Instruction Manual

PHΣ Series
Compact pH Meter

PHΣ

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 12B5B2 - 01E
1st Edition

INTRODUCTION

This manual explains how to use all the instruments in the PHΣ Series needed for constructing a "Compact pH Meter."

Since each part corresponds to one pH instrument, refer to those parts that are necessary for the operation of your system.

FD No. 10006-K

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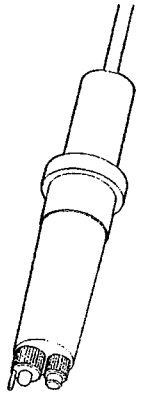
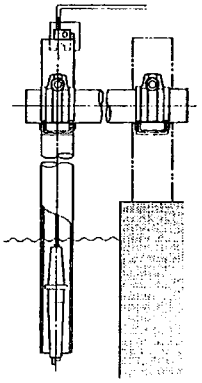
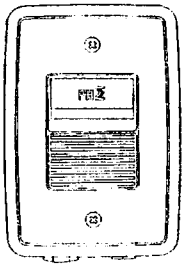
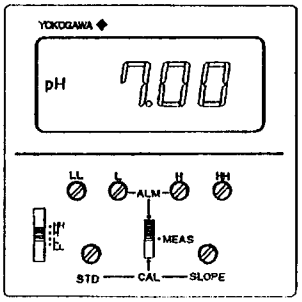
PHΣ SERIES COMPACT pH METER CONFIGURATION

PHΣ SERIES COMPACT pH METER is a pH meter employing digital indication pH controller and suitable for applications such as incorporating in small scale waste-water treatment systems or simplified instrumentation.

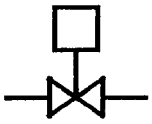
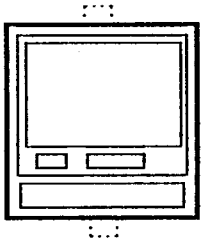
The following are the main features of the meter.

- The pH controller is a compact panel mounting type conforming to DIN96 standard.
- A large, clear, easy-to-read LED permits operators to read display clearly from a distance.
- Contact output for two limits, high and low, to four limits, low-low, low, high, and high-high, can be selected according to purposes.
- In addition to non-isolated 0 to 1 V DC, isolated 4 to 20 mA DC can be obtained as analog output signals.
- Measured values are processed so that, in calibration they are displayed to minimum 0.01 pH for precise calibration but in measurement their digits are changed to minimum 0.1 pH for easy reading.

● Instruments That Compose Compact pH Meter

● PH8ERG KCl refillable type ● PH8EFG KCl filling type	● PH8HG guide pipe holder	● PH8TBG terminal box (option)	● PH8PMC compact pH controller
			
pH sensor	Holder	Note: The terminal box is used when compact pH controller is installed 5 m or more away from the pH sensor (20m max.)	

● Equipment That Can Be Connected

		● μR100T Recorder
		
Solenoid valve	Pump	Recorder

Model PH8PMC
COMPACT pH CONTROLLER

A1

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1. OUTLINE

The PH8PMC Compact pH Controller is a panel mounting controller with a built-in preamplifier used for composing "PHΣ Series Compact pH Meter."

[Features]

- The pH controller is a compact panel mounting type conforming to DIN96 standard.
- A large, clear, easy-to-read LED permits operators to read the display clearly from a distance.
- Contact output for two limits, high and low, to four limits, low-low, low, high, and high-high, can be selected according to purposes.
- In addition to non-isolated 0 to 1 V DC, isolated 4 to 20 mA DC can be obtained as analog output signals.
- Measured values are processed so that, in calibration they are displayed to minimum 0.01 pH for precise calibration but in measurement their digits are changed to minimum 0.1 pH for easy reading.

1.1 Standard Specifications

Construction	:	Indoor installation type
Material	:	Case body Electrolytic zinc coated steel sheet (JIS SECC)
		Case frame Acrylonitrile Butadiene Styrene (ABS) resin
		Front panel Acrylic resin
Color	:	Case Light gray (Munsell 7 equivalent)
		Front Panel Black
Dimensions	:	96 mm W×96 mm H×199 mm D
Weight	:	Approx. 1.2 kg
Mounting	:	Panel mounting
Ambient Temperature	:	0 to 50°C
Ambient Humidity	:	45 to 85% (No condensation)
Measuring Range	:	pH0 to pH14
Display	:	Digital (Red LED) display
		Minimum display digit when measuring pH and setting contact output (alarm) 0.1 pH
		Minimum display digit when calibrating with standard buffer solutions 0.01 pH
Output	:	Contact output and analog signal output (For details of combination and others, see section 1.2 Model and Suffix Codes.)
		Contact output
		Contact status Energized and contact is closed at high (high-high) limit setpoint and above, and at low (low-low) limit setpoint and below
		Contact rating 250 V AC, 3A, non-inductive load

Analog signal output

0 to 1 V DC / pH 0 to 14 (Output resistance 10Ω or less, Not isolated)

4 to 20 mA DC / pH 0 to 14 (Load resistance 550Ω or less, Isolated)

Temperature Compensation Range : −5 to 105°C

Standard (STD) Adjustable Range : ±1.5 pH

Slope (SLOPE) Adjustable Range : −5 to +15% for the difference from pH7

Power Supply : 90 to 121 V AC or 180 to 242 V AC, 50/60 Hz

Power Consumption : Approx. 5 VA

Basic Performance when combined with pH sensors :

Response speed : 30 seconds or less (90% response when the standard solution at 20°C is measured by a sensor stable at 20°C)

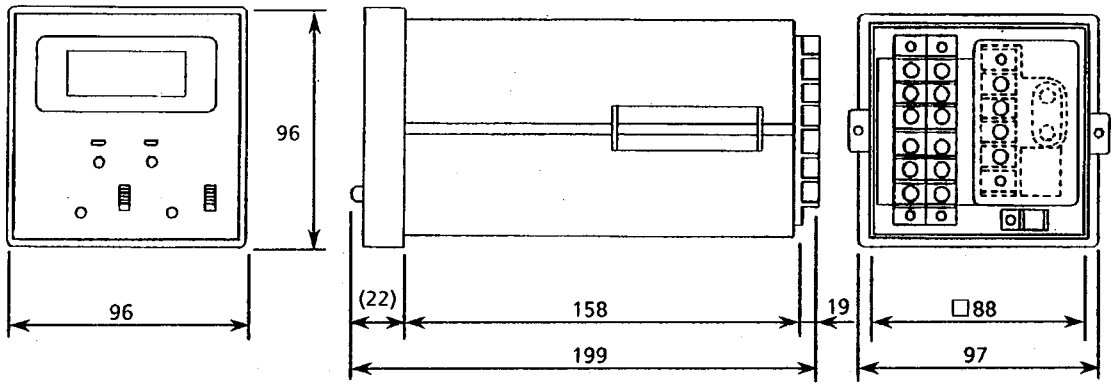
Repeatability : 0.2 pH

1.2 Model and Suffix Codes

Model	Basic Code	Optional Code	Specifications
PH8PMC	.....	.....	Compact pH controller
_____	-A	.....	Always -A
Contact output and analog signal output	-21	.....	High and Low 2-contact outputs
	-22	.....	High and low 2-contact outputs and 0 to 1 V DC (not isolated)
	-23	.....	High and low 2-contact outputs and 4 to 20 mA DC (isolated)
	-31	.....	High. low, and high-high or low-low 3-contact outputs
	-32	.....	High, low, and high-high or low-low 3-contact outputs and 0 to 1 V DC (not isolated)
	-33	.....	High, low, and high-high or low-low 3-contact outputs and 4 to 20 mA DC (isolated)
	-41	.....	High, low, high-high, and low-low 4-contact outputs
Supply Voltage	-A1	.....	90 to 121 V AC, 50/60 Hz
	-A2	.....	180 to 242 V AC, 50/60 Hz
_____	*A	.....	Style A

1.3 External Dimensions

Unit : mm



Note : The front panel in Figure 1.1 shows the model with codes PH8PMC-A-2□-□*A.

Figure 1.1 Compact pH Controller External Dimensions

2. COMPACT pH CONTROLLER OUTPUT SIGNALS

2.1 Output Types

Table 2.1 shows the combination of analog signal outputs and contact outputs in the compact pH controller.

Table 2.1 Compact pH Meter Outputs

Model	Analog Signal Output		Contact Output			
	0 — 1 V	4 to 20 mA	Low-Low Contact	Low Contact	High Contact	High-High Contact
PH8PMC-A-21	—	—	—	○	○	—
PH8PMC-A-22	○	—	—	○	○	—
PH8PMC-A-23	—	○	—	○	○	—
PH8PMC-A-31	—	—	△	○	○	△
PH8PMC-A-32	○	—	△	○	○	△
PH8PMC-A-33	—	○	△	○	○	△
PH8PMC-A-41	—	—	○	○	○	○

○ : Output provided; — : Output not provided
△ : Output terminals are shared with both contacts, which transmit the contact signal even if either contact is closed.

2.2 Relationship between Operation Mode and Contact Output

The relationship between the compact pH controller operation mode and the contact output is as shown in Table 2.2.

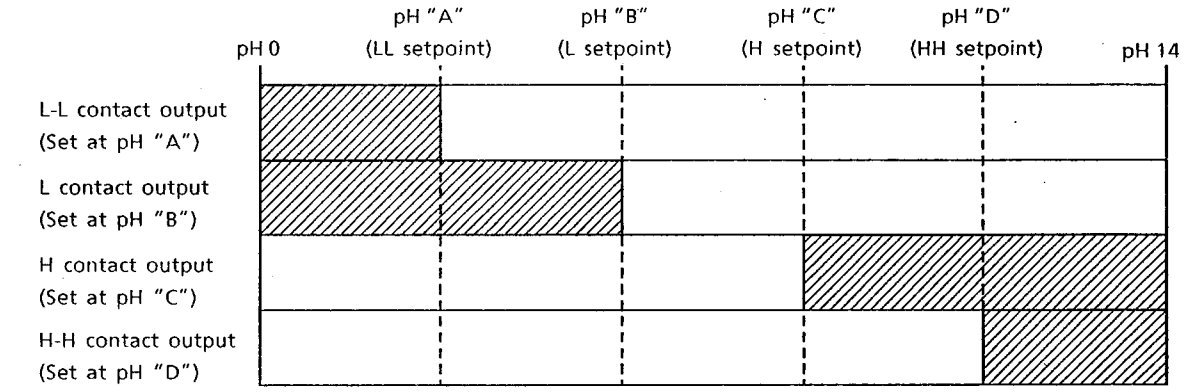
Table 2.2 Relationship between Operation Mode and Contact Output

Operation Mode (Switch Position)	Analog Output	Contact Output
Contact signal setting mode (ALM)	Measured value	Always OPEN contact
Measurement mode (MEAS)	Measured value	Normal operation
Calibration mode (CAL)	Measured value	Always OPEN contact

Note : When the contact is closed, the contact output indicator lamp is lit.

2.3 Contact Signal Output Status

The compact pH controller contact signal output statuses are as shown in Figure 2.1.



: Contact output CLOSED status (alarm action)

: Contact output OPEN status

Note 1 : Determine setpoints so that their pH values increase in the order of LL, L, H, HH. If this setting procedure is not observed, relay contacts cannot be operated properly.

Note 2 : Setting hysteresis ····· 0.1 pH or less

Note 3 : Minimum interval between each setpoint ····· 0.2 pH

Figure 2.1 Contact Signal Output Status

3. INSTALLATION AND WIRING

3.1 Unpacking

The compact pH controller has been thoroughly tested at the factory before shipment and packed in a shipping container so as not to be damaged during transportation. When unpacking, handle it with care so as not to subject it to any sudden or strong shocks. After unpacking, visually check the instrument appearance and confirm whether or not the instrument has incurred any damage.

3.2 Installation

3.2.1 Installation Area

The compact pH controller is an indoor mounting instrument. Install it in an area where the following conditions exist. It is best to have it in a place where:

(1) Mounting and wiring can be done in the rear.
(2) Few corrosive gases are present.
(3) Slight mechanical vibration is present.
(4) Ambient temperature is near normal and its variation is slight.
(5) Humidity can be maintained in the range 45 to 85% R.H. (Too high and too low humidity give adverse effect on the controller.)
(6) There is less effect felt from electromagnetic fields.

3.2.2 Mounting Method

The compact pH controller is mounted on the panel. Figure 3.1 shows the panel cut-out dimensions. Cut out the panel so the controller is properly mounted. Use the panel mounting brackets supplied to mount the controller on the panel (see Figure 3.2).

Unit : mm

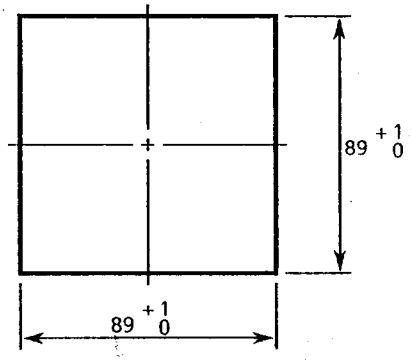


Figure 3.1 Panel Cut-out Dimensions

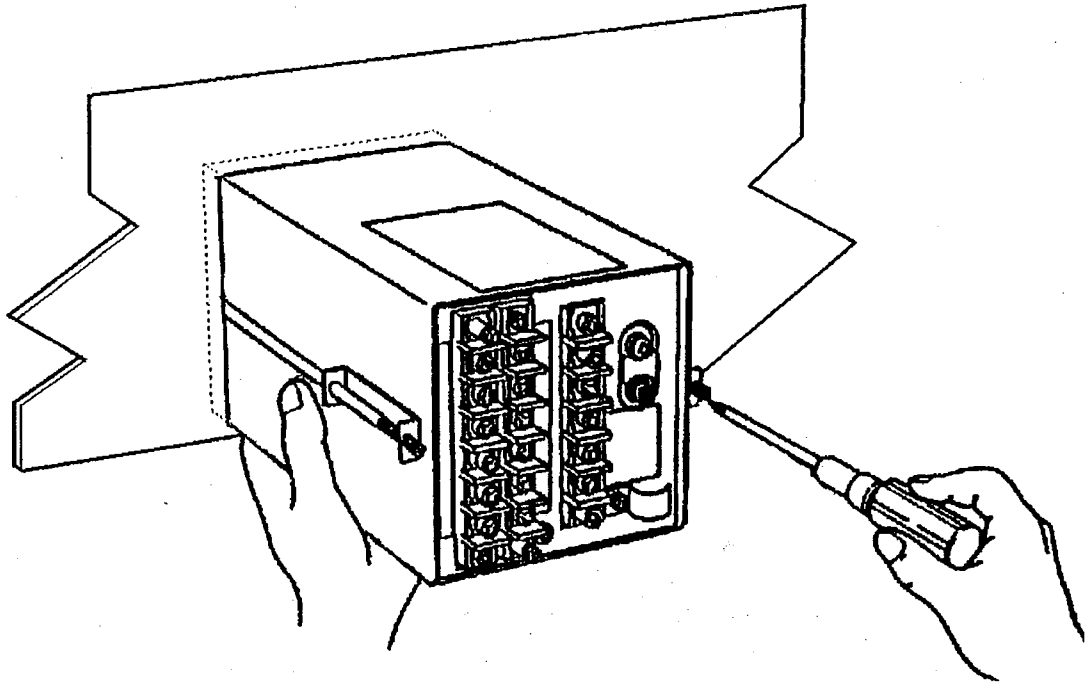


Figure 3.2 Mounting Procedure

3.3 Wiring

Wiring for the compact pH controller will be described.

Figure 3.3 shows connections to the controller (required ones are selected). Figure 3.4 shows terminal arrangements in the rear of the controller case.

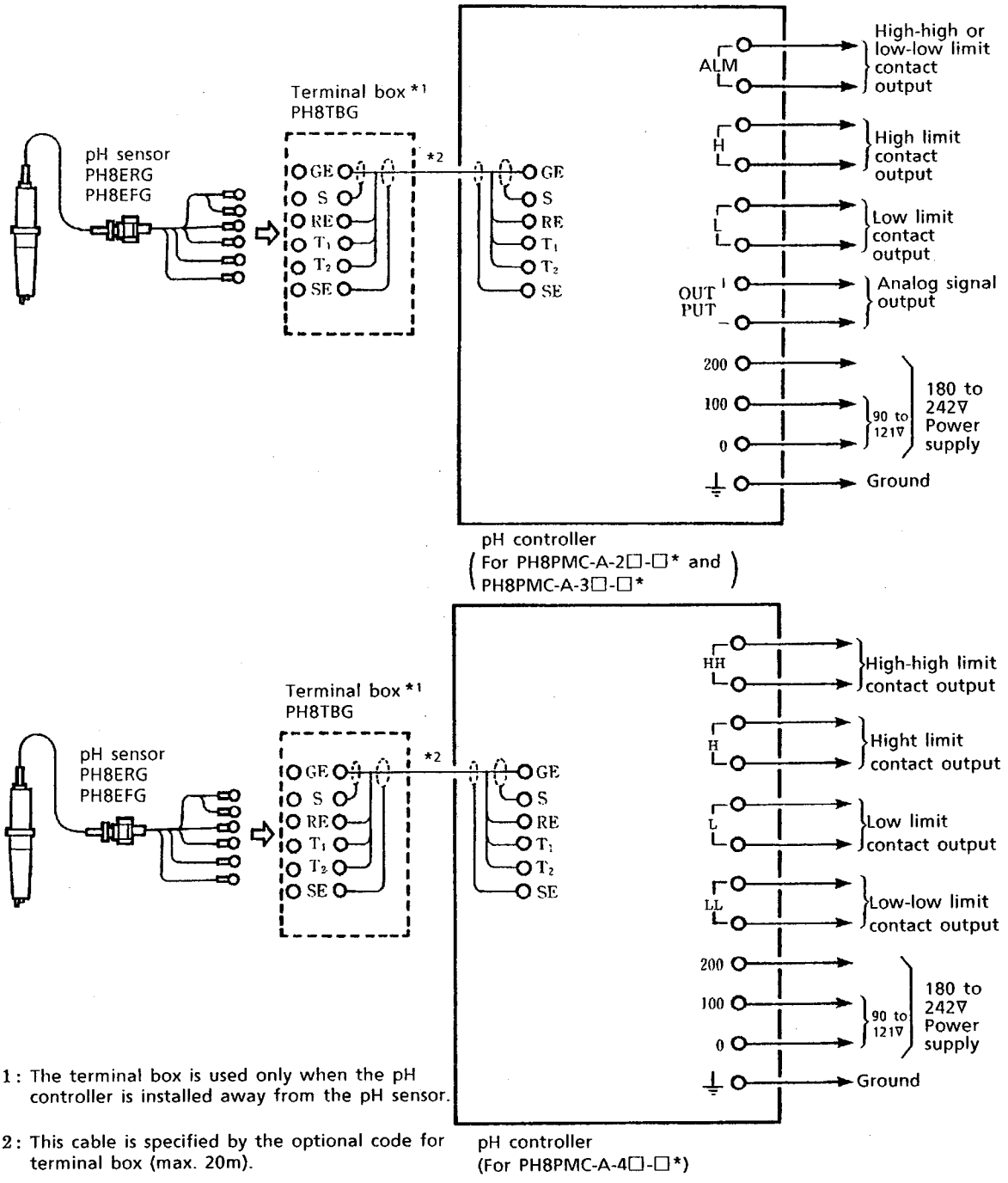
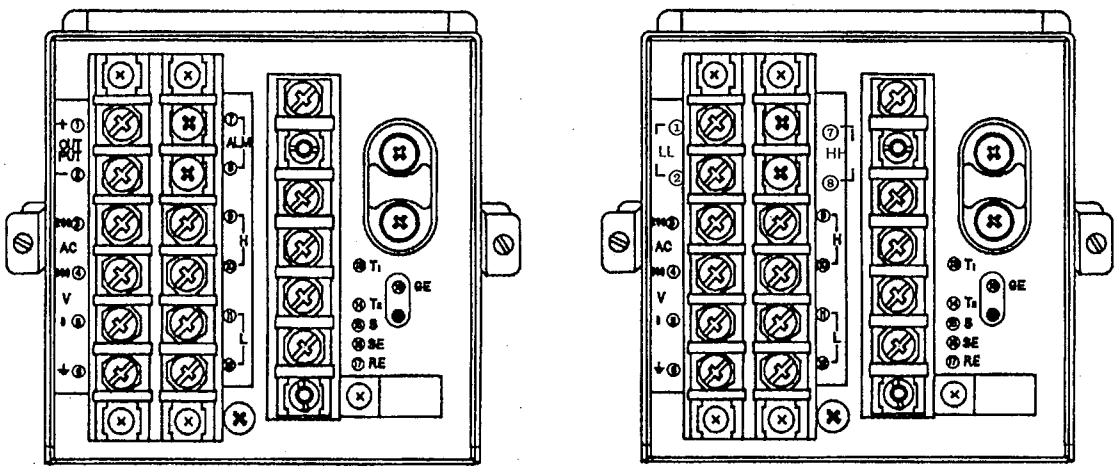


Figure 3.3 Cables Connected to Compact pH Controller



For PH8PMC-A-2□-□*A or PH8PMC-A-3□-□*A

For PH8PMC-A-4□-□*A

Figure 3.4 Compact pH Controller Terminal Arrangement

3.3.1 Sensor Cable Connection

Below is a description of where the pH sensor cable is directly connected to the compact pH controller. In addition, if the cable is to be connected to the terminal box, see section 2.2 of Instruction Manual 12B5W1-E "PH8TBG Terminal Box."

