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**User's  
Manual**

**EXA OR**

**Model OR10FP  
KCl Refillable ORP Sensor**

IM 12C11C01-01E

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## ◆ Introduction

This instruction manual covers the OR10FP KCl Refillable ORP sensor for the OR100; this is used with the PH10HLD Immersion holder. Other related EXA100 series items are described in the following manuals:

Model name	Manual Name	IM No.
PH100	Panel Mount pH Converter	IM 12 B11A01-01E
OR100	Panel Mount ORP Converter	IM 12 C11A01-01E
SC100	Panel Mount Conductivity Converter	IM 12 D11A01-01E
PH10FP	KCl Refillable pH Sensor	IM 12 B11C01-01E
PH10RP	KCl Replenish-free pH Sensor	IM 12 B11C02-01E
OR10RP	KCl Replenish-free ORP Sensor	IM 12 C11C02-01E
SC10XB	Conductivity Sensor for SC100	IM 12 D11C01-01E
PH10HLD	Immersion Holder for EXA100	IM 12 B11D01-01E
PH10HG	Guide-pipe Holder for EXA100	IM 12 B11D02-01E
WTB100	Terminal Box for EXA100	IM 12 B11E01-01E
WF100	Extension Cable for EXA100	IM 12 B11F01-01E

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# ◆ For the safe use of this equipment

## (1) About This Manual

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- This manual explains the functions contained in this product, but does not warrant that they are suitable for the particular purpose of the user.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, when you realize mistaken expressions or omissions, please contact the nearest Yokogawa Electric representative or sales office.
- This manual does not cover the special specifications. This manual may be left unchanged on any change of specification, construction or parts when the change does not affect the functions or performance of the product.
- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

## (2) Safety and Modification Precautions

- Follow the safety precautions in this manual when using the product to ensure protection and safety of the human body, the product and the system containing the product.

## (3) The following safety symbols are used on the product as well as in this manual.



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.



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.



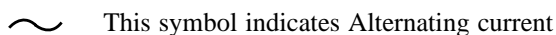
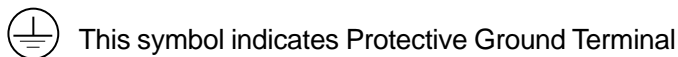
This symbol gives information essential for understanding the operations and functions.



This symbol gives information that complements the current topic.



This symbol identifies a source to be referred to.





## WARNING : Glass Breakage

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Since the sensor contains a glass electrode, do not apply physical shock or excessive force to it. Breakage may occur.

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## ◆ After-sales Warranty

- For repair during the warranty period, 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, give us information of the model name and serial number and a description of the problem. Any diagrams or data explaining the problems 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 purchase quotation. Yokogawa shall conduct warranty service based on its standard. When the customer site is 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 for 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.
- Our maintenance service and the supply of repair parts will be covered for five years after the production ends. For product repair, please contact the nearest sales office described in this instruction manual.

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# 1. Specification

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The compact, easy-to-use KCl Refillable OR10FP ORP sensor is used with the PH10HLD Immersion holder and with the EXA100 series instruments.

## 1.1 Standard Specifications

Measurement:	Oxidation-Reduction Potential of a solution
Measurement:	ORP measurement by platinum electrode
Sensor type:	KCl Refillable type
Measuring range:	-1500 mV to 1500 mV
Installation:	Incorporated in PH10HLD Immersion Holder
Sample temperature range :	0 to 70 ° C
Sample pressure :	Atmospheric pressure (depth: under 3 m water max.)
Sample flow rate :	2 m/s max.

### Wetted part materials:

Polypropylene, rigid PVC resin, silicone rubber, glass, ceramics, chlorinated polyethylene rubber (cable sheath), Platinum (for electrode)

Cable: Specialty 4-conductor cable

Cable length:

3, 5, 10 m (up to 50 m with sensor cable included when WTB100 using terminal box)

Weight: Approx. 300g (3 m), 450g (5 m), 800g (10 m)

### Other related instruments:

WTB100 Terminal Box and WF100 Extension Cable:

Up to 50 m with sensor cable included

PH10HLD Immersion Holder (wetted part materials):

Polypropylene (holder), polyethylene (spacer), silicone rubber (gasket), ethylene propylene rubber (cover)



