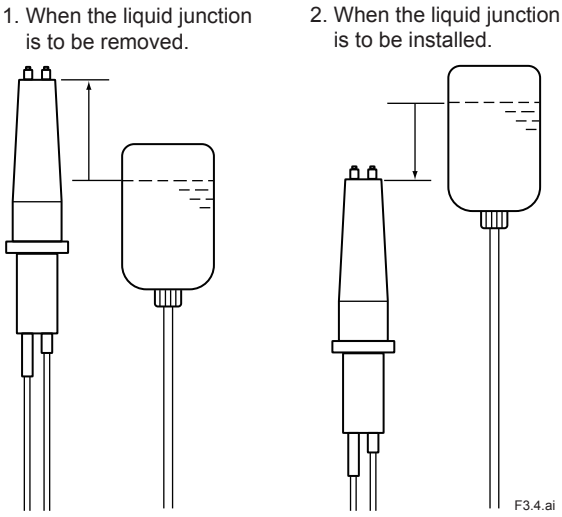
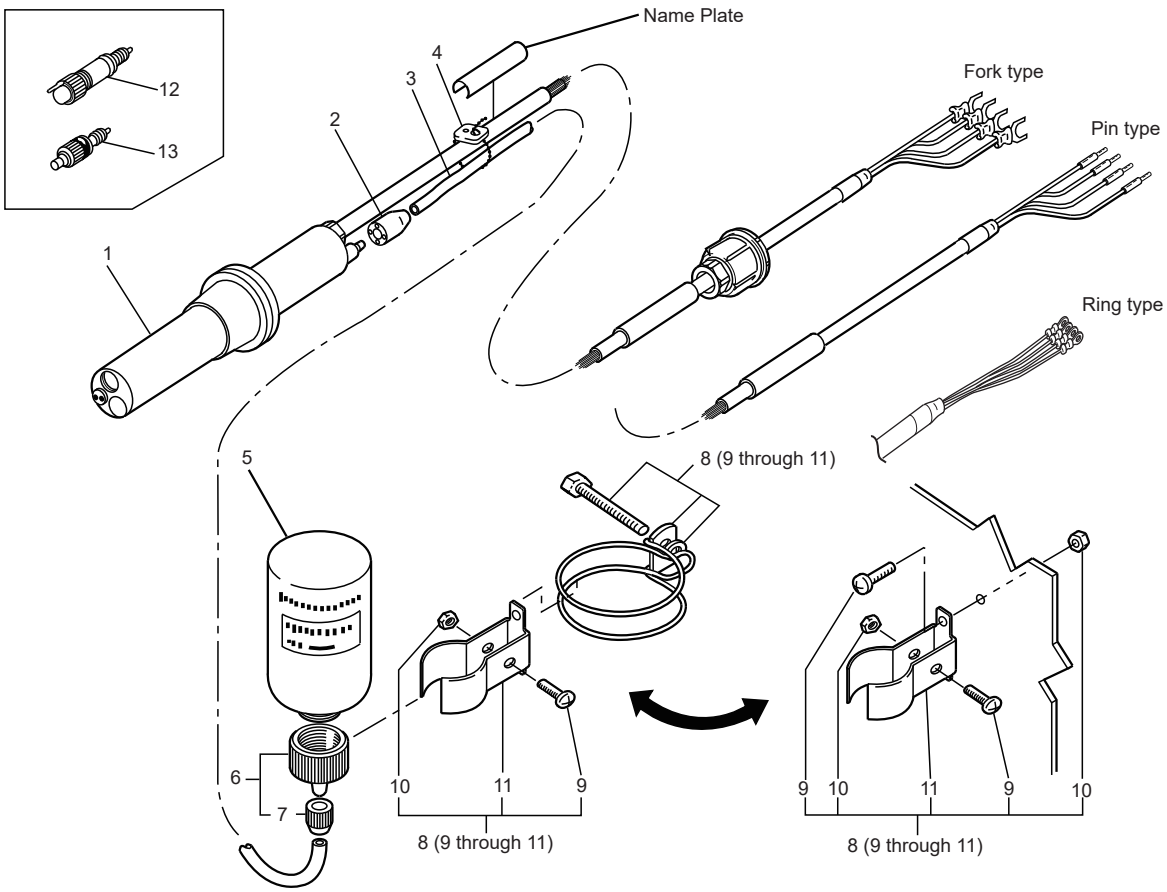