Connect cables to the compact pH controller in the following manner.

(1) Remove the shield cover (covering the sensor cable terminals) in the rear of the compact pH controller by loosening two screws fixing the shield cover.

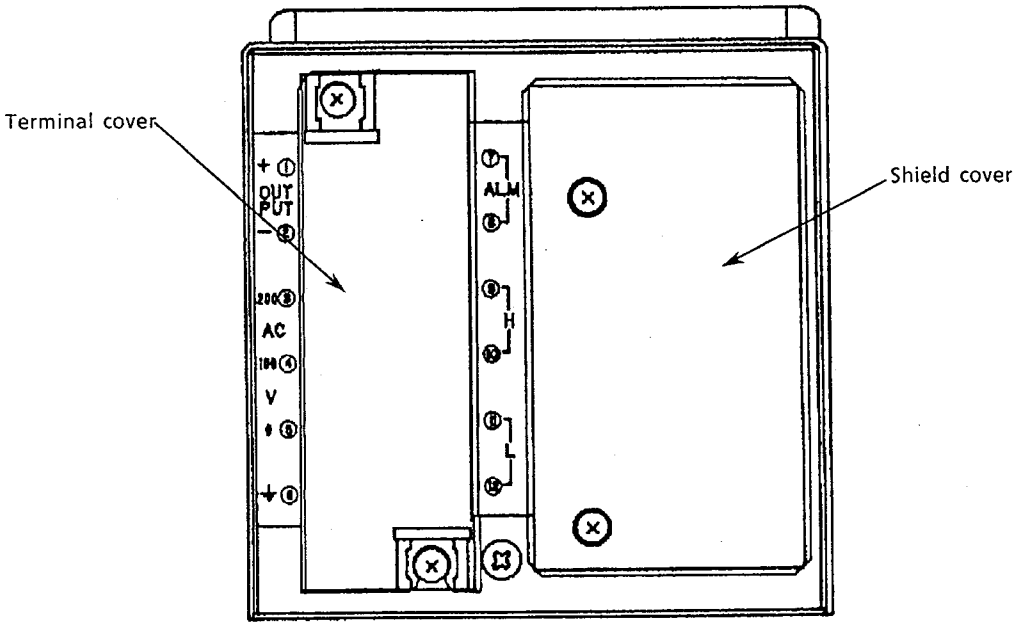


Figure 3.5 Shield Cover and Terminal Cover

(2) Connect the sensor cable to the terminals.
Confirm each conductor symbol and properly connect each conductor to the corresponding terminal.

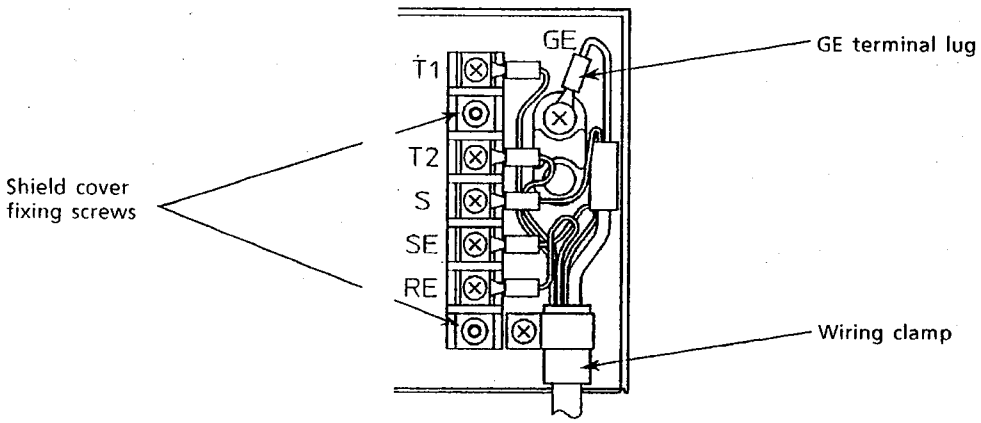


Figure 3.6 Sensor Cable Connection to Compact pH Controller

(3) Attach the sensor cable with the wiring clamp.
(4) Do not connect the GE terminal lug to anywhere other than GE terminal.
(5) Restore the shield cover removed in step (1). In doing this, take sufficient care not to pinch the sensor cable with the cover.

3.3.2 Terminal Box Connecting Cable Wiring

If a terminal box is to be used, connect it to the controller with the special cable attached to the terminal box. Connection to the pH controller applies in accordance with subsection 3.3.1.

In addition, the terminal box is used only when the compact pH controller is installed 5 or more meters away from the pH sensor (though limited up to 20 m).

3.3.3 Output Signal Cable Connection

This is wiring used to transmit the output signal of compact pH controller to a receiving instrument such as recorder, which is necessary only when pH controllers that outputs analog signals. For this wiring, use a two conductor shielded cable.

(1) Remove the terminal cover (see Figure 3.5) covering the power and output signal terminals. The terminal cover is mounted with two screws, so loosen these.
(2) Connect the cable to the terminals. End-treat the cable and properly connect the conductors to the corresponding terminals.
(3) Restore the terminal cover which was removed in step (1).

3.3.4 Contact Output Cable Connection

This is wiring for when the contact output is used. For this wiring, use a cable of two conductors (for one contact signal) to eight conductors (for four contact signals).

The same wiring procedure applies as in subsection 3.3.3.

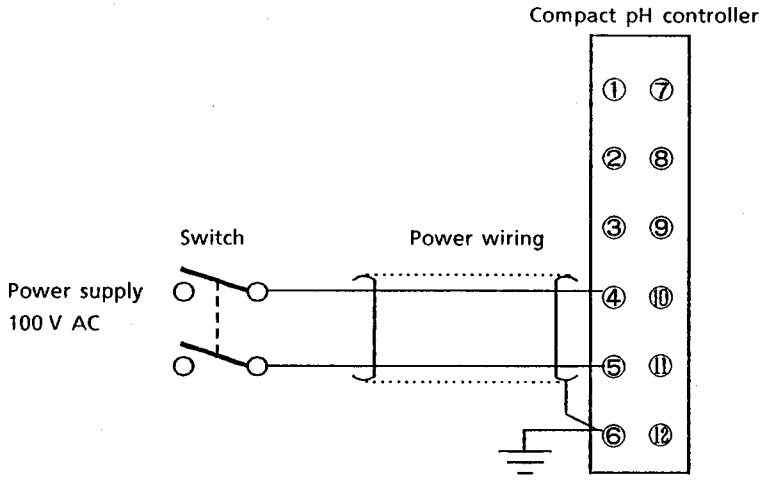
In addition, for low (low-low) limit contact output, the contact becomes ON (conductive status) when the measured value becomes lower than the low (low-low) setpoint, while for high (high-high) limit contact, the contact becomes ON (conductive status) when the measured value becomes higher than the high (high-high) setpoint.

3.3.5 Power and Ground Cable Connection

This is wiring to supply power of specified voltage to the compact pH controller as well as to ground (JIS class 3 grounding, grounding resistance 100Ω or less) the ground circuit in the controller. For this wiring, use a two conductor shielded cable.

The same wiring procedure applies as in subsection 3.3.3.

The compact pH controller does not incorporate a power switch. Thus, it is recommended to provide a switch (double pole type) in the power supply line.



Note: For 200 V AC supply, connect the cable to terminals ③ and ⑤.

Figure 3.7 Power and Ground Cable Connecting Terminals

4. OPERATION

4.1 Names and Functions of Front Face Components

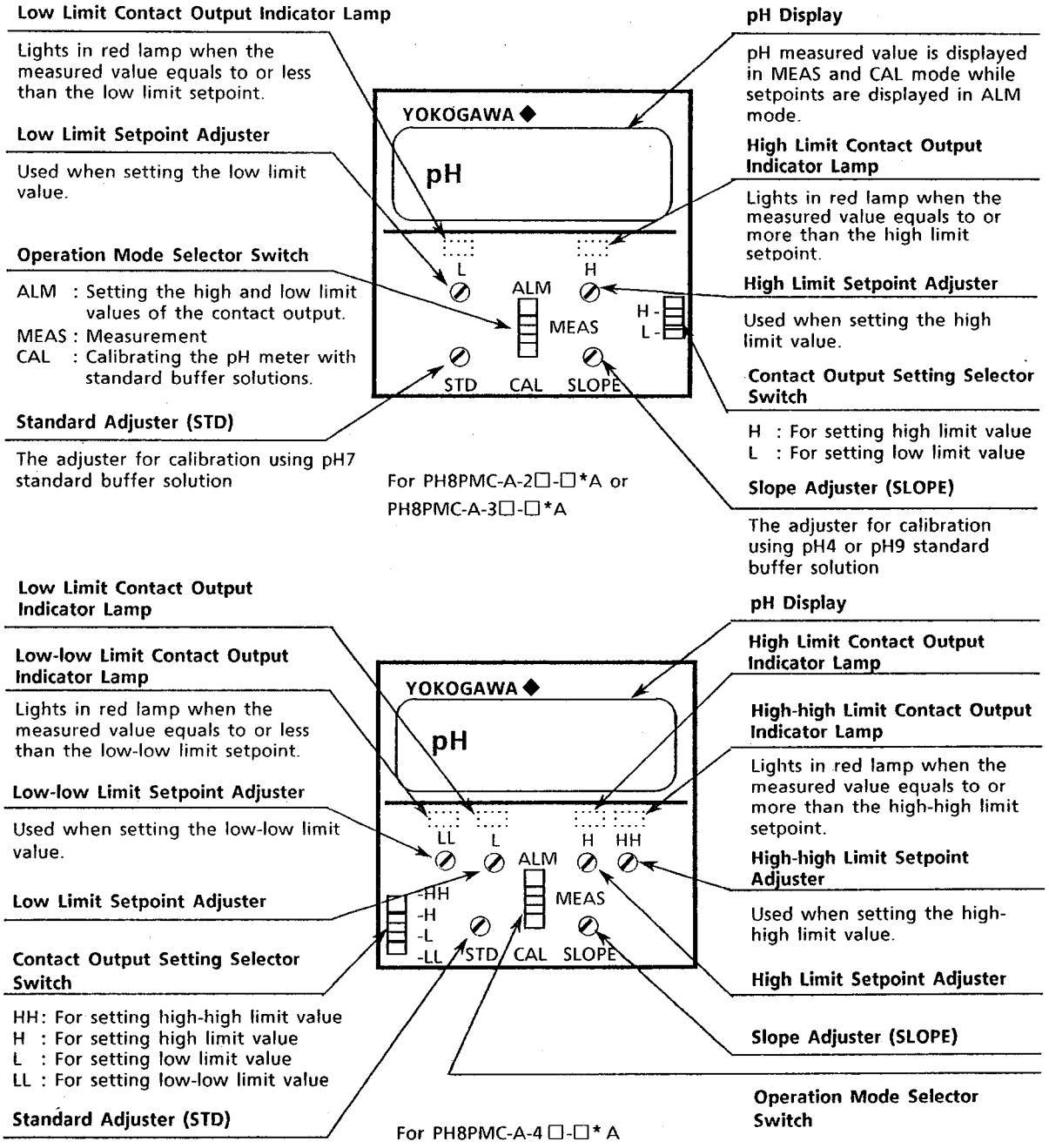


Figure 4.1 Names and Functions of Compact pH Controller Front Face Components

4.2 Start-up

4.2.1 Wiring Condition Checking

Check that all the wirings that are required are connected properly throughout the system.

Especially, examine the following points completely.

- Power supply that conforms to the pH controller specifications is obtained.
- A switch for turning ON and OFF power (double pole type) is provided in the power line.
- The case is grounded.
- Each conductor of the sensor cable are connected to the specified terminals.

4.2.2 Turning Power On

Supply power to the controller.

4.2.3 Setting Low and Low-Low Limits and High and High-High Limits

The compact pH controller includes the following three types of contact output: two contact outputs (high and low limits), three contact outputs (low limit, high limit, and low-low limit or high-high limit), and four contact outputs (low-low, low, high, and high-high limits).

Set the operating points of the contact outputs provided for your controller in the following procedure. Set the setpoints for low (low-low) and high (high-high) limits so that those values are increased in the order of the low-low, low, high, and high-high limits.

(1) Setting Low-low Limit Setpoint

(a) Place the operation mode selector switch in "ALM" position.

(b) Next select the low-low limit value setting mode "LL" of the contact output setting selector switch.

(c) If the setpoint being displayed is to be varied, adjust the low-low limit setpoint adjuster "LL" with a flat blade screwdriver to obtain the desired value. Numerical values increase when the adjuster is turned clockwise. The setting range is pH 0.0 to pH 14.0.

(d) If the pH value decreases below the low-low setpoint, the low-low limit contact output indicator lamp (red) is lit.

(2) Setting Low Limit Setpoint

(a) Place the operation mode selector switch in "ALM" position.

(b) Next select the low limit value setting mode "L" of the contact output setting selector switch.

(c) If the setpoint being displayed is to be varied, adjust the low limit setpoint adjuster "L" with a flat blade screwdriver to obtain the desired value. Numerical values increase when the adjuster is turned clockwise. Although the setting range is pH 0.0 to pH 14.0, pH values lower than the low-low limit setpoint cannot be set.

(d) If the pH value decreases below the low setpoint, the low limit contact output indicator lamp (red) is lit.

(3) Setting High Limit Setpoint

(a) Place the operation mode selector switch in "ALM" position.

(b) Next select the high limit value setting mode "H" of the contact output setting selector switch.

(c) If the setpoint being displayed is to be varied, adjust the high limit setpoint adjuster "H" with a flat blade screwdriver to obtain the desired value. Numerical values increase when the adjuster is turned clockwise. Although the setting range is pH 0.0 to pH 14.0, pH values lower than the low limit setpoint cannot be set.

(d) If the pH value increases above the high setpoint, the high-limit contact output indicator lamp (red) is lit.

(4) Setting High-high Limit Setpoint

(a) Place the operation mode selector switch in "ALM" position.

(b) Next select the high limit value setting mode "HH" of the contact output setting selector switch.

(c) If the setpoint being displayed is to be varied, adjust the high-high limit setpoint adjuster "HH" with a flat blade screwdriver to obtain the desired value. Numerical values increase when the adjuster is turned clockwise. Although the setting range is pH 0.0 to pH 14.0, pII values lower than the high limit setpoint cannot be set.

(d) If the pH value increases above the high-high limit setpoint, the high-high limit contact output indicator lamp (red) is lit.

4.2.4 Calibration Using Standard Buffer Solution

Calibrate the compact pH meter by measuring the standard buffer solutions whose pH values are clearly known so that each measured pH value agrees with the pH value given to each corresponding standard solution.

Carry out the calibration with standard buffer solutions in the following manner.

(1) Prepare pH4 and pH7 standard buffer solutions (*1) supplied in PH8AX accessories which you purchased separately and a thermometer for measuring the temperature of the solutions. Prepare also two clean empty beakers whose volumes are about 200 ml and pII sensor washing water such as purified water.

*1 : If you purchased reagent powder for standard buffer solutions, solve a pouch of powder into purified water to make a 500-ml solution.

(2) Pour about 50 to 100 ml of pH4 and pH7 solutions into each of the two empty beakers respectively.

(3) Select the operation mode selector switch position of CAL.

(4) Remove the pH sensor from the holder, wash the end of the sensor with purified water, and then wipe off any remaining water droplets.

(5) Dip the sensor end into the pH7 solution in the beaker.
If you purchased accessories with a sensor stand, mount the sensor stand onto a pipe (nominal 50A, equivalent to 2") and set the beaker containing standard buffer solution and the sensor as shown in Figure 4.2.

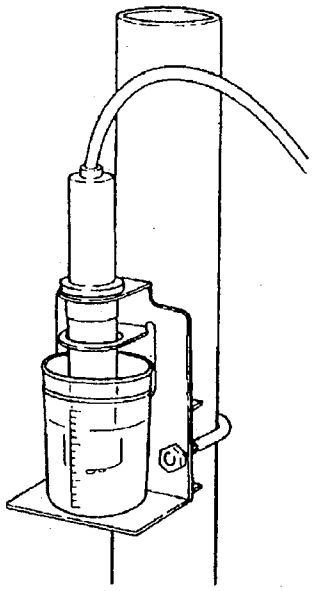


Figure 4.2 Use of Sensor Stand

(6) The pH values of pH standard buffer solutions vary with temperature.
Measure the temperature of the pH7 solution described in step (5) and determine the pH value at this temperature in Table 4.1.

Table 4.1 pH-Temperature Characteristics of pH Standard Buffer Solutions

Temp. °C / Std. buffer solution	0	5	10	15	20	25	30	35	40	45	50	55	60
pH 4	4.01	4.01	4.00	4.00	4.01	4.01	4.01	4.02	4.03	4.04	4.06	4.08	4.10
pH 7	6.98	6.95	6.92	6.90	6.88	6.86	6.85	6.84	6.84	6.83	6.83	6.84	6.84
pH 9	9.46	9.39	9.33	9.27	9.22	9.18	9.14	9.10	9.07	9.04	9.01	8.99	8.96

(7) Adjust the standard adjuster (STD) with a flat blade screwdriver so that the compact pH controller indicates the pH value examined in step (6). Numeric values increase when the standard adjuster is turned clockwise.

(8) Wash off any pH 7 standard buffer solution sticking to the pH sensor and then wipe off the remaining water droplets.

(9) Next, dip the sensor end into the pH 4 standard buffer solution in the beaker.
Measure the temperature of the pH 4 solution and examine the pH value at this temperature in Table 4.1.

(10) Adjust the slope adjuster (SLOPE) with a flat blade screwdriver so that the compact pH controller indicates the pH value examined in step (9). Numeric values increase when the standard adjuster is turned clockwise.

(11) Now the calibration work is completed. However, confirm that the compact pH controller correctly indicates the pH value of pH 7 standard buffer solution be repeating the operation from step (4) through step (7).

(12) Mount the pH sensor on the holder.

Note 1 : Measure the standard buffer solution temperature after temperatures of the solution and the sensor reaches an equilibrium and the pH indication becomes stable.

Note 2 : Discard the standard buffer solutions used at this time. The solutions not used at this time should be stored in a tightly-sealed container in a cool, dark place. In addition, solutions stored for a long term may change in pH value. Decide whether or not the stored solutions have deteriorated by comparing their pH values with those of the solutions newly made up using reagent powder.

Note 3 : For measuring alkaline solutions, it gives more accurate measured pH values to calibrate the meter using pH 9 standard buffer solution instead of the pH 4 solution.

4.2.5 Checking Normality of Solution to be Measured and Sensor Immersing Status

Prior to start steady-state operation, recheck the holder installing conditions and confirm that properties and conditions of the solution to be measured at the measuring point meet with conditions that conform to the use of pH sensor and the guide holder. If the guide holder for submersion type sensor is used, confirm that the sensor end is always dipped into the solution to be measured even if the liquid level varies.