## 1.2 Model and Suffix code

Model	Suffix code	Option code	Description
OR10FP *1			KCl Refillable pH sensor for OR100
Cable length	-03		3m
	-05		5m
	-10		10m
	-AA		Always -AA
Combination holder	-HST		For KCl-filled immersion type holder *2 *3
	-NN		Always -NN

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- Notes
- \*1 : Sensor cannot be used alone and requires a dedicated immersion type holder, PH10HLD-AA-□□-HST-PE, which should be ordered separately.
  - \*2 : Sensor cable incorporates the cover for a holder.
  - \*3 : No KCl solution is filled in previously. Fill KCl solution in the holder before use.  
Please purchase KCl powder (P/N K9020XU : KCl for 250ml preparation X8 packs)

## 1.3 External Dimensions

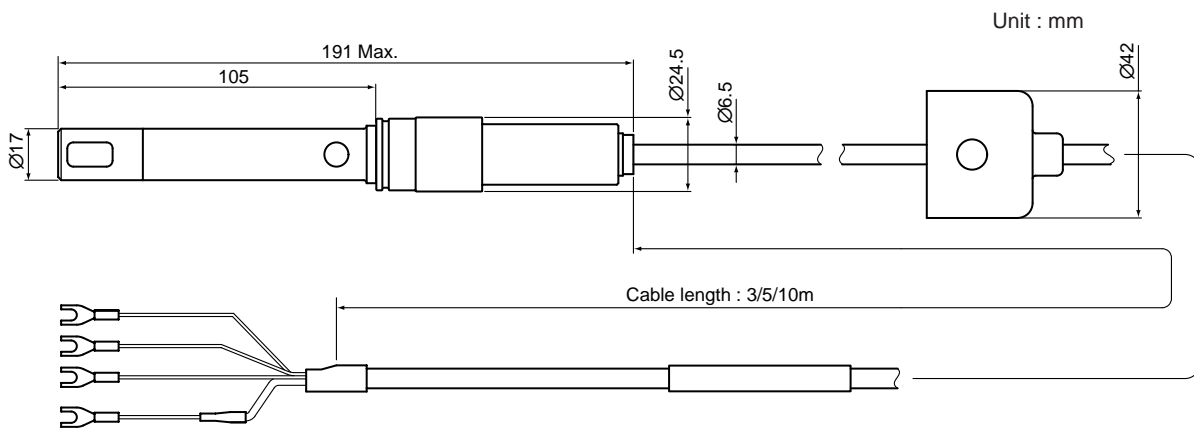


Fig. 1.1

## 2. Installation

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### 2.1 Preparation for Installation

#### 2.1.1 Checking for Damage

The OR10FP KCl Refillable ORP sensor is carefully packed to avoid damage during transportation. However, when you receive it, carefully unpack it and check visible damage.

#### 2.1.2 Installation of the Holder

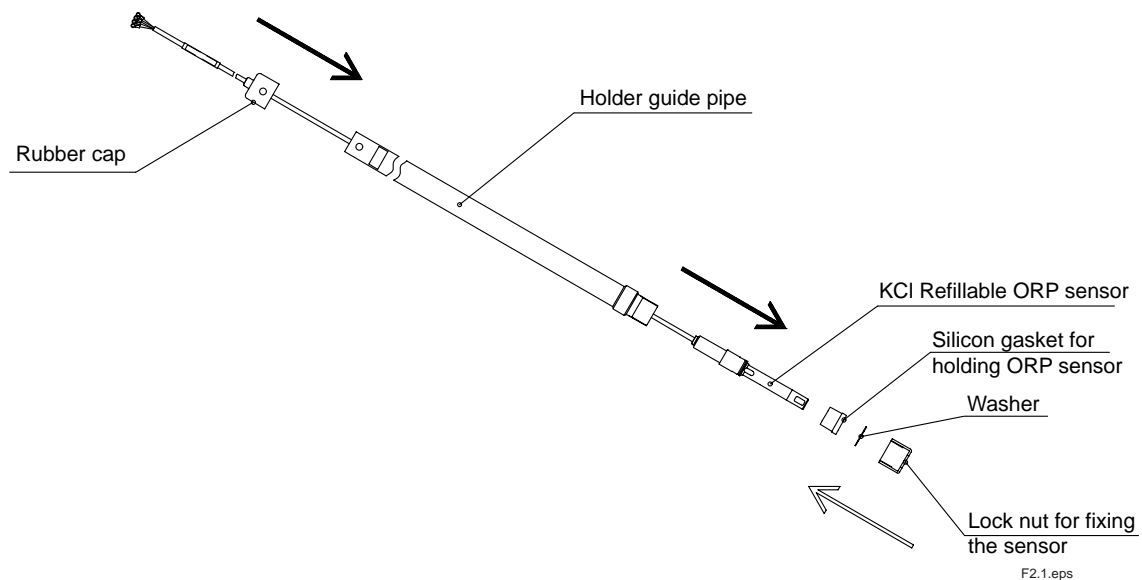
The OR10FP KCl-Refillable ORP sensor used with PH10HLD Immersion holder. Check the holder can be / is installed in a place you select.