**Figure 3.4 Replacing Liquid Junction**

# Customer Maintenance Parts List

## Model OR8EFG
## KCl Filling type ORP Sensor



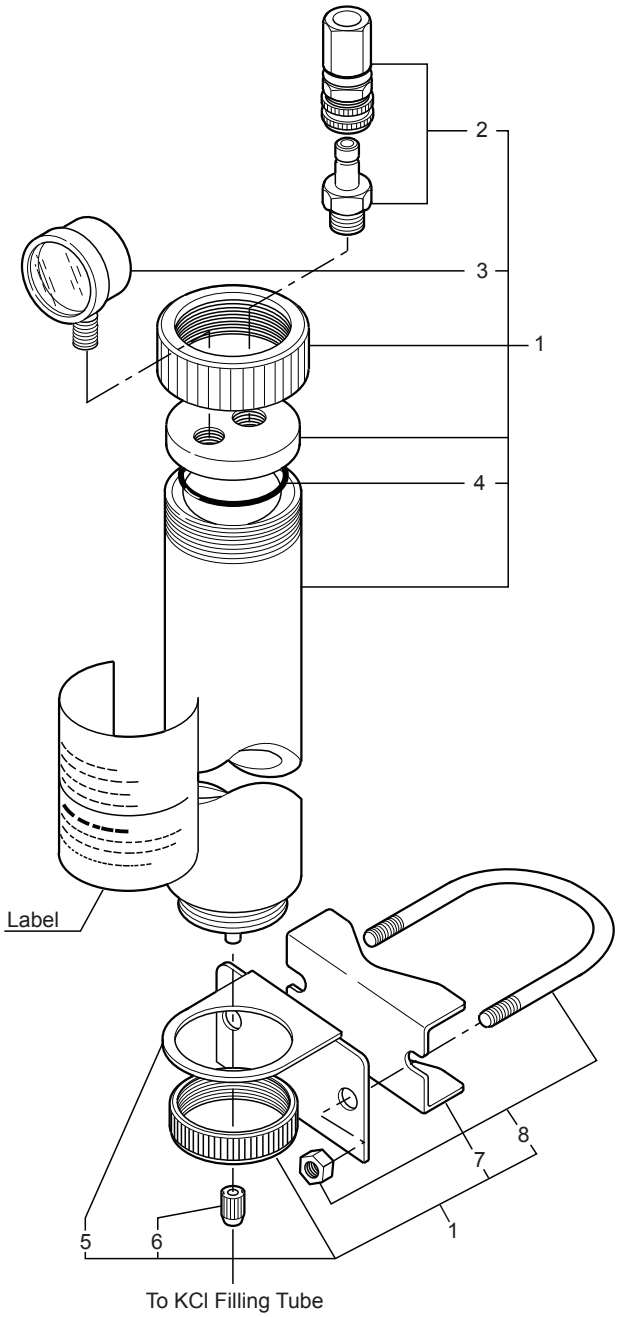



CMPL 12C03J01-01E
11th Edition : Apr. 2023 (YK)