The following shows the main check points.

(1) Temperature of Solution to be Measured

The PH8E□G pH sensor can be used in solutions of −5 to 105°C if the sensor end only is immersed and in solutions of −5 to 85°C if immersed up to the sensor cable. However, if the guide holder for submersion sensor made of unplasticized PVC resin is used, the maximum operation temperature is limited to 50°C and for that of polypropylene resin, the maximum temperature is 80°C.

(2) Immersion Depth of Sensor

When a sensor is immersed up to the sensor cable in solutions, such as in the submersion sensor mounted to the guide holder, the sensor immersion depth is limited to 3 m.

(3) Flow Speed of Solutions to be Measured

If a guide holder is used, the speed of solution flow at the measuring point is generally limited to a maximum of 2m / s.

Highly turbulent and pulsating flow should also be avoided.

4.3 Steady State Operation

When start-up procedures described in section 4.2 are completed, steady-state operation can be started. Put the whole pH measuring system in the status at steady-state operation.

Select the Operation Mode Selector Switch "MEAS" mode position and implement measurement.

In addition, pH values are displayed to the first place of decimals in MEAS mode. If a pH value display of two decimal places is required, execute measurement with the operation mode selector switch placed in CAL mode.

Note 1 : When the operation mode selector switch is placed in "CAL" position, note that the contact output is always carried in "OPEN" state.

Observe first the operating conditions for a certain time and then, after confirming that there is no abnormal point, start the steady-state operation.

Although no special operation is necessary in steady-state operation, it is important that calibration with standard buffer solutions and electrode cleaning should be periodically performed. Referring to section 5.1 "Periodical Maintenance", grasp the maintenance items required. These periods for maintenance to be implemented vary with each operating condition. It is recommended to collect data in early times of starting operation by performing maintenance a little frequently and to decide the longest necessary maintenance period for the purpose of maintaining performance based on the above data.

In addition to the periodical maintenance for maintaining performance, check for anomalies such as sealing O-ring corrosion or degradation.

5. MAINTENANCE

5.1 Periodical Maintenance

This controller can be inspected or undergo maintenance with power turned ON.

If contact signals are not desired to output when inspected or maintained, set the operation mode selector switch to "CAL" mode.

5.1.1 Electrode Cleaning

If pH sensor glass electrode and / or liquid junction are contaminated, this may cause unstable measured value, measured value drift, or slow response speed. Periodically clean the electrode.

For actual electrode cleaning details, see "Maintenance" in the Instruction Manual of the pH sensor model being used.

5.1.2 Calibration Using Standard Buffer Solution

The electromotive force of a pH sensor varies with the extent of glass electrode deterioration and also is affected by the glass electrode contamination. Since these factors lead to measurement errors, maintain the accurate pH measurement by periodically carrying out calibration with standard buffer solutions.

Period in which calibration with standard buffer solutions is performed greatly varies with operating conditions. At the start of operation, collect maintenance data from calibration, for example, every week and determine the calibration period based on the collected data.

If you have a portable precision pH meter (YOKOGAWA's product : PH81 or PH82 personal pH meter or equivalent), the frequency of calibration with a standard buffer solution can be reduced by utilizing the simple calibration using this portable pH meter. The simple calibration can be implemented by comparing the measured values by an accurately calibrated portable pH meter with those of compact pH controller. Adjust the slope adjuster (SLOPE) of the compact pH controller so that it indicates the same values as those of portable pH meter.

For actual calibration procedure with standard buffer solutions, see subsection 4.2.4 "Calibration Using Standard Buffer Solutions".

5.1.3 Checking KCl Solution for pH Sensor

If a KCl filling type pH sensor is used, replenish KCl solution when KCl in the reserve tank is about to be used up. If a KCl refillable pH sensor is used, replace the KCl solution inside the sensor before its concentration varies (*1).

For KCl solution replenishing procedure, see "Maintenance" of Instruction Manual for the pH sensor used.

*1 : Change in concentration affects the sensor electromotive force. Normally, replace KCl every 6 to 12 months.

5.2 Inspection and Maintenance for Preventing Troubles

5.2.1 Checking Seal O-Ring

Check O-rings for its deterioration that damages its sealing capability because O-rings are used in glass electrode and liquid junction.

However, note that checking so frequently may rather result in damaging sealing capability. When checking O-ring of the glass electrode, do not get the mounting hole wet.

Note : Use of the O-ring suggested by YOKOGAWA is recommended for replacement.

5.2.2 Checking KCl Solution Filling Tube

This is a check to be performed when the filling type pH sensor is used.

If the filling tube is damaged and KCl solution is leaking out of the damaged portion, a great deal of KCl solution will be lost. Check for deterioration or damage of the filling tube frequently and, if necessary replace it with a new tube.

6. TROUBLESHOOTING

6.1 Action to Take If Trouble Occurs

Symptom	Cause	Remedial Action
Significant Measurement Error	1. Temperature and flow speed of solution to be measured do not meet operating conditions.	1. Check and adjust points which do not meet the conditions.
	2. Glass electrode is contaminated.	2. Clean the electrode.
	3. Poor insulation in glass electrode mounting place.	3. Fully dry the electrode mounting hole. If O-ring is damaged, replace it with a new good one.
	4. Deterioration of glass electrode characteristics. (life)	4. Replace it with a good one. (Examine that replacement of glass electrode allows calibration with standard solution.)
	5. Liquid junction is clogged.	5. Clean. If it does not recover, replace it with a good one. For KCl filling type sensor, check also air in the filling tube.
	6. Change in sensor inner liquid concentration (for refillable type sensor, known by inner liquid life, for filling type sensor, known by measuring solution backflow.	6. For KCl refillable type sensor, replace the liquid in a determined procedure. For KCl filling type sensor, re-fill 3.3 M KCl solution after fully cleaning inside of sensor.
	7. Poor insulation of measuring circuit.	7. Remove moisture and dirt around cable-connected terminal board and recover insulation resistanceto $10^{11}\Omega$ or more.
	8. Compact pH controller electric circuit failure (when sensor is normal).	8. Repair or replace with a good one. Note : Compact pH controller failure confirmation: Remove conductors GE, RE, S and SE of sensor cable connected to the controller and short terminals GE and RE. Turn standard adjuster fully clockwise and counterclockwise. If indication reads only pH7 ± 1 or less, the circuit is failed.
	9. Sensor body failure	9. Replace it with a good one. (Contact YOKOGAWA.)
Contact out-put cannot be obtained from controller.	1. Relay failure in controller.	1. Replace it with a good one. (Contact YOKOGAWA.)
Measured value fluctuates	1. Measuring solution flow speed changes abruptly.	1. Examine and improve the key points.
	2. Glass electrode contamination	2. Clean electrode.
	3. Liquid junction clogging	3. Clean junction. If still not normal, replace it with a good one.
	4. Poor insulation of measuring circuit	4. Remove moisture and dirt around cable-connected terminal board and recover insulation resistance to $10^{11}\Omega$ or more.

Symptom	Cause	Remedial Action
Sluggish response	1. Measuring solution is not well replaced at measuring point. 2. Glass membrane of the glass electrode is in dried up. 3. Glass electrode is contaminated. 4. Liquid junction clogging	1. Examine it and improve. 2. Leave the glass electrode dipped in the solution for a while to wait for recovery of the performance. 3. Wash and clean the electrode. 4. Wash and clean the junction. If still not normal, replace it with a good one.
Abnormal indication	1. Insulation around the glass electrode mounting area is defective. 2. Glass electrode is defective. 3. Poor insulation of measurement circuit.	1. Dry the glass electrode mounting area. If the O-ring is damaged, replace it with a new one. 2. Replace the glass electrode with a good one. 3. Remove moisture and dirt around cable-connected terminal board and recover insulation resistance to $10^{11}\Omega$ or more.
No indication	1. Fuse in the controller internal assembly is blown. 2. Electronic circuit failure	1. Replace it with a new one. 2. Replace the circuit with a new one (contact YOKOGAWA).

6.2 Checking and Replacement of Fuse Inside Controller

When nothing is displayed with the power ON, a blown fuse (of the internal assembly) inside the controller may be suspected. Check it in the following procedures and if the fuse is blown, replace it with a new one.

(1) Remove all the leadwires connected to terminals in the rear.
(2) Remove the internal assembly mounting screw in the rear.
(3) The internal assembly can be drawn out from the controller case by pushing the terminal board portion forward. (The black bezel (about 15 mm wide) around the controller front panel is fixed to the case and thus cannot be pulled out by hand.)
(4) Check the fuse (see Figure 6.1) and if it is blown, replace it with a new one (rating 0.3 A, cartridge fuse of 30 mm long).

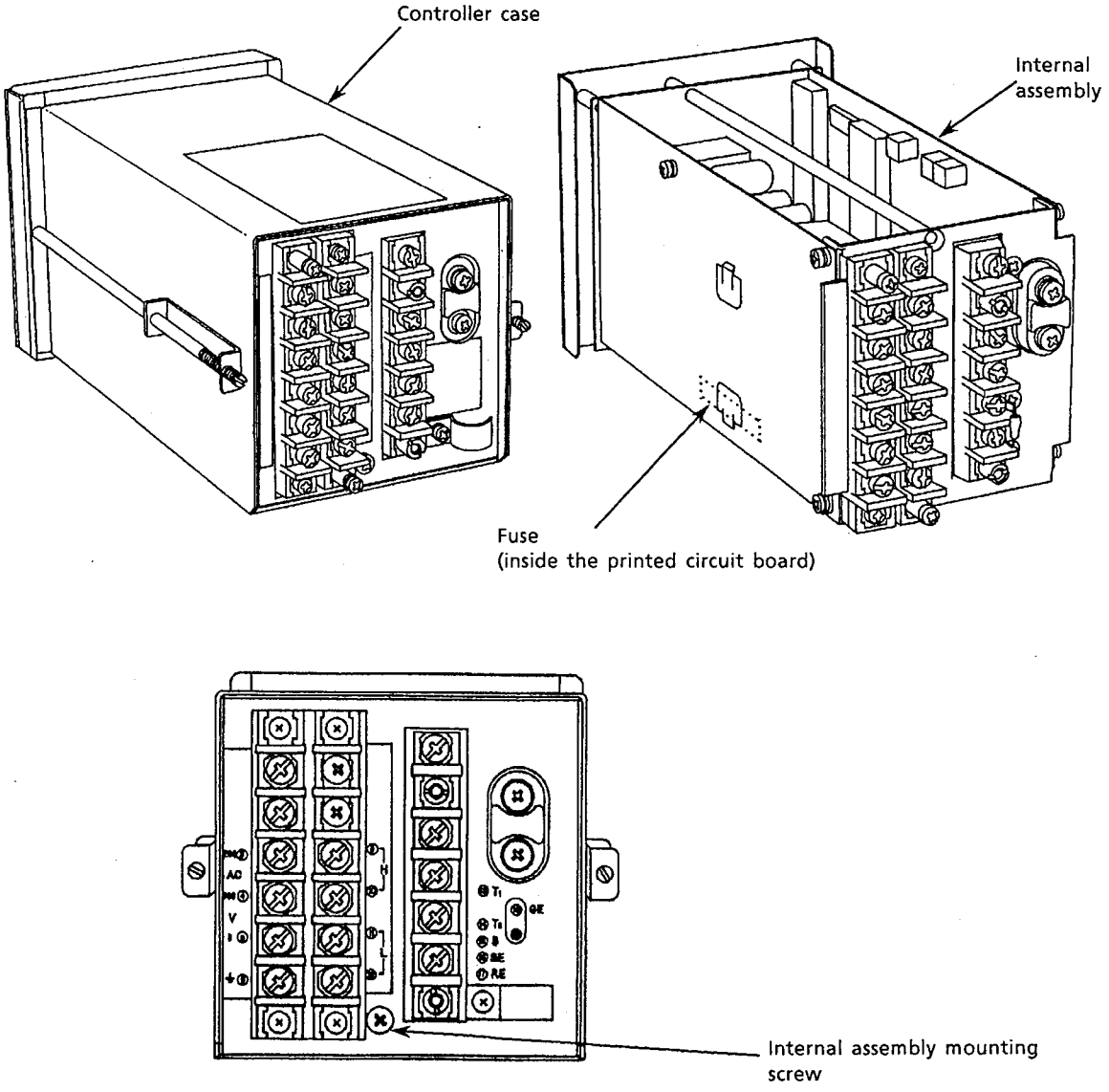
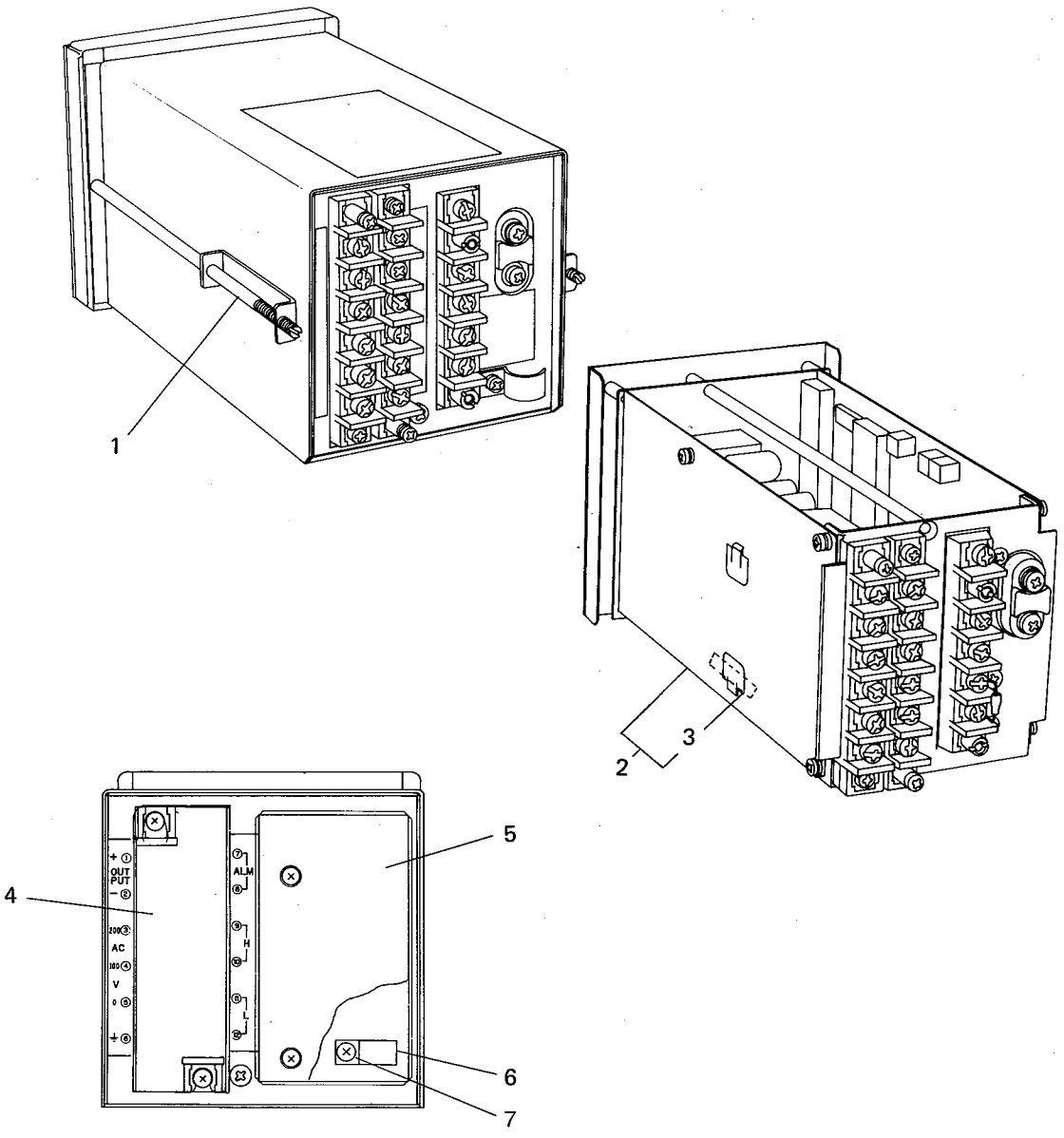


Figure 6.1 Location of Fuse Inside the Controller

Customer Maintenance Parts List

PH8PMC
Compact pH Controller

PHΣ



Item	Part No.	Qty	Description
1	K9310DA	2	Mounting Fitting
2	K9310DD	1	PCB Unit
3	S9514VK	1	Fuse
4	K9310DE	1	Terminal Cover
5	K9310DF	1	Shielding Cover
6	K9310DG	1	Clamp
7	K9310DH	1	Screw for Clamp

YOKOGAWA ◆
Yokogawa Electric Corporation

CMPL 12B5Y2-E

Model PH8TBG
TERMINAL BOX

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●	Customer Maintenance Parts List	CMPL 12B5W1−01E

1. SPECIFICATIONS.

The Model PH8TBG Junction Terminal Box is used to connect the pH sensor to related remote instrument.

1-1. General Specifications.

Construction: JIS raintight.
Case Material: Glass fiber reinforced polycarbonate resin.
Case Color: Gray (Munsell 2.5G5/1.5 or equivalent).
Weight:
Body: 0.5 kg.
Mounting Hardware: 0.7 kg.
Mounting:
Bracket mounting
Pipe mounting (mounting hardware must be specified)
Wall mounting (mounting hardware must be specified)
Ambient Temperature: −10 to 50°C.

Electrical Connection: Cable gland to be installed.
Sensor Cable Hole: 13 mm dia. punched out with a tool supplied.
Note: A JIS A8 watertight polycarbonate resin gland is installed on the sensor cable.
Other Cable Hole: 21 mm dia. punched out when wiring.
Note: A JIS A15 polycarbonate cable gland is supplied with the terminal box. A JIS PF 1/2 or 1/2 NPT female threaded conduit adaptor is supplied if specified at ordering time.

1-2. Model and Suffix Codes.

Model	Suffix Code		Description
PH8TBG	.....		Junction Terminal Box
	•A		Style A
Mounting Hardware	/P		Pipe mounting hardware
	/W		Wall mounting hardware
Signal Cable Length	/C□		□: 03 for standard (3 m), 07 (7 m) and 10 (10 m)
Conduit Adaptor		/ATBG..	JIS PF 1/2 female thread
		/ATBN..	1/2 NPT female thread

1-3. External Dimensions.

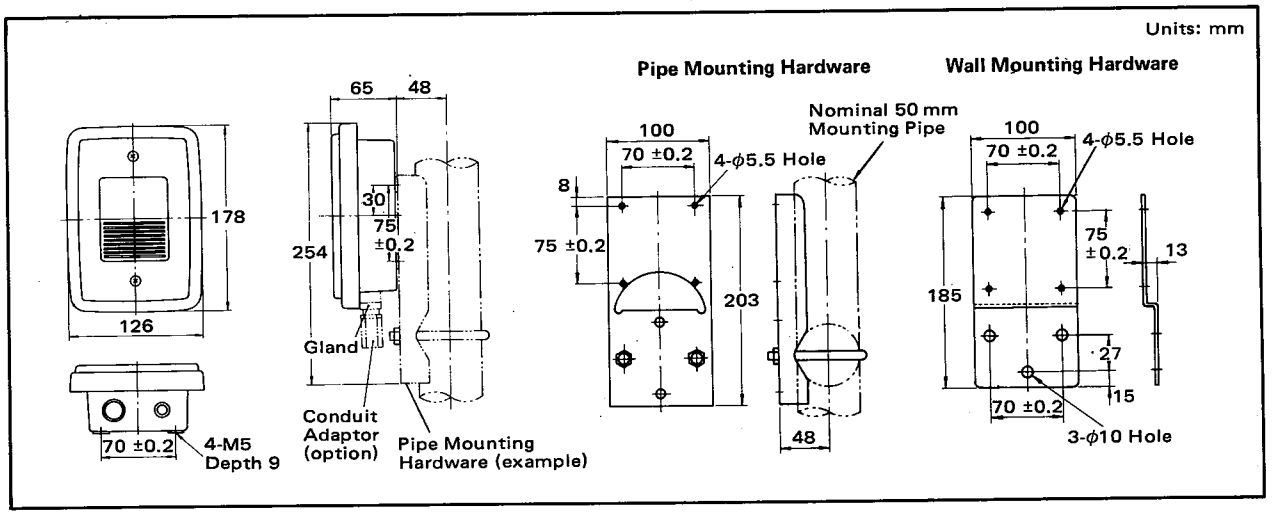


Figure 1-1. External Dimensions of Junction Terminal Box.