#### 2.1.3 Installation of Associated Equipments

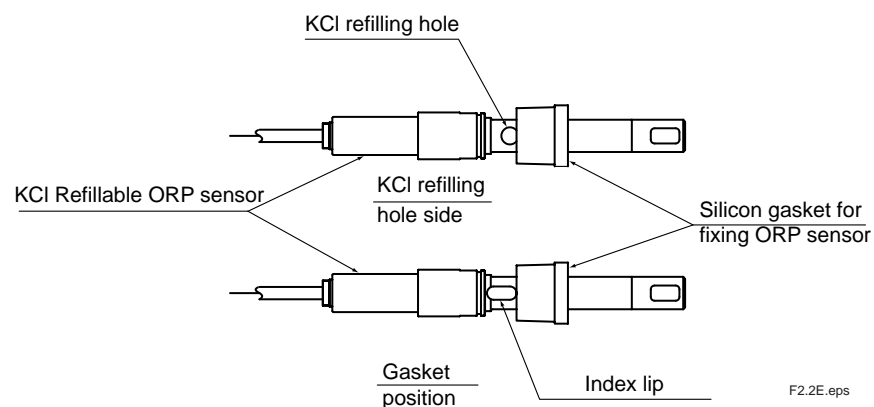
Check that associated equipments such as the WTB100 terminal box or the OR100 ORP converter is installed.

## 2.2 Procedure for mounting the ORP sensor in the immersion holder

- (1) Take the cap – that prevents the ORP sensor from drying out – off the tip of the sensor.
- (2) Remove the tape covering the KCl filling hole of sensor.  
Mount the sensor in the immersion holder as the following procedures.
  - Loosen the Lock nut on the tip of the immersion holder
  - Remove the nut, a washer and gasket.
  - Pass the sensor through the holder as the direction of the black arrow in Fig. 2.1
  - Push out the sensor until it sticks out other pipe side.
  - Insert the sensor into the removed gasket until it reaches the index lip.(See Fig 2.2)
  - Attach the sensor equipped with the gasket to the guide pipe.
  - Putting the removed washer between the gasket and the nut, tighten the nut so strongly to hold them in place. In Fig. 2.1, the white arrow indicates the insert direction of the gasket, washer, and nut.
  - Set the cap cover to the waterproofing cap of the holder guide pipe.



**Fig. 2.1**



**Fig. 2.2**

- (3) Fill the KCl solution (3.3 mol/l) through the intel port in the holder. (See Fig. 2.3)  
you can poure the KCl solution by a beaker or the like.

**Tip**

You can make the KCl solution with KCl powder supplied by YOKOGAWA.

- Preparation

Prepare the following items:

KCl powder (one-bag containing 62g of powder supplied by YOKOGAWA.  
pure water, beaker for blending, a stirring rod, etc.,

- Blending

Pour little pure water to a beaker.