| Item | Part No. | Qty | Description |
|---|---|---|---|
| 1 | — | 1 | Body Assembly<br>see GS 12B07B02(E) |
| 2 | K9142EJ | 1 | Cap |
| 3 | — | 1 | KCl Filling Tube |
| | K9142PF | | for general use, length 3 m |
| | K9142PG | | for general use, length 5 m |
| | K9142NH | | for general use, length 7 m |
| | K9142NJ | | for general use, length 10 m |
| | K9142NK | | for general use, length engith, 15 m |
| | K9142NL | | for general use, length engith, 20 m |
| | (L9901MB) | | (for general use, length by meter, max.100 m) * |
| | K9142PJ | | for medium pressure, length 3 m |
| | K9142PK | | for medium pressure, length 5 m |
| | K9142NM | | for medium pressure, length 7 m |
| | K9142NN | | for medium pressure, length 10 m |
| | K9142NP | | for medium pressure, length 15 m |
| | K9142NQ | | for medium pressure, length 20 m |
| | (L9901CA) | | (for medium pressure, length by meter, max.100 m) * |
| | K8022GT | | for UV resistance, length 3m |
| | K8022GU | | for UV resistance, length 5m |
| | K8022GV | | for UV resistance, length 7m |
| | K8022GW | | for UV resistance, length 10m |
| | K8022GX | | for UV resistance, length 15m |
| | K8022GY | | for UV resistance, length 20m |
| | (L9901AE) | | (for UV resistance, length by meter, max. 50 m) * |
| 4 | L9813UG | 3 or 5 | Clamp |
| 5 | K9084KQ | 1 | Bottle (for general use) |
| 6 | K9084KV | 1 | Connector Assembly (for general use) |
| 7 | K9084CG | 1 | Nut |
| 8 | K9142VE | 1 | Holder Assembly |
| 9 | — | 3 | B.H. Screw, M4X18 |
| 10 | — | 3 | Nut |
| 11 | — | 1 | Bracket |
| 12 | — | 1 | ORP Electrode Assembly |
| | K9142TS | | Pt |
| | K9142TT | | Au |
| | K8022GP | | Pt/PF |
| | K8022GQ | | Au/PF |
| 13 | — | 1 | Junction Assembly |
| | K9142TH | | for general use |
| | K9319QA | | for OR8EFG/PF |
| | K9142HW | | for OR8EFG/TF |
| | K9319QB | | for OR8EFG/TF and /PF |
| | K9142UH | | for OR8EFG/CJ |
| | K9142UL | | for OR8EFG/CJ and /PF |

*: Specify the length in meters when specifying the quantity.

Medium Pressure Type




| Item | Part No. | Qty | Description |
|---|---|---|---|
| 1 | K9142VG | 1 | Tank Assembly (item 2 through 8) |
| 2 | L9835DD | 1 | Joint |
| 3 | L9867BS | 1 | Pressure Gauge (Range:0 to 700 kPa) |
| 4 | G9303AE | 1 | O-Ring |
| 5 | K9142VP | 1 | Bracket |
| 6 | K9142EJ | 1 | Cap |
| 7 | L9826AL | 1 | Bracket |
| 8 | D0117XL-A | 1 | U-Bolt Assembly |

# Revision Information

- Title : Model OR8EFG KCl Filling type ORP Sensor
- Manual No. : IM 12C07J01-01E

**Apr. 2023/12th Edition**
CMPL 12C03J01-01E was revised to 11th edition (a part number was corrected).

**Aug. 2022/11th Edition**
Corrected the descriptions. (P.3-4)

**Feb. 2022/10th Edition**
Added option code /DG1, /MC1, /PF, /FEP, and consumables (P. 1-3, 1-4).
Deleted “3.2.2 Replacing O-rings for Indicator Electrode”
CMPL 12C03J01-01E was revised to 10th edition (added parts for UV resistance, /PF, /TF).

**Jul. 2021/9th Edition**
Changed the description in Section “2.2.2 Installing Sensor in PH8HS Submersion Holder”

**Apr. 2020/8th Edition**
Revised along with an additional code for option /TF (P.1-2, 1-3, 1-4. 3-1)
CMPL 12C03J01-01E was revised to 9th edition (a part addition: Junction for /TF)

**Feb. 2020/7th Edition**
Added a terminal connection to -E: FLXA402 to Pin terminal (P. 1-2)

**Nov. 2018/6th Edition**
**Added FLXA402**
P i, P1-3.

**Oct. 2015/5th Edition**
**Added FLXA202**
P i, P1-3.
**Unification ot the material name**
P1-1, P1-2.
CMPL 12C03J01-01E was revised to 8th edition

**Jun. 2013/4th Edition**
P 1-4, Some revision of consumables; P 3-1, Some revision of pressurizing reserve tank; etc.

**Sep. 2011/3rd Edition Page layout changed by InDesign**
P.i, Reference manual number of FLXA21 added; P.v, Some of contents corrected; P.1-3, M4 ring terminals for FLXA21 added to MS-code; P.1-5, M4 ring terminals added to external dimensions; P.2-13, Section no. corrected (2.3.3--->2.3.4);
CMPL 12C03J01-01E was revised to 7th edition (P/N of KCl tube modified).

**Apr. 2008/2nd Edition**
M3 ring terminals added for PH450G, CMPL12C03J01-01E revised to 5th edition.

**Sep. 2006/1st Edition**
Newly published.

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