2. INSTALLATION.

2-1. Mounting.

2-1-1. Installation Site.

Since the junction terminal box is raintight construction, it can be installed outdoors. However, it should be installed as near to the pH sensor as possible.

2-1-2. Mounting Method.

The junction terminal box can be mounted on a bracket, 50 mm pipe, and wall surface. The pipe mounting and wall mounting types require optional mounting hardware which must be specified when ordering.

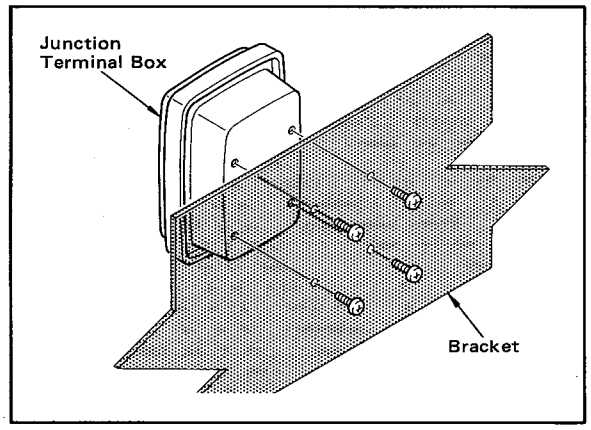


Figure 2-1. Bracket Mounting.

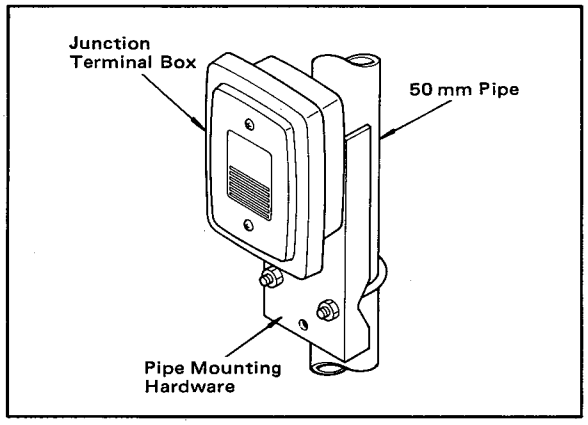


Figure 2-2. Pipe Mounting.

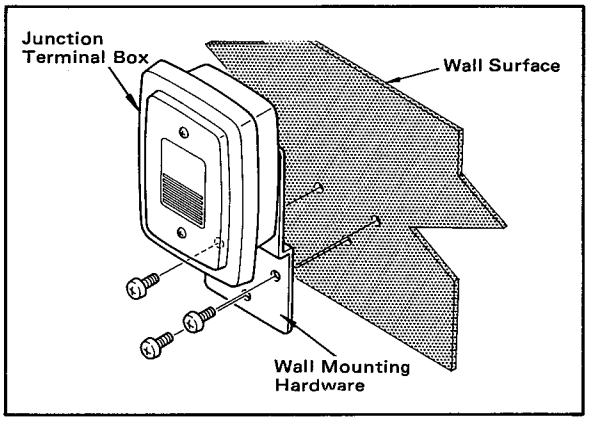


Figure 2-3. Wall Mounting.

2-2. Wiring.

The terminal board in the junction terminal box connects the sensor cable and pH converter cable, pH transmitter cable or compact pH controller cable.

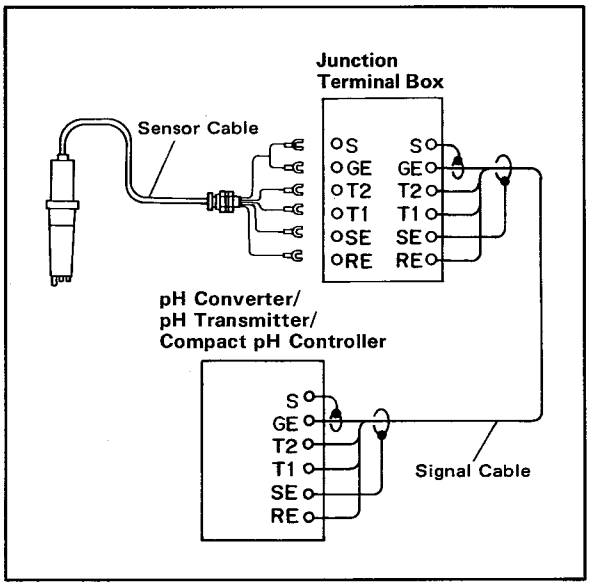


Figure 2-4. Wiring Diagram.

2-2-1. Punching Out Wiring Holes.

The wiring holes are semi-punched on the bottom of the junction termial box as shown in Figure 2-5. Puch out only the necessary holes using the tool supplied.

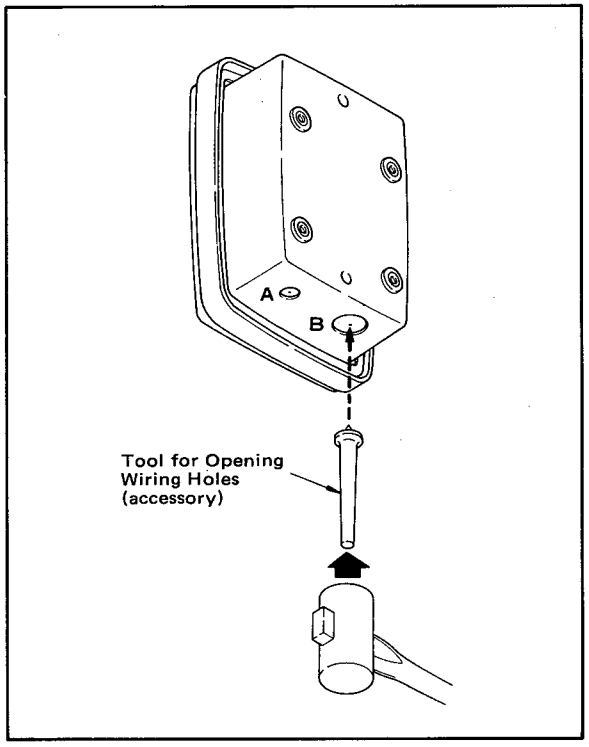


Figure 2-5. Opening Holes.

2-2-2. Sensor Cable Connection.

(1) Loosen two screws on the the terminal box front panel and remove the cover.
(2) First remove the nut from the sensor cable gland, then pull the cable into the internal assembly through the wiring hole.
(3) Pass the cable through the nut. Correctly connect each conductor to the corresponding terminal observing conductor marking.

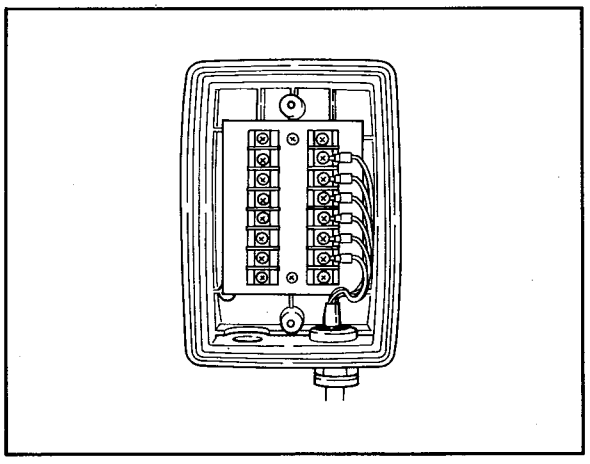


Figure 2-6. Sensor Cable Connections.

(4) Mount the cable gland on the wiring hole (see Figure 2-7). Attach the nut in position and tighten the gland firmly with the gland nut loosened to prevent the cable twisting.
When the gland is mounted, tighten the gland nut firmly on the gland to keep out moisture. However, if the gland nut is secured too tight, the cable may be damaged.

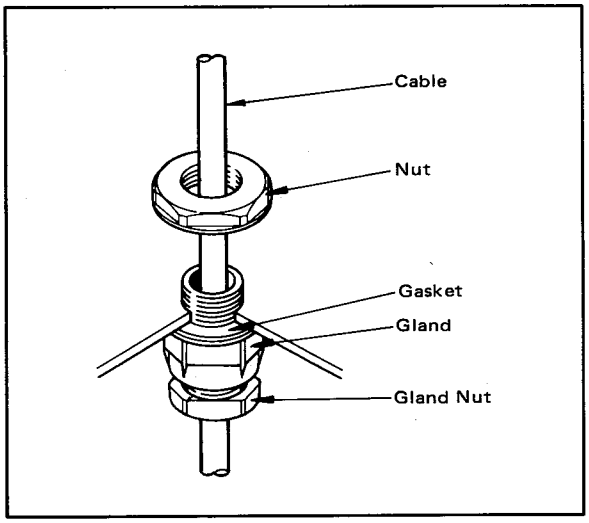


Figure 2-7. Cable Gland.

2-2-3. Junction Cable Connection.

Connect between the junction terminal box and pH converter, pH transmitter or compact pH controller with the junction cable whose length is specified by the user.

If the junction cable is protected by a conduit pipe, remove packing glands from cable glands for the junction terminal box and pH converter or pH transmitter, and mount conduit adaptors (supplied) instead.

(1) First disassemble the cable gland supplied, then pass the junction cable through the gland nut (or adaptor), cable holding ring, packing, gland body, and gasket in that order. Mount the nut to the wiring hole after passing the cable into the junction terminal box. The cable of a heat-shurinkable tube covered area must be fixed with the cable gland.
(2) After passing the cable into the terminal box, correctly connect each cable conductor to the corresponding terminals.
(3) After completing the wiring, firmly mount the cable gland in the wiring hole. Place the nut to the desired position and screw the gland body securely. After the gland body is fixed, firmly install the gland packing or conduit adaptor to keep out moisture.

(4) After completing the wiring, replace the junction terminal box cover. Tighten all cover mounting screws to keep out moisture from the case.
(5) If the cable is protected by a conduit pipe, screw the conduit union to the conduit adaptor.

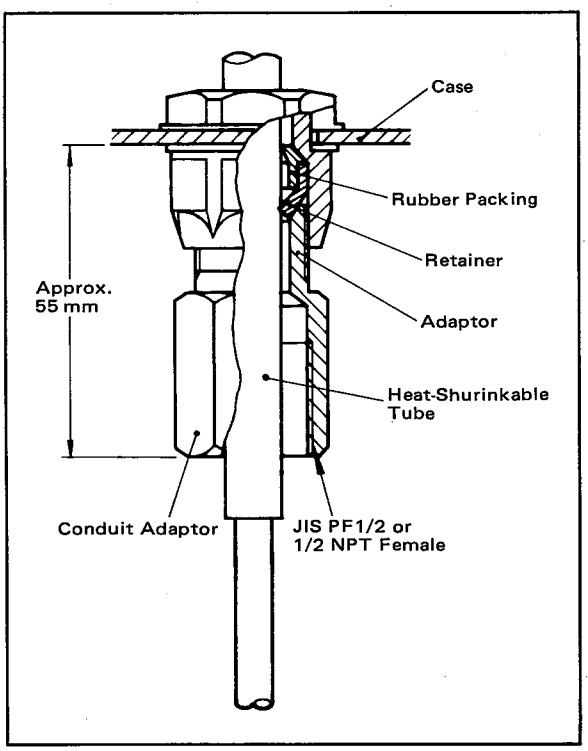
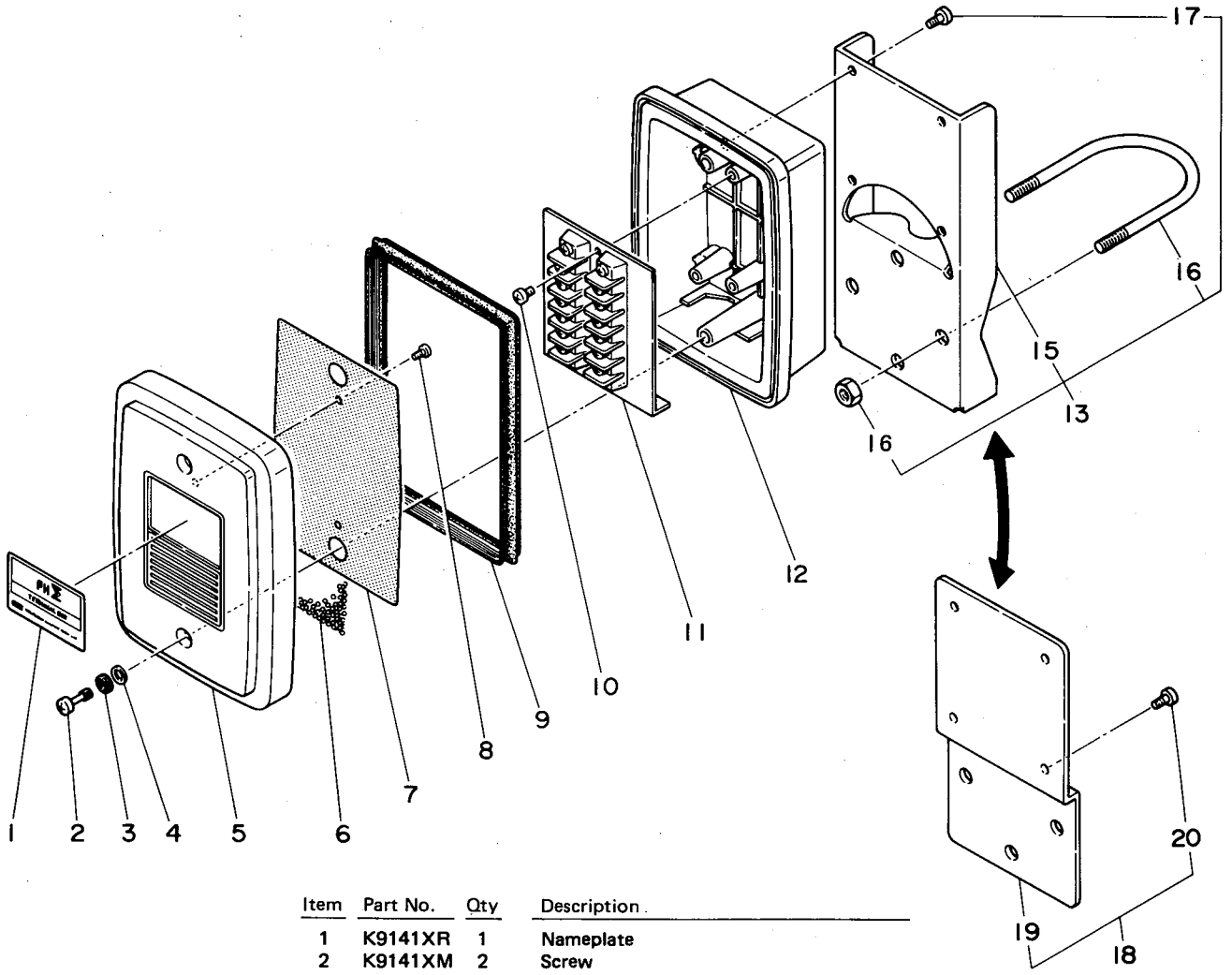


Figure 2-8. Conduit Pipe Adaptor.

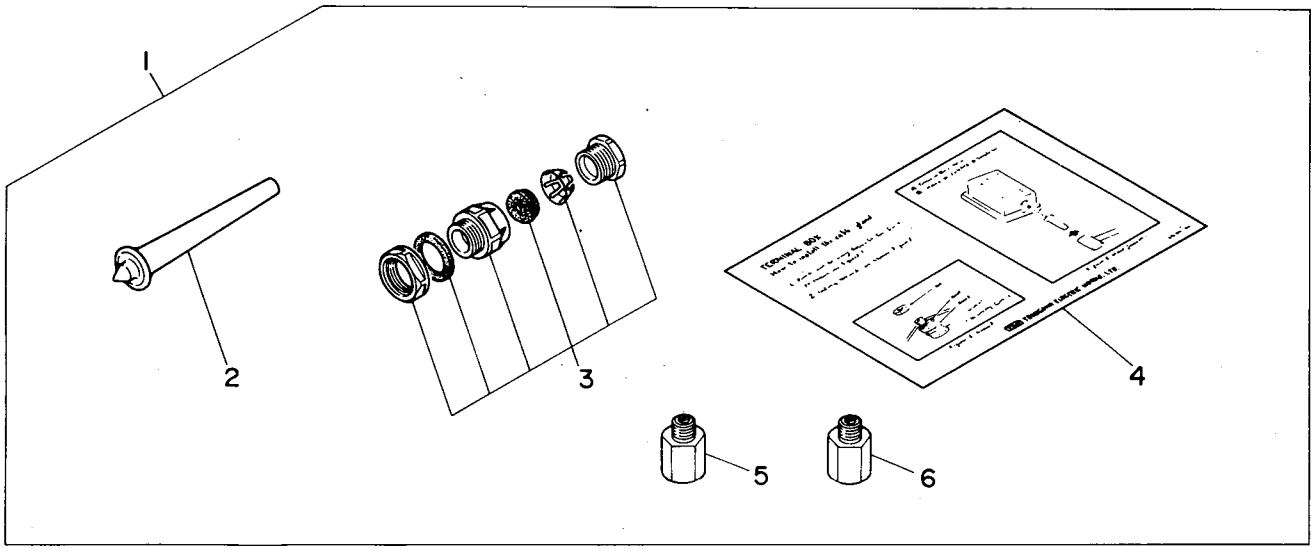
Customer Maintenance Parts List

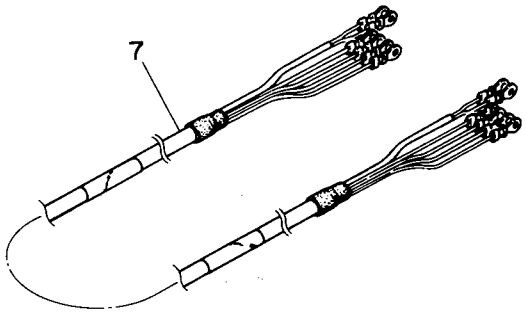
Model PH8TBG
Terminal Box

PHΣ



Item	Part No.	Qty	Description
1	K9141XR	1	Nameplate
2	K9141XM	2	Screw
3	K9141XN	2	Gasket
4	G9303NB	2	O-Ring
5	K9141XD	1	Case
6	K9020XR	1	Desiccative
7	K9141XT	1	Plate
8	Y9304LB	2	B.H. Screw, M3 x 5
9	K9141XQ	1	Gasket
10	Y9405LB	2	B. H. Screw, M4 x 5
11	K9141YA	1	Terminal Assembly
12	K9141XA	1	Case
13	K9141SA	1	Bracket Assembly (for pipe mounting)
15	K9141SB	1	Bracket
16	D0117XL-A	1	U-Bolt and Nut
17	Y9508JU	4	Pan H. Screw, M5 x 8
18	K9141SC	1	Bracket Assembly (for wall mounting)
19	K9149SC	1	Bracket
20	Y9508JU	4	Pan H. Screw, M5 x 8





Item	Part No.	Description	Item 1 Grand Assembly	
			K9141TE	K9141UE
2	K9141SR	Punch	1	1
3	L9811CV	Grand	1	1
4	K9141ST	Sheet	1	1
5	K9141TN	Fitting		1
6	K9141TP	Fitting		1

Item	Part No.	Qty	Description
7	Below	1	Cable Assembly
	K9141ZK		Cable length 1m
	K9141ZL		Cable length 2m
	K9141ZM		Cable length 3m
	K9141ZN		Cable length 4m
	K9141ZP		Cable length 5m
	K9141ZQ		Cable length 6m
	K9141ZR		Cable length 7m
	K9141ZS		Cable length 8m
	K9141ZT		Cable length 9m
	K9141ZU		Cable length 10m

Model PH8ERG
pH SENSOR (KCℓ refillable type)

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3.	**USE OF pH SENSOR**	B1−8
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•	**PARTS LIST**	PL 12B5K1-01

1. SPECIFICATIONS.

The Model PH8ERG pH Sensor (KCℓ refillable type) permits no KCℓ solution outflow from its liquid junction and is easy to maintain.