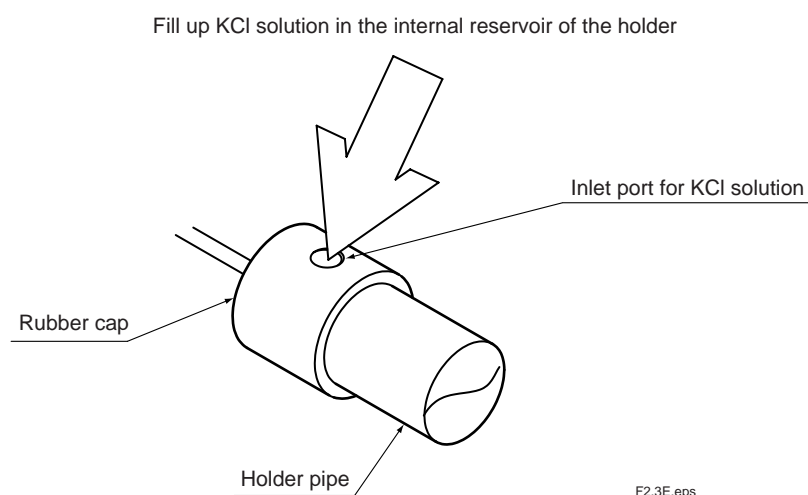
Put KCl powder into the beaker.

Pour in pure water, mixing with a stirring rod or the like while pouring, until  
the total amount reaches 250ml.

Stir thoroughly until KCl powder is solved perfectly.

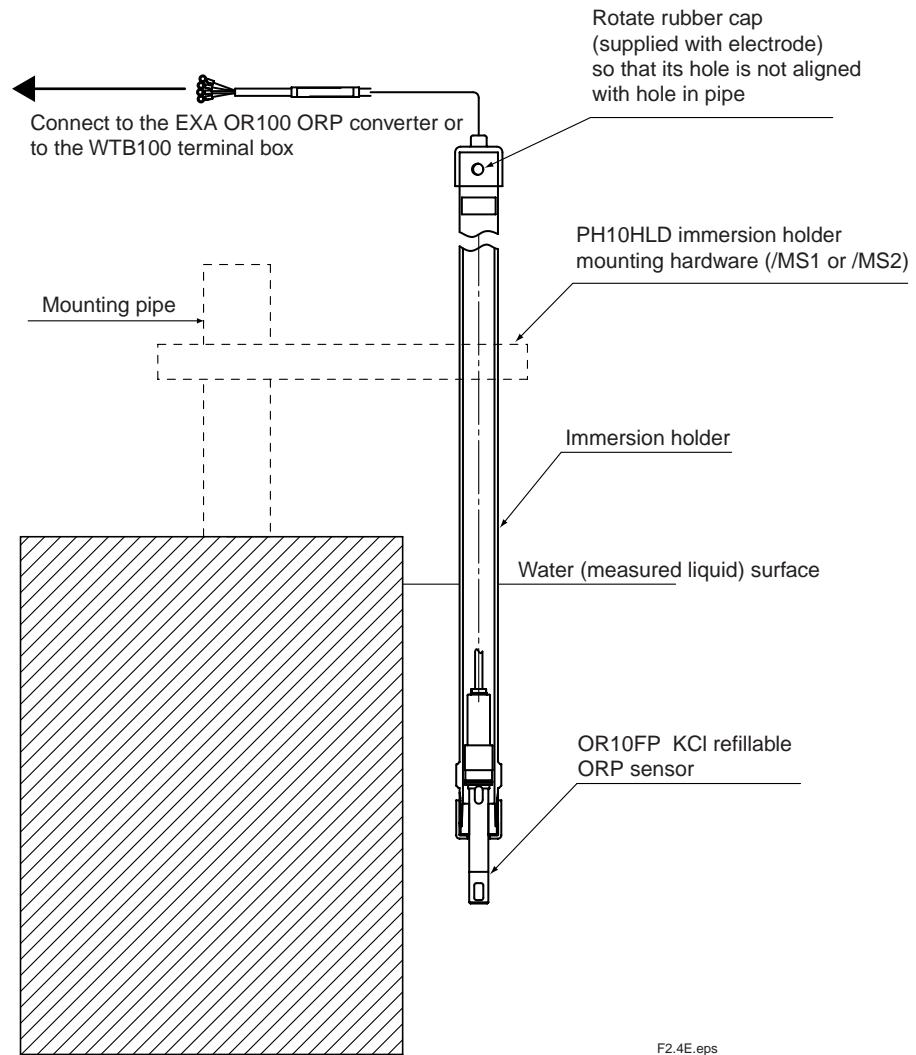
**CAUTION**

Be sure to follow the blending cautions on the KCl powder bag.

**Fig. 2.3**

- (4) After filling up the KCl solution, shut the inlet port by rotating the rubber cap.  
(5) Check no leakage of the KCl solution when carrying the holder.

(6) Install the PH10HLD Immersion holder. Refer to IM 12B11D01-01E for details of the installation method.



**Fig. 2.4**

(7) Connect the ORP sensor cable to associated equipments, such as OR100 ORP converter and WTB100 terminal box. Referring to ORP sensor cable connection diagram in Sec. 2.3, take care to make no mistakes when wiring.

 **CAUTION**

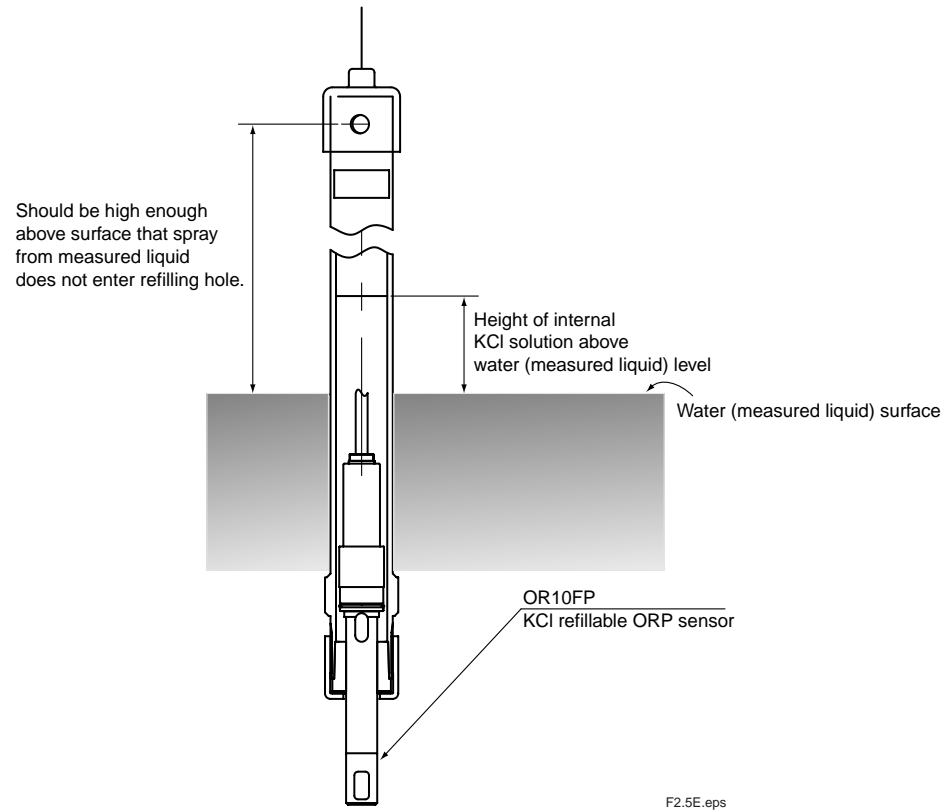
In installing the holder, open the inlet port a little.

In other words, rotate the rubber cap so that the internal KCl solution can be under the atmospheric pressure.

 **CAUTION**

Take care that spray from measured liquid does not enter refilling hole.

Be sure to keep the internal KCl solution surface higher than the measured liquid surface.



**Fig. 2.5**

## 2.3 ORP Sensor Cable Wiring Procedure



CAUTION

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Place ORP sensor cable wiring as far as possible from power supply and ground wiring.

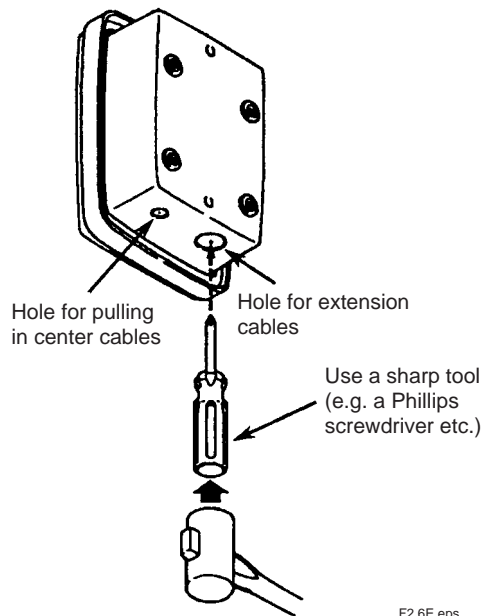
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### 2.3.1 Connecting to a WTB100 terminal box

- (1) Open wiring hole in terminal box.