The sensor can be installed in a PH8HF flow-through type holder, in a PH8HS submersion type holder, or it can be used alone suspended in the solution (maximum depth 3 m).

1-1. General Specifications.

Measured Item: pH of water solution.
Measuring Principle: Glass electrode method.
Measuring Range: 2 to 12 (pH).
Weight: Approx. 0.4 kg (including cable 3 m long).
Type of Installation:
Suspended freely by cable
Suspended in guide pipe
In flow-through type holder
In submersion type holder
Wetted Part Materials:
Body: Polyphenylene sulfide resin (PPS resin).
Grounding Electrode: Titanium or Hastelloy C.
Glass Electrode (changeable): Glass, PPS resin, Fluorocarbon rubber (O-ring).
Liquid Junction (changeable): Ceramic, PPS resin, Fluorocarbon rubber (O-ring).
*Cable Sheath: Polyethylene chroride rubber.
Note: * Cable sheath is not wetted when it is installed in a flow-through or submersion type holder.
Cable Specifications: Four-conductor composite low noise cable.
Outside Diameter: Approx. 6.5 mm.
Cable Length: 3 m or 5 m (must be specified).

Operating Conditions:
Solution Temperature: −5 to 80°C.
Note: The maximum operating temperature is also limited by the types and materials of the holder being used.
Solution Pressure: Maximum 2 kg/cm^2 (applies only when the sensor is installed in a flow-through type holder).
Operating Solution Depth: Maximum 3 m (when the sensor and sensor cable are submerged in solution).
Solution Flow Velocity: Maximum 2 m/s.
Solution Flow Rate: 3 to 11 ℓ/min. (when the sensor is installed in a flow-through type holder).
Solution Conductivity: Min. 50 μS/cm.
Note
If any of the following conditions apply to the solution, installed the sensor in a flow-through type or submersion type holder.
- 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 or hydrogen sulfide gas, etc.).
- When the solution contains a few percent of organic solvent or oil.

Properties: Response time (for 90% response); Less than 10 seconds (when the pH sensor and buffer solution are both at 20°C).

1-2. Model and Suffix Codes.

Model	Suffix Code	Description
PH8ERG	. . . . .	KCℓ Refillable Type pH Sensor
Cable Length	-03	3 m
	-05	5 m
Grounding Electrode Material	-TN	Titanium
	-HC	Hastelloy C
Intrinsic Safety Rating	-N	Always N
System Type	-C . . .	Field type pH system
	-P . . .	Compact pH meter
	-T . . .	Two-wire transmission type pH system
	*A	Style A

1-3. External Dimensions.

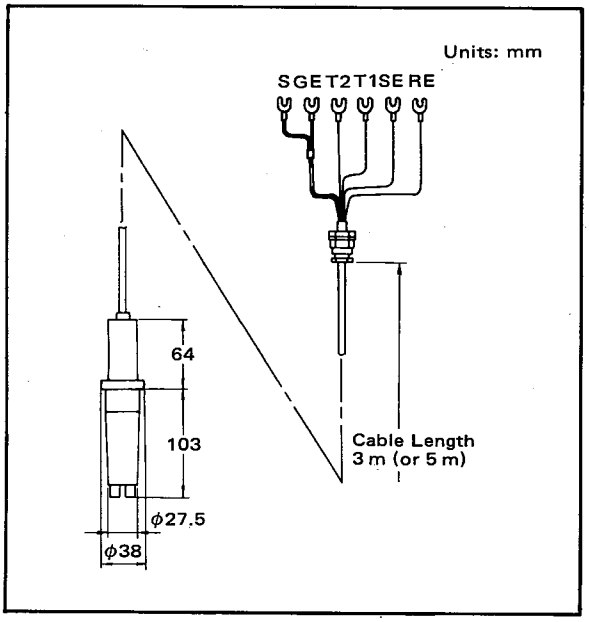


Figure 1-1. External Dimension of Refillable Type Sensor.

2. INSTALLATION.

2-1. Preparation for Installation.

2-2-1. Unpacking and Visual Inspection.

The Model PH8ERG pH sensor is well packed at the factory so as to prevent damage during shipment.

After removing the sensor from its shipping container, visually check the sensor for damage.

Note: Do not remove the "liquid junction", because this may cause inner liquid outflow. Leave the protective cap on the tip of the pH sensor until the sensor is installed, or the "liquid junction" and the "glass electrode" may dry out.

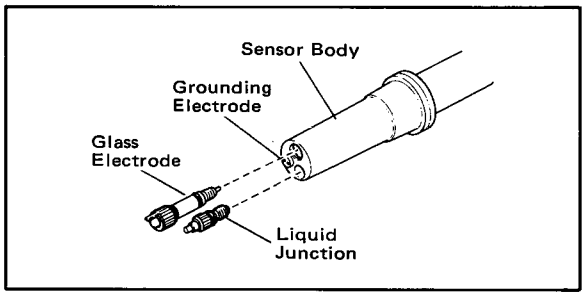


Figure 2-1. Names of Sensor Components.

2-1-2. Holder Installation.

Usually, the pH sensor is suspended in a guide pipe or installed in a flow-through or submersion type holder.

First install the holder.

2-1-3. Installation of Associated Equipment.

Confirm that associated equipment (e.g. pH converter, two-wire transmitter, junction terminal box or compact pH controller) which is to be connected to the pH sensor cable has been installed.

Table 2-1. Devices to be Connected to Sensor Cable.

pHΣ System	Combination Devices
Compact pH Meter	PH8PMC Compact pH controller or PH8TBG Terminal box
Field Mounting pH Meter	PH8FG pH converter or PH8TBG Junction terminal box
pH Meter with Two-wire Transmitter	PH8FT□ Two-wire transmitter or PH8TBG Junction terminal box

2-2. pH Sensor Installation.

2-2-1. Sensor Installation in the Guide Pipe.

(1) Connect the sensor cable to the associated equipment. Correctly connect the sensor cable as per Section 2-3.

(2) Attach the stopper supplied with the guide pipe to the sensor cable. Fix the sensor cable by fixing the cable clamp so that the sensor tip projects 2 to 3 cm from the pipe end when the pH sensor is suspended in the guide pipe as shown in Figure 2-2.

Note: If the sensor tip does not project from the pipe end, the measured value may not respond quickly to the pH variation of the measured solution. This may cause problems for measurement or control. On the other hand, if the sensor tip projects too far from the pipe end, the force on the sensor (due to the measured solution) may damage the sensor cable by chafing it against the pipe.

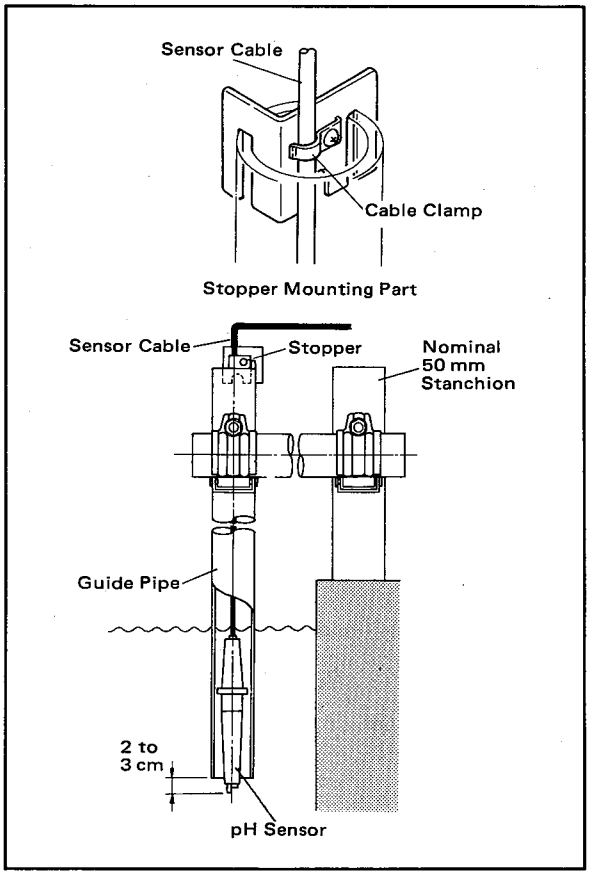


Figure 2-2. Sensor Installation in the Guide Pipe.

2-2-2. Sensor Installation in the Submersion Type Holder.

(1) Pass the sensor cable through the sensor holder. If a submersion type holder has been installed, remove the sensor holder temporarily. For a pipe mounting submersion type holder without cleaner, loosen the nut on the right angled pipe clamp to remove the holder (see Figure 2-3).

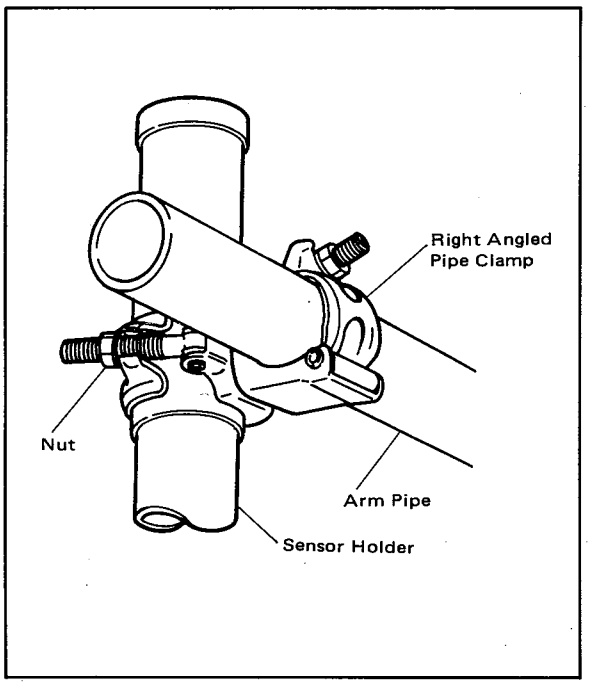


Figure 2-3. Sensor Holder Removal (Pipe Mounting Type).

For a flange mounting submersion type holder without cleaner, remove the sensor holder by loosening the two bolts fixing the sensor holder to the flange (see Figure 2-4).

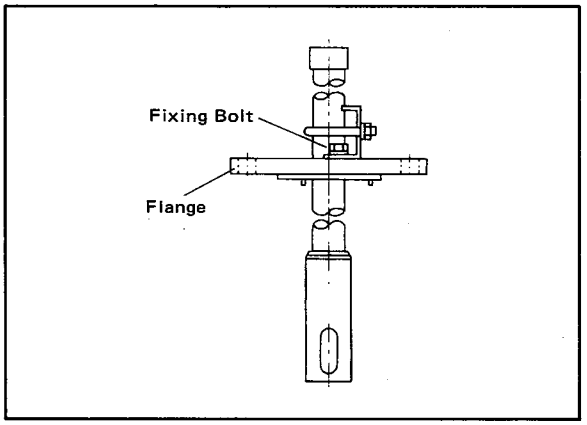


Figure 2-4. Sensor Holder Removal (Flange Mounting Type).

For a submersion type holder with cleaner, both pipe mounting and flange mounting holders may be removed by loosening the clamp of the cleaner holder and sliding it upwards. (see Figure 2-5).

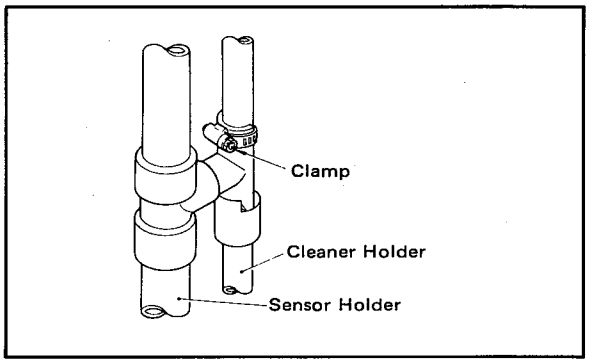


Figure 2-5. Sensor Holder Removal (with Cleaner).

To install the sensor cable in a submersion type holder, first remove the protector screwed onto the sensor holder end and remove the sponge (part for shipment, this is not necessary after the sensor is installed in the holder). Pass the sensor cable through the O-ring then attach the O-ring to the sensor flange.

When passing the sensor cable through the holder, if the holder has stains or waterdrops inside, be careful to use such means as convering the sensor cable and with a polyethylene bag, etc. to keep the cable dry.

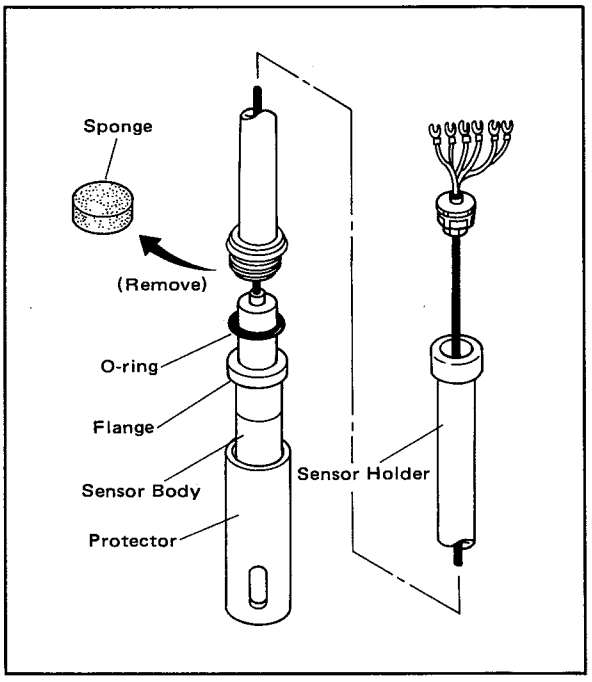


Figure 2-6. Sensor Cable Installation.

(2) Connect the sensor cable to the associated equipment. Correctly connect as per Section 2-3.
(3) Screw the protector on the sensor holder to fix the sensor in the holder. Remove the protective cap on the pH sensor tip. Screw the protector securely on the sensor holder so that the flange of the sensor body compresses the O-ring firmly (see Figure 2-7).

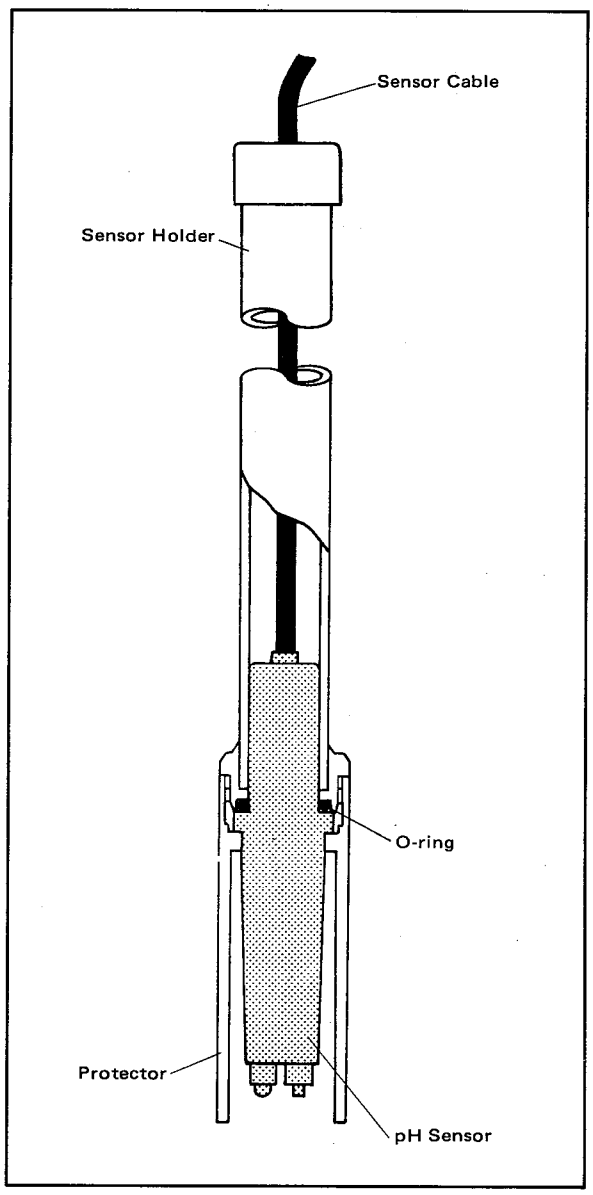


Figure 2-7. Sensor Installation (Submersion Type).

(4) Remount the sensor holder on the mounting pipe, flange or cleaning holder.

2-2-3. Sensor Installation in a Flow-Through Type Holder.

(1) Connect the sensor cable to the associated equipment. First. remove the sensor fixing nut and pass the sensor cable through the nut (see Figure 2-8). Correctly connect as per Section 2-3.

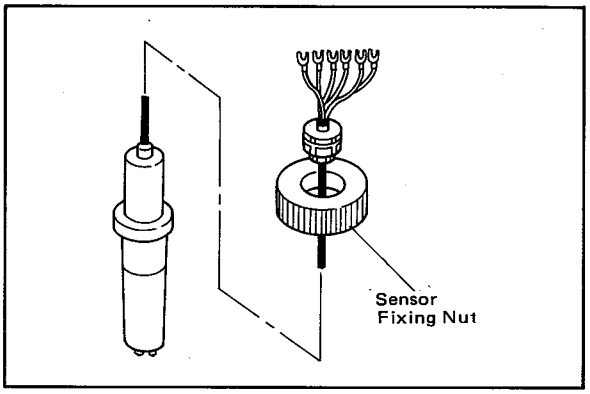


Figure 2-8. Preparation for Sensor Cable Connection.

(2) Fix the pH sensor in the holder. Remove the protective cap from the sensor and remove the sponge (part for shipment, this is not necessary after the sensor is installed in the holder) from the holder. Confirm that the "liquid junction" and the "glass electrode" are firmly screwed into the sensor body. Insert the sensor tip in the holder and firmly tighten the sensor fixing nut on the holder (see Figure 2-9).

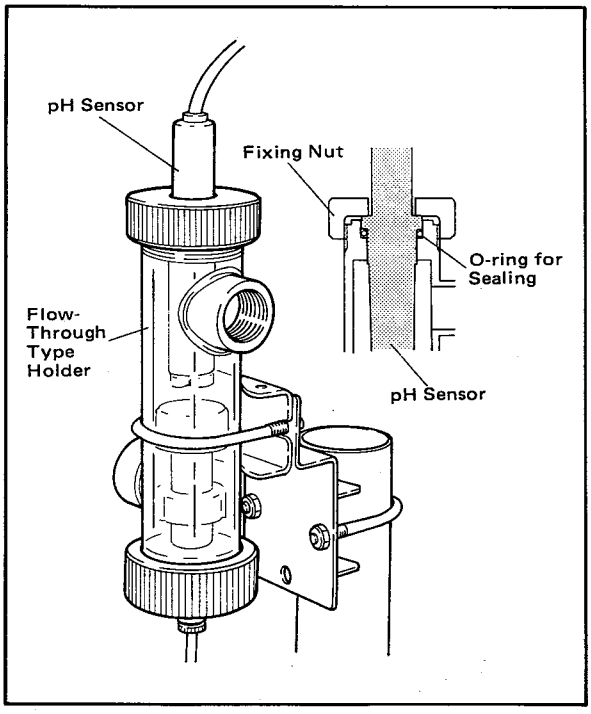


Figure 2-9. Sensor Installation (Flow-Through Type Holder).

2-3. Sensor Cable Connection.

2-3-1. When the Cable is to be Connected to the Model PH8TBG Terminal Box

(1) Open the wiring hole to the terminal box. A semi-punched wiring hole is provided in the case bottom. Place the tip of the tool – supplied with the terminal box – on the semi-punched hole edge and tap the tool end gently using a hammer as shown in Figure 2-10.