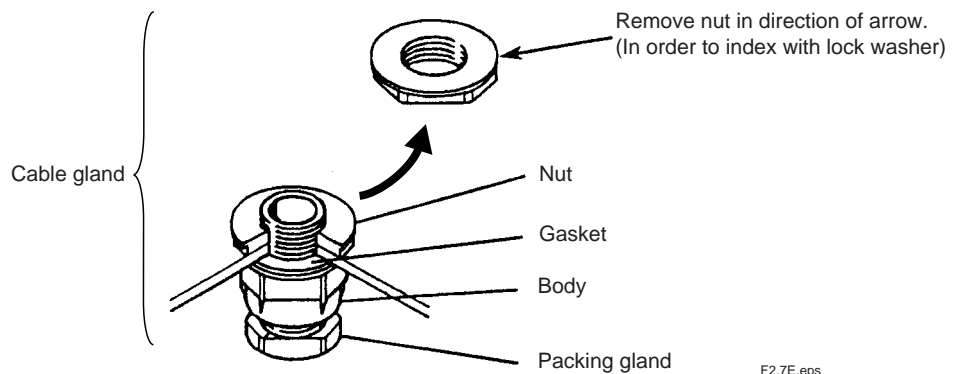
On the bottom of the terminal box you can see a circular hole for wiring (covered by a blind plate). Place the tip of a screwdriver or the like in the center of the blind hole, and hit it with a hammer or the like to punch out the blind plate.

- (2) Loosen two screws in the front of the terminal box, and remove the cover.



**Fig. 2.6**

- (3) Remove the nut from the dedicated cable gland (see Fig. 2.7), which is used for locking the sensor cable.



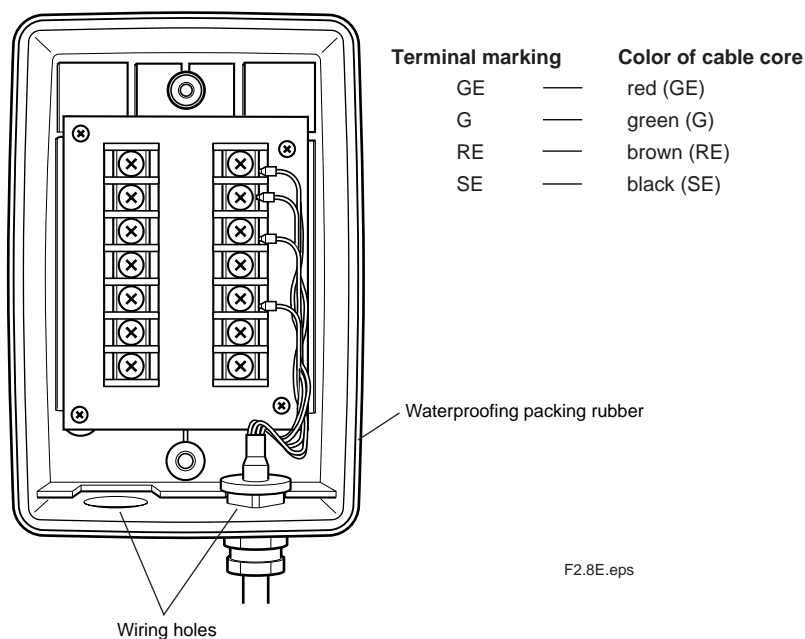
**Fig 2.7**

- (4) Pass the cable through the cable gland except the removed nut.
- (5) Pass the cable through the right side of the wiringhole.
- (6) Pass the cable through the removed nut.

- (7) Check each tag on the terminal of the cable, and connect each cable terminal to the corresponding terminal in the box.
- (8) Loosen the packing gland (shown in Fig. 2.10) beforehand.
- (9) Attach the cable gland to the wiring hole by screwing up securely the body.
- (10) Screw up the packing gland so that humidity can not enter.

 **CAUTION**

Do not screw up these nuts very tightly.  
Its very strong tightness can damage the cable as well as the cable gland itself.

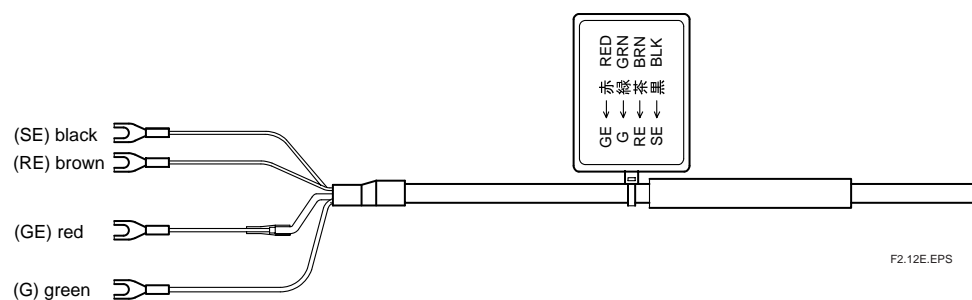


**Fig. 2.8 Example of wiring to a terminal box**

- (11) When the wiring work is completed, attach the cover of the terminal box and tighten the removed screws. In addition, check that neither dirt nor water drops are adhering to waterproofing packing rubber of the case part.

 **Tip**

The tag as show in the below figure is attached to the sensor cable you can refer in connecting the related equipment.





### 2.3.2 Connecting to an EXA OR100 ORP converter

Connect the sensor cable to the EXA OR100 ORP converter as follows:

Connect the sensor cable terminals to appropriate terminals of the converter. (See Table.2.1)

For details, see IM 12C11A01-01E for wiring of panel mount ORP converter.

**Table 2.1**

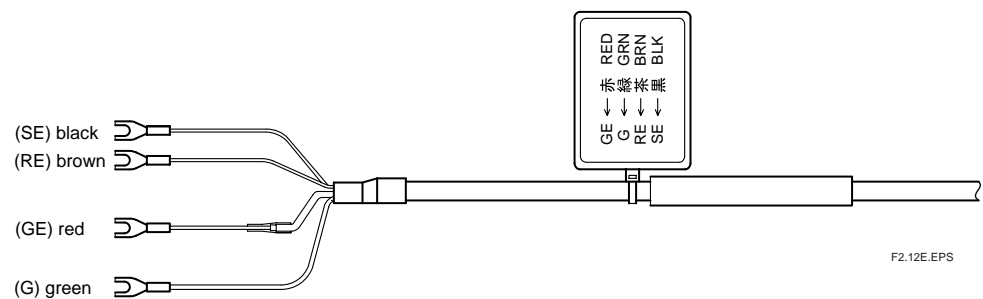
ORP converter terminal no.	Color of OR10FP, ORP sensor cable core
11	(do not use)
12 (GE)	red
13 (G)	green
14 (RE)	brown
15	(do not use)
16 (SE)	black
17	(do not use)
18	(do not use)

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#### Tip

The tag as show in the below figure is attached to the sensor cable you can refer in connecting the related equipment.



## 3. Maintenance on operation

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### 3.1 Calibration and Periodic Maintenance



#### CAUTION

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Since the electrode of ORP sensor consists of glass, it may be broken if force or shock is applied to the sensor, or it is dropped. Please handle it carefully.

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#### 3.1.1 Check or calibration

ORP measuring system is usually used for measuring not absolute ORP values but changes of the value.

It is natural that the value between the instrument indication and a real solution can become different.

The ORP system is usable without any maintenance in case of the small difference of them.

However, if you think their difference is beyond the accuracy necessary to operate process, please check or try to calibrate the ORP sensor. Furthermore, a periodical cleaning is recommended to prevent dirt from adhering to the platinum electrode and liquid junction.

For check or calibration details, refer to the OR100 ORP converter: Document No. IM12C11A01-01E.

##### (1) Outline of Checking the OR10FP sensor

- Check the ORP sensor for the following cases:

In using a new sensor, After cleaning the sensor, or in restarting after stopping operation for a long time

- Method of the check

Check the indication is within tolerance error by measuring a solution with a definite ORP value. Quinhydrone solution or iron (II, III) compound solution is useful for checking.

##### (2) Outline of Calibrating the OR10FP

- Calibrate the ORP sensor for the following case:

In confirming the tolerance error is beyond the property value of the real solution by checking

In adjusting indication of the ORP converter to a certain value such as a manual measurement value or the indication of another converter.