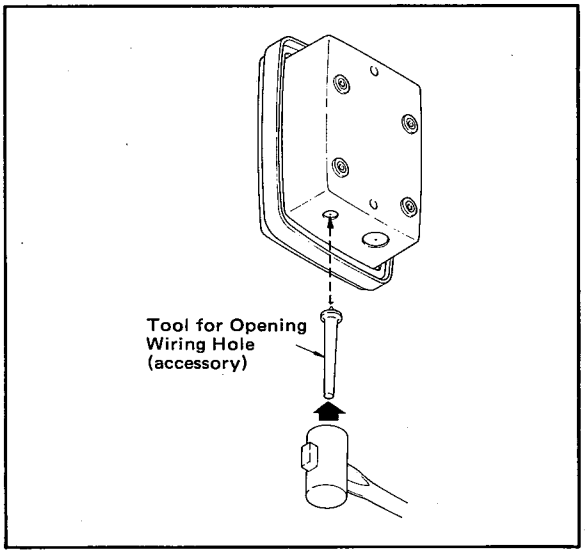


Figure 2-10. Opening Wiring Hole.

(2) Loosen two screws on the terminal box front panel and remove the cover.

(3) Connect the sensor cable to the terminal box terminals. First, remove the nut from the cable gland, then pull the cable into the internal assembly through the wiring hole. Pass the cable through the nut. Correctly connect each conductor to the corresponding terminal, observing conductor marking (see Figure 2-11).

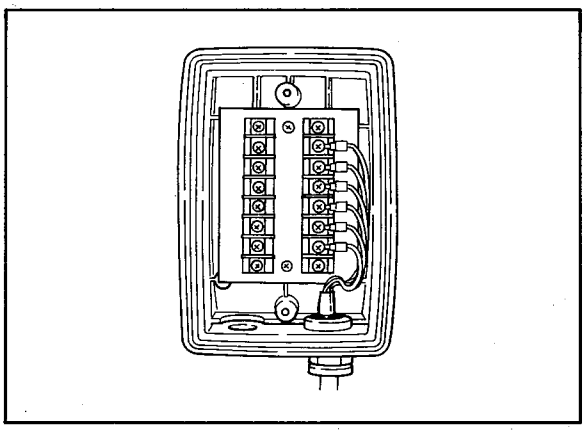


Figure 2-11. Sensor Cable Connection to Terminal Box.

(4) Mount the cable gland in the wiring hole (see Figure 2-12). Attach the nut in position and tighten the gland firmly. When tightening the gland nut, be careful not to twist the cable. When the gland is mounted, tighten the gland nut firmly on the gland to keep out moisture. However, if the gland nut is screwed too tight, the cable may be damaged.

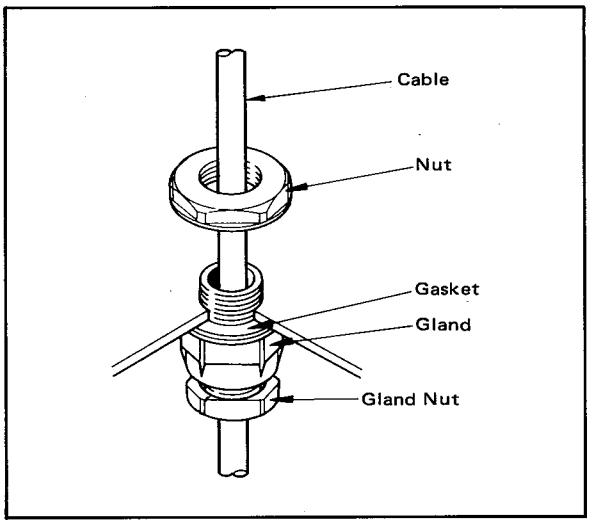


Figure 2-12. Cable Gland Installation.

(5) After completing the wiring, firmly replace the terminal box cover. Confirm that there are no stains or water drops on the waterproof packing part of the case.

2-3-2. When the Cable is to be Connected to the Model PH8FC pH Converter.

(1) Open the wiring hole to the pH converter. A semi-punched wiring hole is provided in the case bottom. Place the tip of the tool supplied with the pH converter on the semi-punched hole edge and tap the tool end gently using a hammer as shown in Figure 2-10.

(2) Loosen two screws on the pH converter front panel by turning them counterclockwise with your hands to remove the cover. Remove the plate covering the sensor cable connecting terminals located in the right side of the case. The plate is fixed with two screws.

(3) Connect the sensor cable to the converter terminals. First, remove the nut from the cable gland, then pull the cable into the internal assembly through the wiring hole. Pass the cable through the nut. Correctly connect each conductor to the corresponding terminal observing conductor marking.

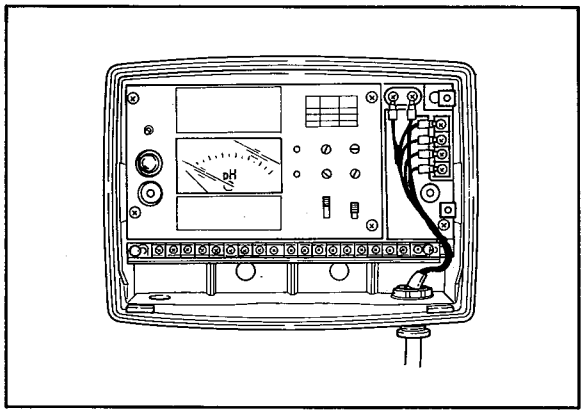


Figure 2-13. Sensor Cable Connection to pH Converter.

(4) Reassemble the plate – which has been removed in item (2) – as it was.
(5) Mount the cable gland on the wiring hole. After inserting the gland into the wiring hole, tighten the nut securely. When the gland is mounted, tighten the gland nut firmly on the gland to keep out moisture. However, if the gland nut is screwed too tight, the cable may be damaged.
(6) After completing the wiring, firmly replace the pH converter cover. Confirm that there are no stains or waterdrops on the waterproof packing part of the case.

2-3-3. When the Cable is to be Connected to the Model PH8PMC Compact pH Controller

Connect cables to the compact pH controller in the following manner.

(1) Remove the shield cover (covering the sensor cable terminals) at the rear of the compact pH controller by loosening two screws fixing the shield cover.
(2) Connect the sensor cable to their terminals. Confirm each conductor symbol and properly connect each conductor to the corresponding terminal.

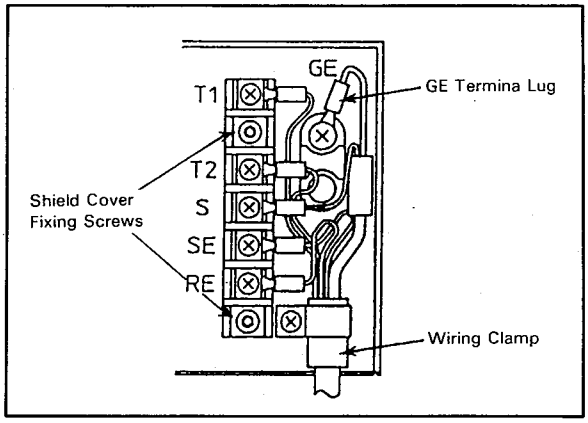


Figure 2-14. Sensor Cable Connection to Compact pH Controller

(3) Fix the sensor cable with the siring clamp.
(4) Do not connect the GE terminal lug to places other than GE terminal.
(5) Restore the shield cover once removed in step (1). In doing this, take sufficient care not to pinch the sensor cable with the cover.

2-3-4. When the Cable is to be Connected to the Model PH8FT□ Two-Wire Transmitter.

(1) Turn the two-wire transmitter cover counterclockwise and remove it.
(2) Connect the sensor cable to the transmitter terminals. First, remove the nut from the cable gland, pull the cable into the internal assembly through the wiring hole on the front panel right side. Correctly connect each conductor to the corresponding terminal observing conductor marking (see Figure 2-15).

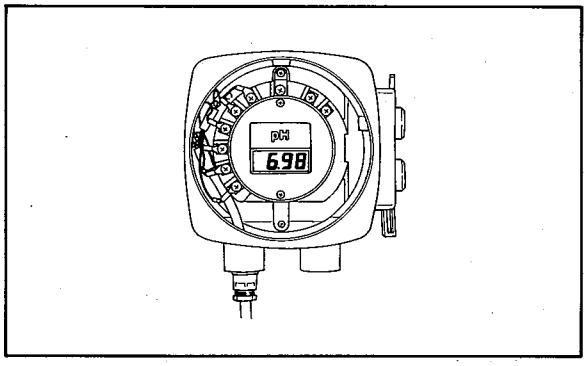


Figure 2-15. Sensor Cable Connection to Two-Wire Transmitter.

(3) Mount the cable gland on the wiring hole. The nut which has been removed in item (2) is not necessary. Screw the gland body securely into the wiring hole (see Figure 2-16). In this case, loosen the gland nut so as not to twist the cable. When the gland is mounted, tighten the gland nut firmly on the gland to keepout moisture. However, if the gland nut is screwed too tight, the cable may be damaged.

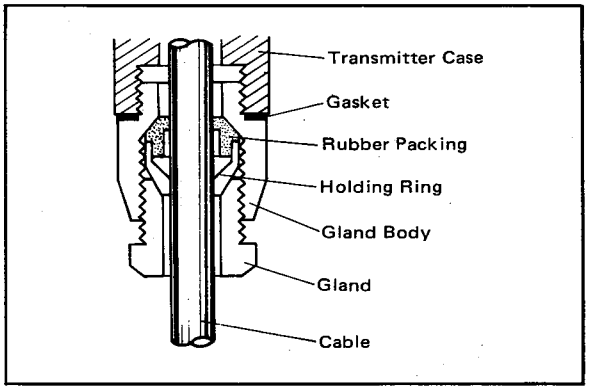


Figure 2-16. Two-Wire Transmitter Cable Inlet.

(4) After completing the wiring, firmly, replace the two-wire transmitter cover. Confirm that no stains sticks to the O-ring for sealing of the cover.

3. USE OF pH SENSOR.

3-1. Operation and Periodical Maintenance.

3-1-1. Buffer Solution Calibration.

Calibrate with buffer solution before starting normal operation because the emf of the glass electrodes differ a little from each other.

The emf of the glass electrode gradually changes due to electrode staining and electrode deterioration. Therefore, the buffer solution calibration must be performed periodically within a given period to keep the measurement error within tolerance.

Refer to the Section "OPERATION" in the instruction manul of the pH indicator, pH converter or two-wire transmitter for instructions for buffer solution calibration.

3-1-2. Cleaning the "Glass Electrode" and "Liquid Junction".

Staining of the glass electrode or liquid junction can cause measurement error. Consequently, if the measured solution tends to stain the electrode, the glass electrode and liquid junction must be cleaned periodically – the period depending on the degree of staining.

Clean the glass electrode and liquid junction as per the following procedure:

- **Stains due to suspended solids, sticky material or microbes, etc.**

Using soft tissue paper, wipe the stains off the glass electrode and liquid junction. Further, clean off the remaining stains by rinsing with water.

- **Stains due to oily material.**

Wash off the stains by submerging in a neutral detergent solution in a beaker, etc.

- **Chemical stains such as due to metallic adsorption.**

Submerge the "glass electrode" and the "liquid junction" in a diluted hydrochloric acid solution (1 to 2%) for several minutes (acid washing).

When the pH sensor is used while it is installed in a holder with cleaner, the sensor is continuously (for ultrasonic cleaner) or intermittently (for jet or brush cleaner) cleaned automatically. Therefore, sensor cleaning is usually not necessary. However, if the sensor characteristics are affected by chemical staining, e.g. when the sensor is used for pH measurement of a highly alkaline solution, carry out acid washing.

3-1-3. Replacing Internal Solution.

The cconcentration of the KCℓ solution slowly decreases, since the KCℓ solution diffusing from the liquid junction cannot maintain its saturated concentration. Replace the sensor internal solution before its concentration begins to decreases – because if it decreases, the sensor characteristics will be affected.

The replacement period varies depending on the operating conditions. For example, the greater the temperature change or the higher the temperature of the measured solution, the quicker the KCℓ solution diffuses from the liquid junction and the more frequently the KCℓ solution should be replaced.

Furthermore, besides the KCℓ concentration of the internal solution, when the internal solution is contaminated by ions from the measurement solution, the sensor characteristics are affected. The rate of contamination of the internal solution depends on the measurement solution properties.

For the reasons above, the solution replacement period is not fixed. However, in general, replacement must be carried out once every half to one year.

Replace the internal solution as per the following procedure:

(1) Use the "Internal solution set (part No. K9142 UT)" which you have purchased as a spare part. If you haven't purchased this, prepare approx. 12 g of KCℓ powder and approx. 50 mℓ of pure water and a clean syringe (or 20 mℓ injector).

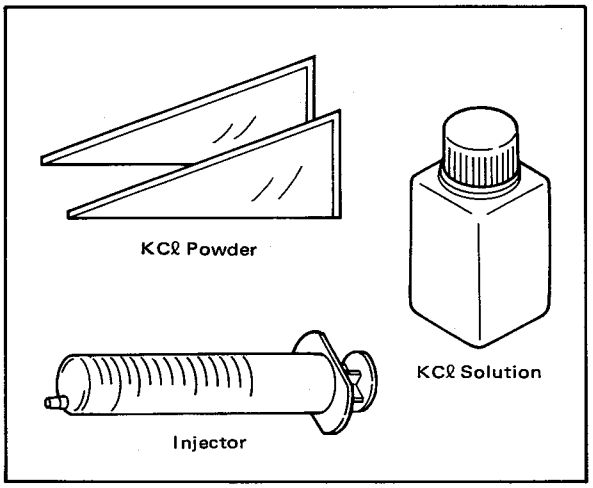


Figure 3-1. Internal Solution Set (K9142UT).

(2) Remove the sensor from the holder and wipe off the stains from the sensor tip.
(3) Remove the liquid junction but leave the glass electrode installed firmly.
(4) Discharge the sensor body internal solution from the liquid junction mounting hole.
(5) Clean the "internal solution compartment". Inject about 10 mℓ of KCℓ solution (or pure water) into the liquid junction mounting hole and throughly shake the sensor body. Discharge the liquid.
(6) Pour approximately 10 to 12 g KCℓ powder into the "internal solution compartment". When using KCℓ powder from the internal solution set, use one bag of the powder. Cut off the bag tip with scissors and pour the KCℓ powder into the "internal solution compartment" as shown in Figure 3-2. If the KCℓ powder in the bag have hardened, crumple the bag throughly.

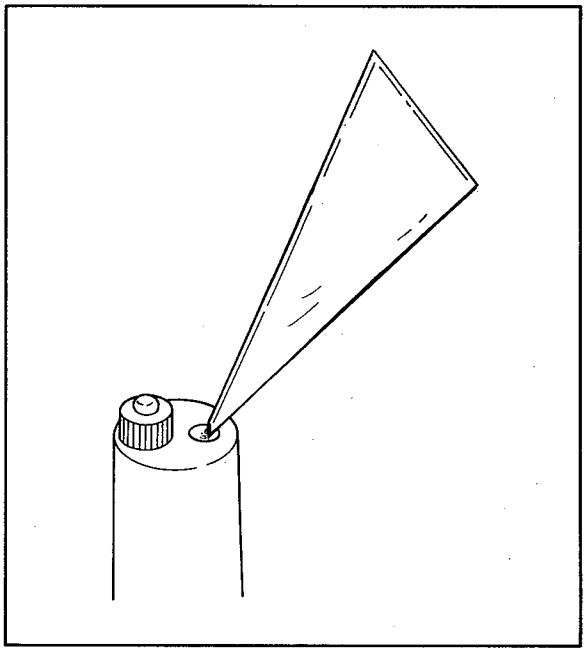


Figure 3-2. KCℓ Powder Pouring.

(7) Pour the KCℓ solution (or pure water) into the "internal solution compartment" until it overflows from the liquid junction mounting hole. Take care that no air remains in the "internal solution compartment".
(8) Reassemble the liquid junction – which has been removed on item (3). In general, carry out buffer solution calibration.

3-2. Worn Out Part Replacement.

3-2-1. Glass Electrode Replacement.

When buffer solution calibration becomes impossible due to deterioration of the glass electrode, replace it with a new electrode. After the glass electrode is replaced, always carry out buffer solution calibration. However, a glass electrode whose glass membrane has dried out does not show stable properties until some time after immersion in solution. Submerge the electrode in water for about 30 minutes to stabilize its characteristic before carrying out buffer solution calibration.

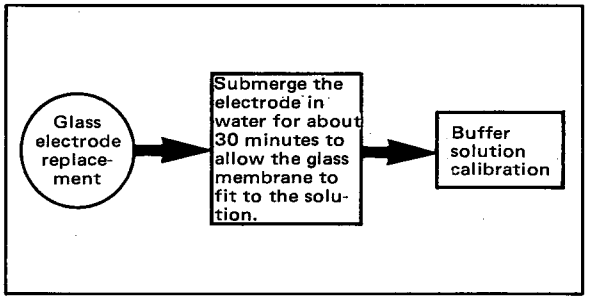


Figure 3-3. Treatment after Glass Electrode Replacement.

3-2-2. Liquid Junction Replacement (see Figure 3-4).

Even after washing the liquid junction, if normal measurement is impossible, replace the liquid junction.

The sensor body "internal solution compartment" must be filled with KCℓ solution so that no air space remains in the compartment. When replacing the liquid junction, before mounting a new one in the sensor, replenish the 3.3 M KCℓ solution (higher concentration solution or powder may be used) until the internal solution overflows from the liquid junction mounting hole.

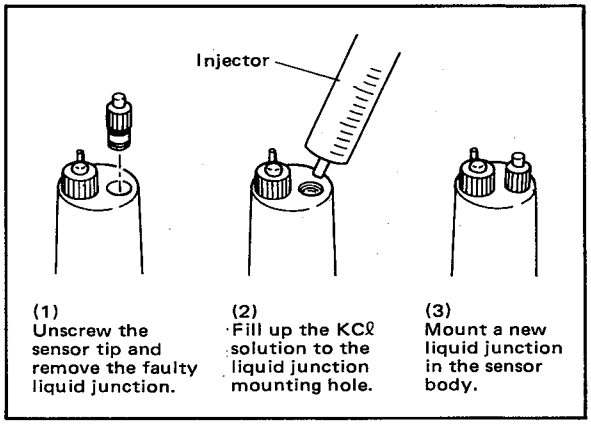


Figure 3-4. Liquid Junction Replacement.

3-2-3. Replacing O-ring to Seal "Glass Electrode" (see Figure 3-5).

As the inside of the glass electrode mounting hole must have high insulation resistance, a FPM O-ring – with superior chemical and heat resistance – is used for sealing. Except for special use, this O-ring lasts a long time, so in general, the O-ring does not need replacement. If any change – which might cause trouble – is detected in the O-ring, as a rule, replace it together with the glass electrode.

If the O-ring deteriorates faster than the glass electrode, the O-ring alone may be replaced, however, in this case, use the O-ring recommended by Yokogawa. When installing the O-ring, wind a slip of paper or tape around the screw on the glass electrode and be careful not to scratch the O-ring – such scratches may prevent sealing.

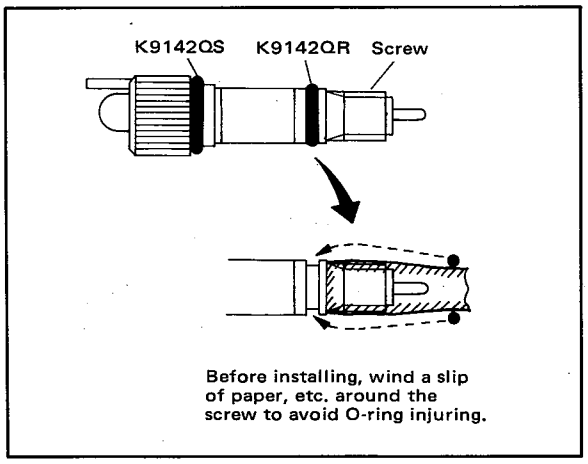


Figure 3-5. Installing the O-ring.