- Method of the calibration

Use a solution with a definite ORP value for calibration, or a solution to be measured for adjusting other measurement value. Quinhydrone solution or iron (II, III) compound solution is useful for calibration.

Dip the sensor into the solution.

Calibrate or adjust indication in the manual calibration mode on the converter



#### Tip

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YOKOGAWA can supply Quinhydrone powder (P/N: K9024EC) and iron (II, III) compound powder (P/N: K9024ED).

Please purchase them if necessary.

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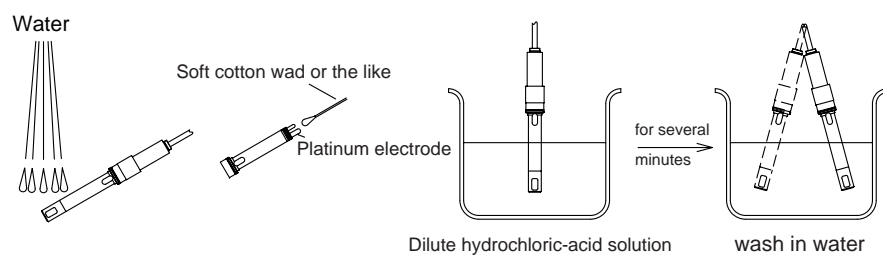
### 3.1.2 Washing of platinum electrode and liquid junction

If a lot of dirt is adhering to the platinum electrode or liquid junction, measurement errors may occur. Therefore, they need cleaning periodically. The required washing interval will depend on how quickly they become dirty.

Wash the electrode and liquid junction as follows:

- If the dirt is colloidal, adhesive substances, microbes, etc., wipe it off with soft tissue etc. Further wash liquid junction with water to remove remaining dirt.
- If the dirt is oily substances, dip in neutral detergent solution in a beaker to remove.
- If the dirt is chemical stains, such as caused by adsorption of metal, dip in weak (about 1-2%) hydrochloric acid for several minutes. (Acid washing)  
Perform acid washing if the sensor is used to measure high-alkalinity solution, and its performance starts to fall off due to chemical dirt adhering to it.

< Washing at intervals that depend on measured liquid > < Chemical dirt, such as adsorbed metal >



### 3.1.3 Filling up KCl solution in the holder.

The amount of KCl solution lost from the liquid junction of the OR10FP ORP sensor under a pressure of 10 kPa (representing a head difference of 1 m between the liquid junction of the KCl sensor and the surface of the liquid being measured) is 3 ml/day maximum. Under normal conditions, the 250ml of KCl solution will usually last 3-6 months. Periodically check the level of KCl in the sensor, and top up if necessary.

Refer to (3) of 2.2 for the procedure.

## 3.2 Replacement of consumables

### ● Replacement of OR10FP KCl Refillable sensor

The OR10FP sensor has limited life. When it can no longer be calibrated with standard solution, it should be replaced.



### CAUTION

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- Take care not to hit the electrode and the junction to a rigid place.
- Take care not to let the electrode and the junction touch a ground.
- Dip the sensor in a solution to be measured as early as possible, because a measurement drift may occur right after immersing the sensor in the solution,
- Keep in mind the OR10FP cannot apply to a chromium coating process solution because of the platinum electrode tolerance.
- Be careful not to allow the liquid junction to dry out.

When storing the ORP sensor or keeping it in air for long time, be sure to attach the protective cap (supplied with it when it is shipped) to its tip.

If the protective cap has been lost, then store the sensor with its tip immersed in tap water to keep the liquid junction wet.

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### ● Replacing the gasket in the PH10HLD Immersion holder

For the PH10HLD immersion holder, the sealing characteristics of the silicon gasket do not usually deteriorate if it is unused for a short time, so replacement of the silicon gasket alone is usually not required. If, however, deterioration of the silicon gasket is noticeable, replace it. Use only silicon gaskets supplied by Yokogawa.



# Revision Record

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Manual Title : Model OR10FP KCI Refillable ORP sensor

Manual Number : IM 12C11C01-01E

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<b>Edition</b>	<b>Date</b>	<b>Remark (s)</b>
1st	May. 2003	Newly published
2nd	May 2004	OR100 shield cover changed

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