3-2-4. Sensor Body Replacement.

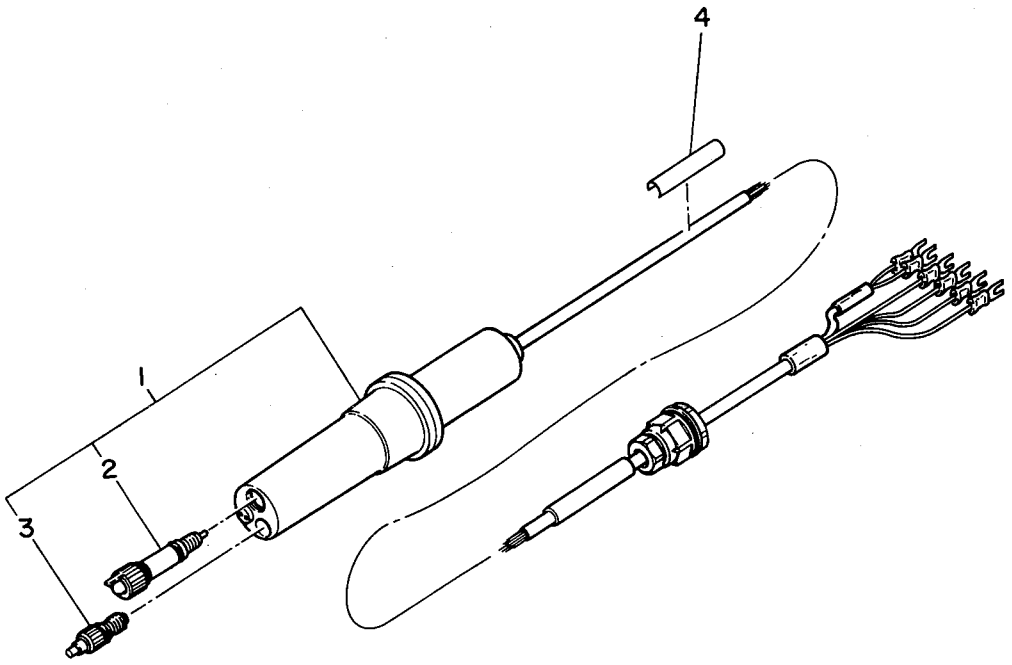
The life of the sensor body depends on the deterioration of the reference electrode installed in it.

When a faulty part cannot be found at all even when the cause of abnormarity is clearly in the pH sensor, replace the sensor body.

Parts List

PHΣ

Model PH8ERG
KCℓ REFILLABLE pH SENSOR



Item	Part No.	Qty	Description
1	Below	1	Body Assembly
	K9142CA		For Model PH8ERG-03-TN
	K9142CB		For Model PH8ERG-05-TN
	K9142CC		For Model PH8ERG-03-HC
	K9142CD		For Model PH8ERG-05-HC
2	K9142TN	1	Glass Electrode Assembly
—	K9142QR	1	O-Ring, 6 mm ID X 9 mm OD
—	K9142QS	1	O-Ring, 9 mm ID X 12 mm OD
3	K9142TH	1	Junction Assembly
—	K9142QR	1	O-Ring, 6 mm ID X 9 mm OD
4	K9142RB	1	Nameplate

YOKOGAWA
Yokogawa Electric Corporation

Model PH8EFG
pH SENSOR (KCℓ filling type)

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1. SPECIFICATIONS.

The Model PH8EFG pH Sensor (KCℓ filling type) permits stable pH measurement even for the solutions having comparatively severe properties. The sensor can be installed in a PH8HF flow-through type holder, in a PH8HS submersion type holder, or it can be used alone suspended in the solution (maximum depth 3 m).

1-1. General Specifications.

Measured Item: pH of water solution.
Measuring Principle: Glass electrode method.
Measuring Range: 0 to 14 (pH).
Weight: Approx. 0.4 kg (including cable-3 m long).
Type of Installation:
Suspended freely by cable
Suspended in guide pipe
In flow-through type holder
In submersion type holder
Operating Temperature: −10 to 50°C.
Note: Must not be below −10°C for preventing the KCℓ solution in the reserve tank frozen.
Wetted Part Materials:
Body: Polyphenylene sulfide resin (PPS resin).
Grounding Electrode: Titanium or Hastelloy C.
Glass Electrode (changeable): Glass, PPS resin, Fluorocarbon rubber (O-ring).
Liquid Junction (changeable): Ceramic, PPS resin, Fluorocarbon rubbers (O-ring).
*Cable Sheath: Polyethylene chroride rubber.
*KCℓ Solution Supply Tube: Heat-resistant non-rigid polyvinyl chroride resin.
Note: The parts marked with * are not wetted when they are installed in a flow-through or submersion type holder.
Cable Specifications: Four-conductor composite low noise cable.
Outside Diameter: Approx. 6.5 mm.
Cable Length: 3 m or 5 m (must be specified).

Operating Conditions:
Solution Temperature:
−5 to 80°C (when the sensor and sensor cable are submerged).
−5 to 105°C (when the sensor tip only is submerged).
Note: The maximum operating temperature is also limited by the types and materials of the holder being used.
Solution Pressure: Atmospheric pressure, however, maximum 5 kg/cm^2 when the sensor is installed in a flow-through type holder and the KCℓ solution reserve tank for medium pressure is used.
Operating Solution Depth: Maximum 3 m (when the sensor and sensor cable are submerged in solution).
Solution Flow Velocity: Maximum 2 m/s.
Solution Flow Rate: 3 to 11 ℓ/min. (when the sensor is installed in a flow-through type holder).
Solution Conductivity: Minimum 50 μS/cm.
Note
If any of the following conditions apply to the solution, install the sensor in a flow-through type or submersion type 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 or hydrogen sulfide gas, etc.).
- When the solution contains a few percent of organic solvent or oil.

KCℓ Solution Consumption: Maximum 3 mℓ/day (pressurized with 0.1 kg/cm^2).
Properties: Response time (for 90% response); Less than 10 seconds (when the pH sensor and buffer solution are both at 20°C).

1-2. Model and Suffix Codes.

Model	Suffix Code	Description
PH8EFG	. . . . .	KCℓ Refillable Type pH Sensor
Cable, KCℓ Tube Length	-03	3 m
	-05	5 m
Grounding Electrode Material	-TN	Titanium
	-HC	Hastelloy C
With KCℓ Reserve Tank	-TT1	General purpose type (contains 250 mℓ KCℓ solution)
	-TT2	Medium pressure type
Without KCℓ Reserve Tank	-TN1	Spare sensor for TT1
	-TN2	Spare sensor for TT2
Intrinsic Safety Rating	-N	Always N
System Type	-C	Field type pH system
	-P	Compact pH meter
	-T	Two-wire transmission type pH system
	*A . .	Style A
	/K	With pH certification according to Japanese Measurement Laws

1-3. External Dimensions.

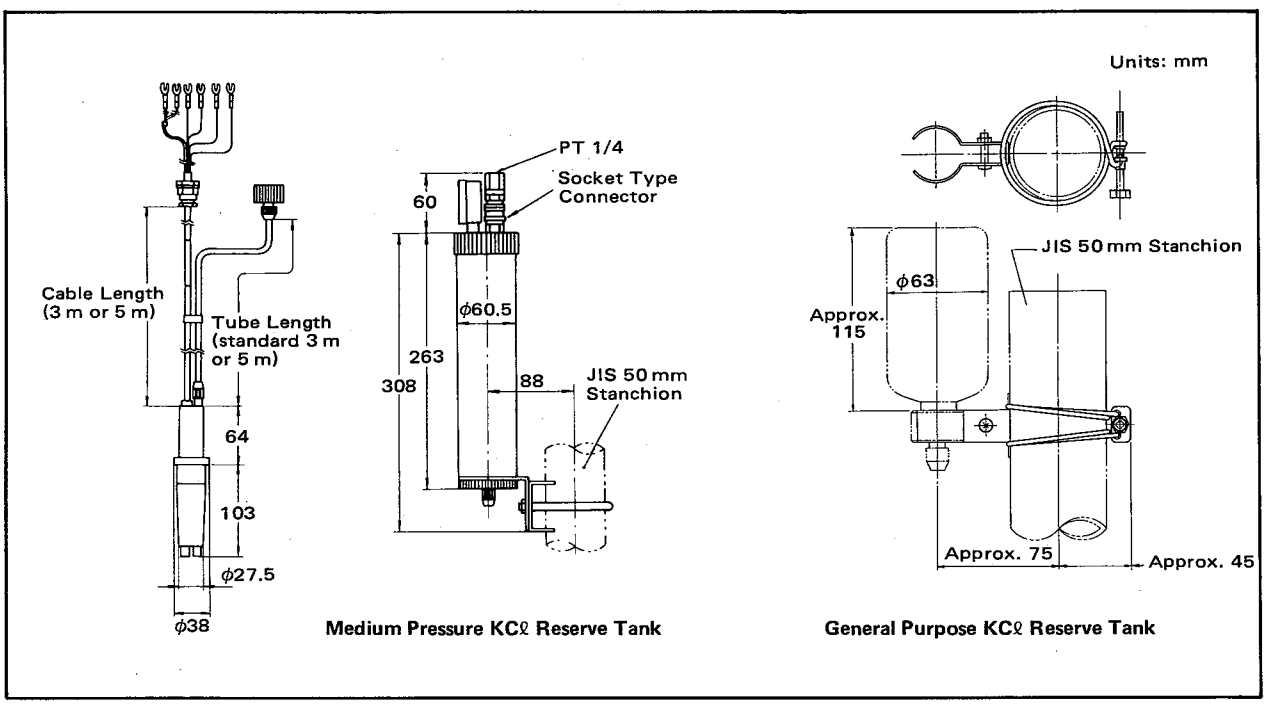


Figure 1-1. PH8EFG pH Sensor (KCℓ Filling Type).

2. INSTALLATION.

2-1. Preparation for Installation.

2-1-1. Unpacking and Visual Inspection.

The Model PH8EFG pH sensor is well packed at the factory 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 "glass electrode" and the "liquid junction" are packed separate from the sensor body.
2. So that the "liquid junction" does not dryout do not take unpack it at this time.

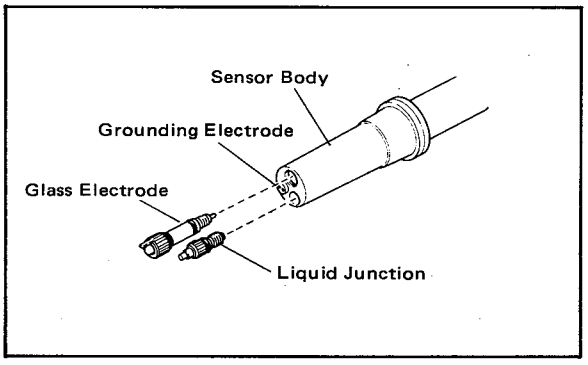


Figure 2-1. Names of PH8EFG pH Sensor Components.

2-1-2. Mounting Glass Electrode.

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

(1) Peel off the seal convering to the electrode mounting hole on the sensor body.
(2) Take the glass 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 glass 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. Holder Installation.

Usually, the pH sensor is suspended in a guide pipe or installed in a flow-through or submersion type holder.

First install the holder.

2-1-5. Installation of Associated Equipment.

Confirm that associated equipment (e.g. pH converter, two-wire transmitter, junction terminal box or compact pH controller) which is to be connected to the pH sensor cable has been installed.

Table 2-1. Devices to be Connected to Sensor Cable.

pHΣ System	Combination Devices
Compact pH Meter	PH8PMC Compact pH controller or PH8TBG Terminal box
Field Mounting pH Meter	PH8FG pH converter or PH8TBG Junction terminal box
pH Meter with Two-wire Transmitter	PH8FT□ Two-wire transmitter or PH8TBG Junction terminal box

2-2. pH Sensor Installation.

2-2-1. Sensor Installation in the Guide Pipe.

(1) Connect the sensor cable to the associated equipment. Correctly connect the sensor cable as per Section 2-3.
(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 PH8EFG pH sensor. Attach the holding hardware to the pipe (nominal diameter 50 mm). 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 2-2). First, mount the reserve tank on the mounting hardware with the tube connection part directed downwards. Using the pin supplied with the tank, make several holes in its top (see Figure 2-2). Stand the sensor upside down at a lower position than the reserve tank as shown in Figure 2-2 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.

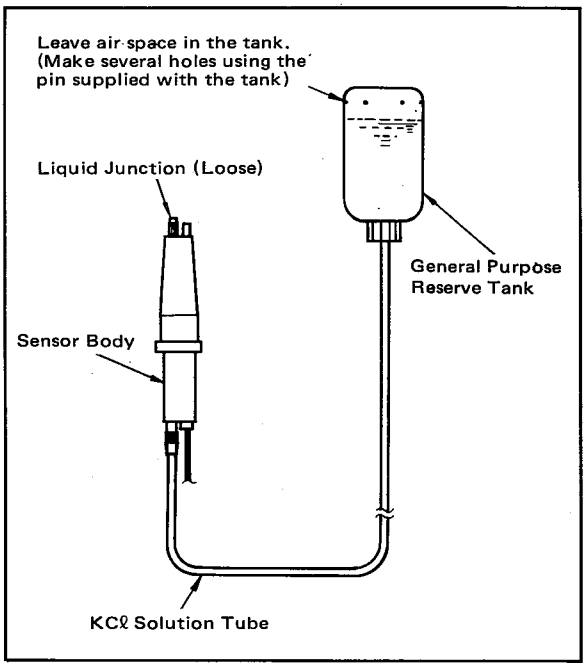


Figure 2-2. Supplying KCℓ Solution to Sensor Body.

(5) Attach the stopper supplied with the guide pipe to the sensor cable. Fix the sensor cable by fixing the cable clamp so that the sensor tip projects 2 to 3 cm from the pipe end when the pH sensor is suspended in the guide pipe as shown in Figure 2-3.

Note: If the sensor tip does not project from the pipe end, the measured value may not respond quickly to the pH variation of the measured solution. This may cause problems for measurement or control. On the other hand, if the sensor tip projects too far from the pipe end, the force on the sensor (due to the measured solution) may damage the sensor cable by chafing it against the pipe.

2-2-2. Sensor Installation in the Submersion Type Holder.

(1) Pass the sensor cable and KCℓ solution supply tube through the sensor holder. If a submersion type holder has been installed, remove the sensor holder temporarily. For a pipe mounting submersion type holder without cleaner, loosen the nut on the right angled pipe clamp to remove the holder (see Figure 2-4).

For a flange mounting submersion type holder without cleaner, remove the sensor holder by loosening the two bolts fixing the sensor holder to the flange (see Figure 2-5).

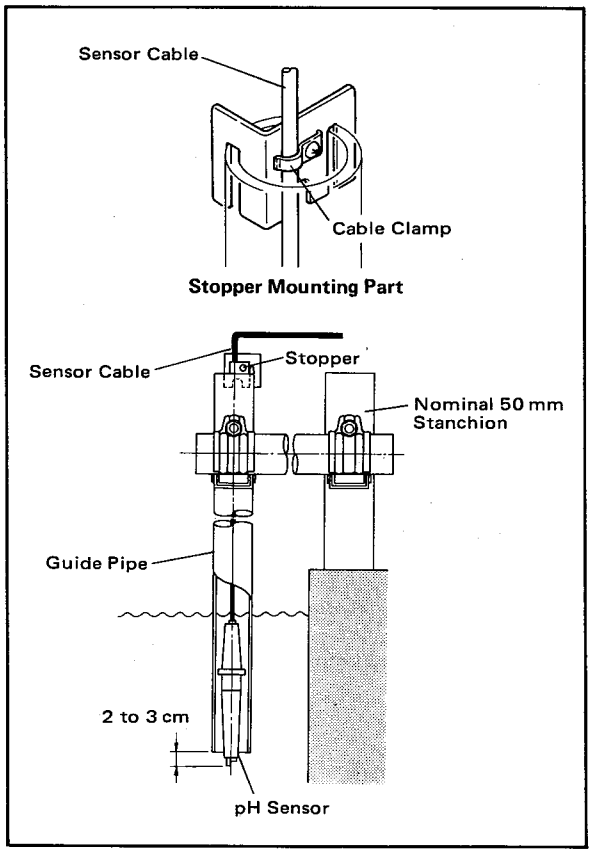


Figure 2-3. Sensor Installation in the Guide Pipe.

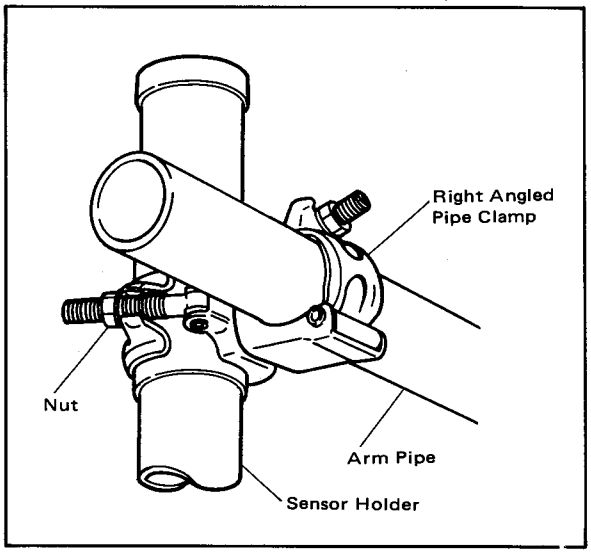


Figure 2-4. Sensor Holder Removal (Pipe Mounting Type without Cleaner).

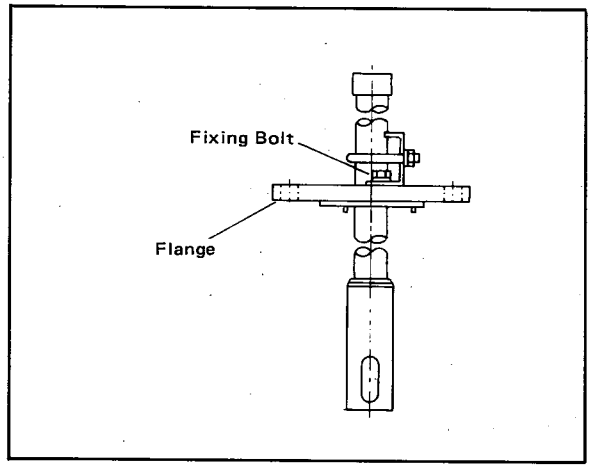


Figure 2-5. Sensor Holder Removal (Flange Mounting Type without Cleaner).

For a submersion type holder with cleaner, both pipe mounting and flange mounting holders may be removed by loosening the clump of the cleaner holder and sliding it upwards. (see Figure 2-6).

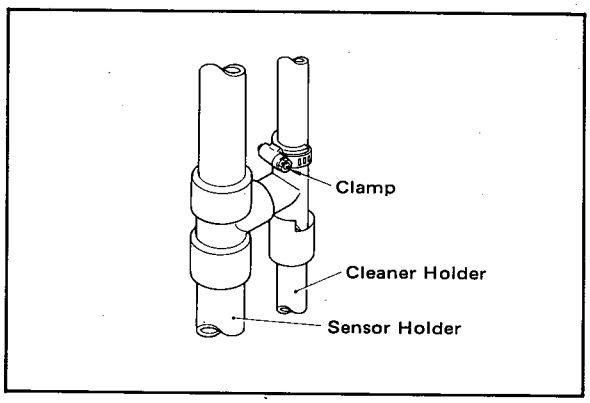


Figure 2-6. Sensor Holder Removal (with Eleaner).

To install the sensor cable in a submersion type holder, first remove the protector screwed onto the sensor holder end and remove the sponge (part for shipment, this is not necessary after the sensor is installed in the holder). Pass the sensor cable through the O-ring then attach the O-ring to the sensor flange.

When passing the sensor cable through the holder, if the holder has stains or waterdrops inside, be careful to use such means as convering the sensor cable and with a polyethylene bag, etc. to keep the cable dry.

(2) Connect the sensor cable to the associated equipment. Correctly connect as per Section 2-3.

(3) 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.

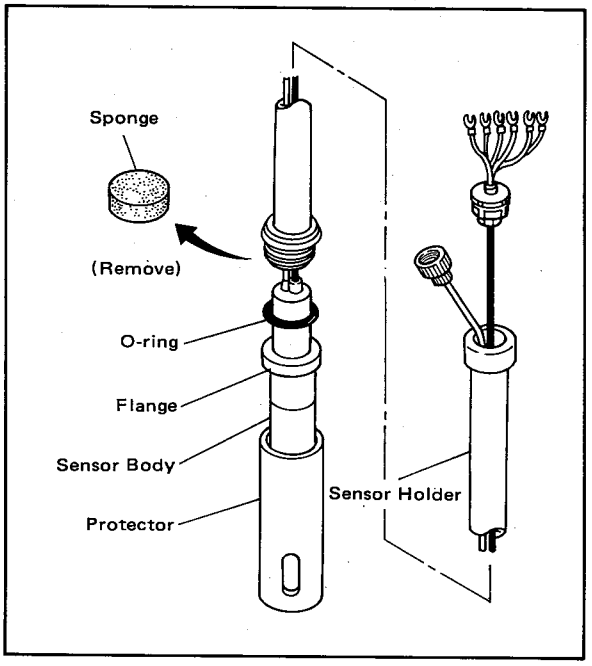


Figure 2-7. Sensor Cable Installation.

(4) If specified, a reserve tank containing 250 mℓ KCℓ solution and mounting hardware to hold this tank are supplied with the PH8EFG pH sensor. Attach the mounting hardware to the pipe (nominal diameter 50 mm). 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.

(5) Supply KCℓ solution to the sensor. First, mount the reserve tank on the mounting hardware with the tube connection part directed downwards. Using the pin supplied with the tank, make several holes in its top (see Figure 2-2). Stand the sensor upside down at a position lower than the reserve tank as shown in Figure 2-2 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.

(6) Screw the protector on the sensor holder to fix the sensor in the holder. Screw the protector securely on the sensor holder so that the flange of the sensor body compresses the O-ring firmly (see Figure 2-8).

(7) Remount the sensor holder on the mounting pipe, flange or cleaning holder.

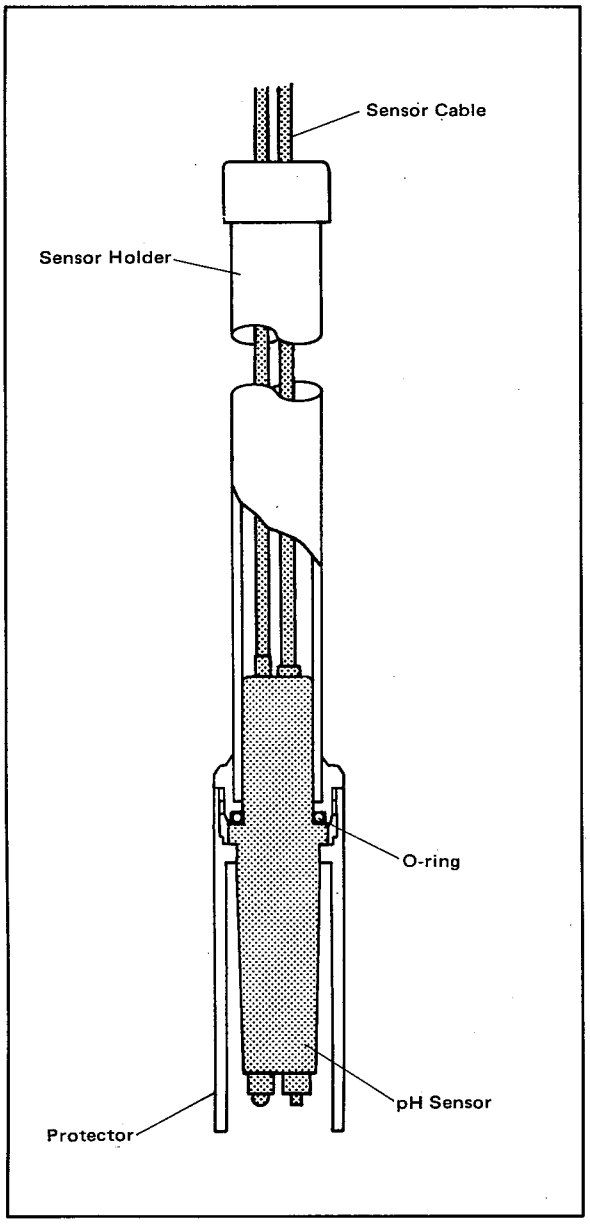


Figure 2-8. Sensor Installation (Submersion Type).

2-2-3. Sensor Installation in a Flow-Through Type Holder.

(1) Connect the sensor cable to the associated equipment. First, remove the sensor fixing nut and pass the sensor cable through the nut (see Figure 2-9). Correctly connect as per 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.

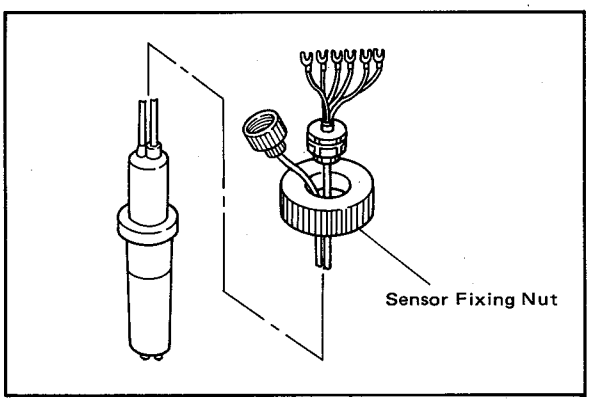


Figure 2-9. Preparation for Sensor Cable Connection.

(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 PH8EFG pH sensor. Attach the mounting hardware for general purpose reserve tank to a pipe (nominal diameter 50 mm). 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 (nominal diameter 50 mm) and perform air piping to supply pressure for reserve tank as shown in Figure 2-10. Connect the KCℓ supply tube of the sensor to this reserve tank.

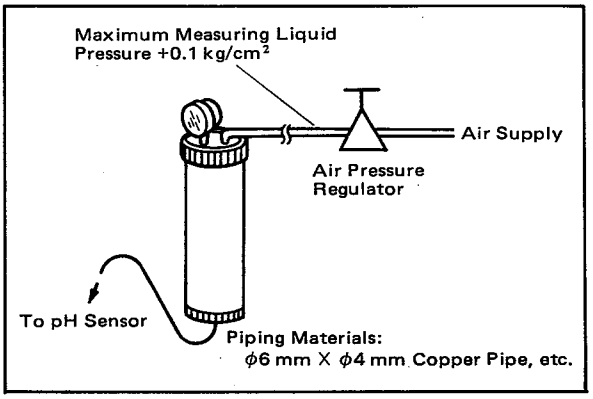


Figure 2-10. Air Piping for Pressurizing Medium Pressure Reserve Tank.

(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. Using the pin supplied with the tank, make several holes in its top (see Figure 2-2). Stand the sensor upside down at a position lower than the reserve tank as shown in Figure 2-2 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. First, fill the reserve tank with KCℓ solution*. Loosen the nut on the reserve tank upside and remove the cap – the pressure gauge is mounted – and pour about 250 mℓ of KCℓ solution into the tank. Stand the sensor upside down at a position lower than the reserve tank as shown in Figure 2-2 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.

*: Use 3.3 M 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) Fix the pH sensor in the holder. Remove the sponge (part for shipment, this is not necessary after the sensor is installed in the holder) from the holder. Insert the sensor tip into the holder and tighten the sensor fixing nut securely (see Figure 2-11).

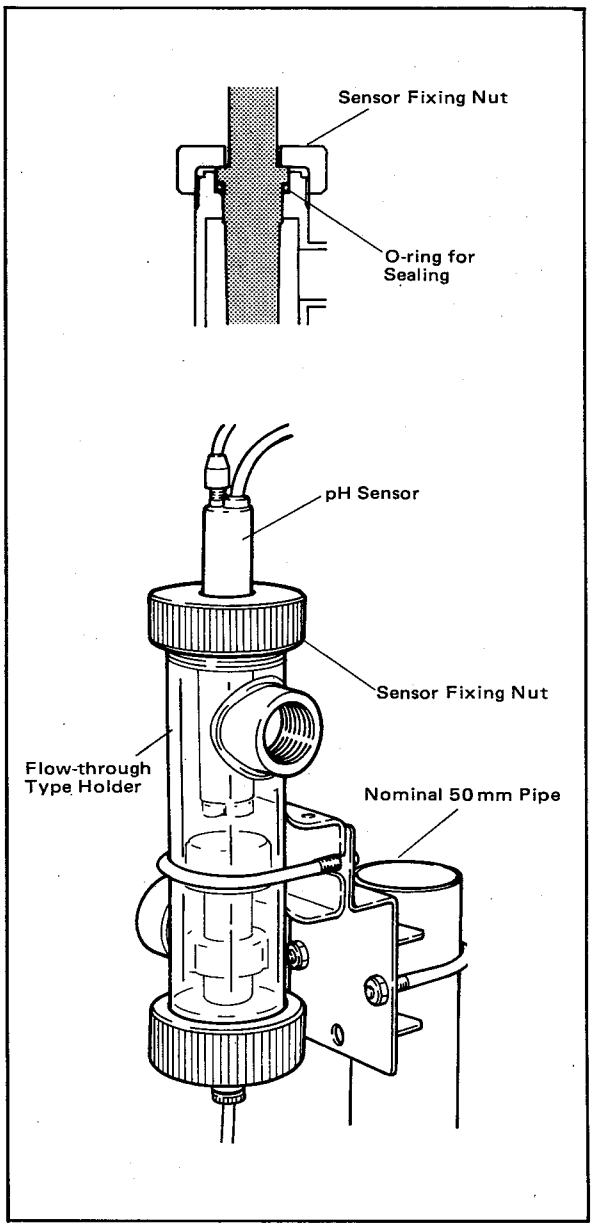


Figure 2-11. Sensor Installation (Flow-through Type).

2-3. Sensor Cable Connection.

2-3-1. When the Cable is to be Connected to the Model PH8TBG Terminal Box

(1) Open the wiring hole to the terminal box. A semi-punched wiring hole is provided in the case bottom. Place the tip of the tool — supplied with the terminal box — on the semi-punched hole edge and tap the tool end gently using a hammer as shown in Figure 2-12.

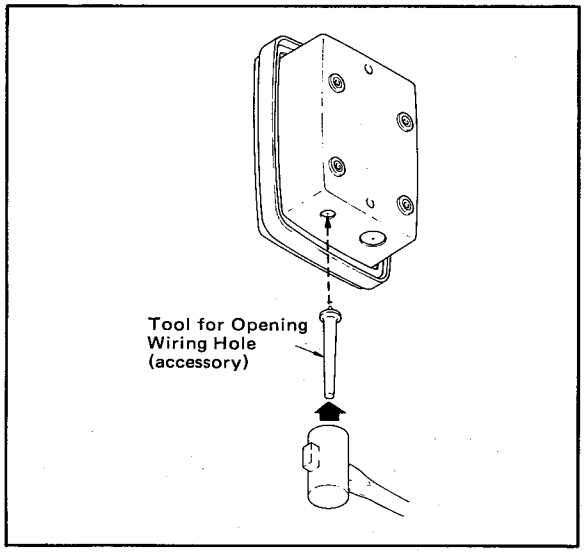


Figure 2-12. Opening Wiring Hole.

(2) Loosen two screws on the terminal box front panel and remove the cover.

(3) Connect the sensor cable to the terminal box terminals. First, remove the nut from the cable gland, then pull the cable into the internal assembly through the wiring hole. Pass the cable through the nut. Correctly connect each conductor to the corresponding terminal, observing conductor marking (see Figure 2-13).

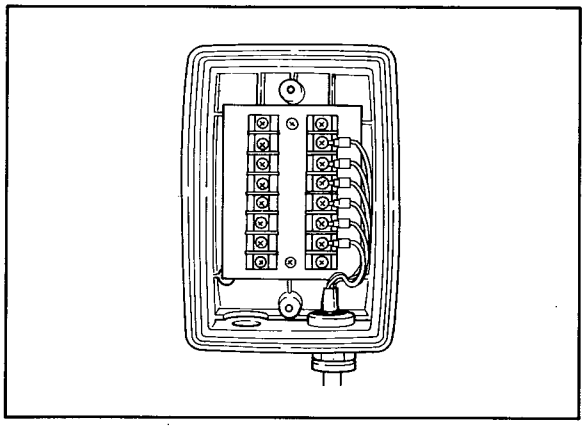


Figure 2-13. Sensor Cable Connection to Terminal Box.

(4) Mount the cable gland in the wiring hole (see Figure 2-14). Attach the nut in position and tighten the gland firmly. When tightening the gland nut, be careful not to twist the cable. When the gland is mounted, tighten the gland nut firmly on the gland to keep out moisture. However, if the gland nut is screwed too tight, the cable may be damaged.

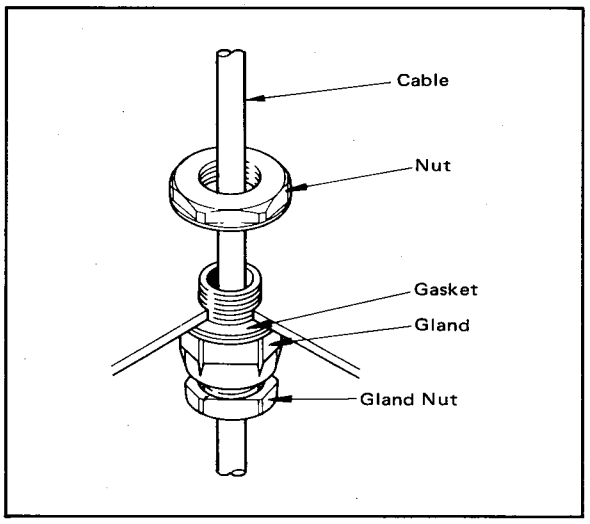


Figure 2-14. Cable Gland Installation.

(5) After completing the wiring, firmly replace the terminal box cover. Confirm that there are no stains or water drops on the waterproof packing part of the case.

2-3-2. When the Cable is to be Connected to the Model PH8FC pH Converter.

(1) Open the wiring hole to the pH converter. A semi-punched wiring hole is provided in the case bottom. Place the tip of the tool supplied with the pH converter on the semi-punched hole edge and tap the tool end gently using a hammer as shown in Figure 2-12.

(2) Loosen two screws on the pH converter front panel by turning them counterclockwise with your hands to remove the cover. Remove the plate covering the sensor cable connecting terminals located in the right side of the case. The plate is fixed with two screws.

(3) Connect the sensor cable to the converter terminals. First, remove the nut from the cable gland, then pull the cable into the internal assembly through the wiring hole. Pass the cable through the nut. Correctly connect each conductor to the corresponding terminal observing conductor marking.

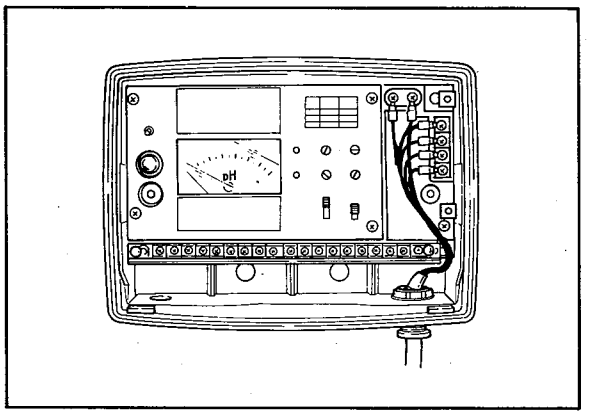


Figure 2-15. Sensor Cable Connection to pH Converter.

(4) Reassemble the plate – which has been removed in item (2) – as it was.
(5) Mount the cable gland on the wiring hole. After inserting the gland into the wiring hole, tighten the nut securely. When the gland is mounted, tighten the gland nut firmly on the gland to keep out moisture. However, if the gland nut is screwed too tight, the cable may be damaged.
(6) After completing the wiring, firmly replace the pH converter cover. Confirm that there are no stains or waterdrops on the waterproof packing part of the case.

2-3-3. When the Cable is to be Connected to the Model PH8PMC Compact pH Controller

Connect cables to the compact pH controller in the following manner.

(1) Remove the shield cover (covering the sensor cable terminals) at the rear of the compact pH controller by loosening two screws fixing the shield cover.
(2) Connect the sensor cable to their terminals. Confirm each conductor symbol and properly connect each conductor to the corresponding terminal.

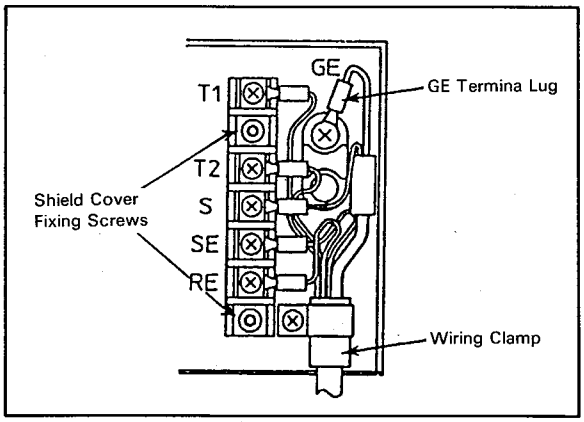


Figure 2-16. Sensor Cable Connection to Compact pH Controller

(3) Fix the sensor cable with the siring clamp.
(4) Do not connect the GE terminal lug to places other than GE terminal.
(5) Restore the shield cover once removed in step (1). In doing this, take sufficient care not to pinch the sensor cable with the cover.

2-3-4. When the Cable is to be Connected to the Model PH8FT□ Two-Wire Transmitter.

(1) Turn the two-wire transmitter cover counterclockwise and remove it.
(2) Connect the sensor cable to the transmitter terminals. First, remove the nut from the cable gland, pull the cable into the internal assembly through the wiring hole on the front panel right side. Correctly connect each conductor to the corresponding terminal observing conductor marking (see Figure 2-17).

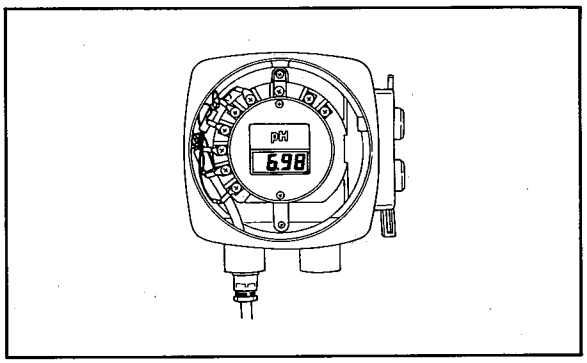


Figure 2-17. Sensor Cable Connection to Two-Wire Transmitter.

(3) Mount the cable gland on the wiring hole. The nut which has been removed in item (2) is not necessary. Screw the gland body securely into the wiring hole (see Figure 2-18). In this case, loosen the gland nut so as not to twist the cable. When the gland is mounted, tighten the gland nut firmly on the gland to keepout moisture. However, if the gland nut is screwed too tight, the cable may be damaged.

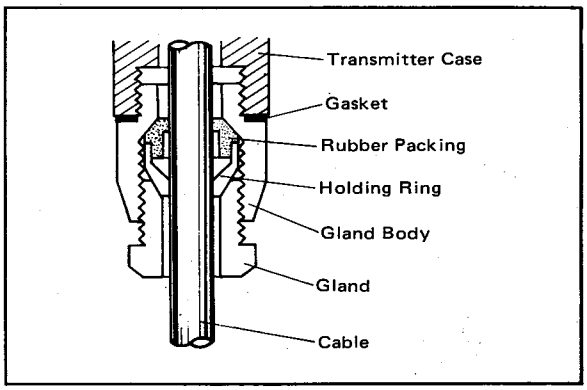


Figure 2-18. Two-Wire Transmitter Cable Inlet.

(4) After completing the wiring, firmly, replace the two-wire transmitter cover. Confirm that no stains sticks to the O-ring for sealing of the cover.

3. USE OF pH SENSOR.

3-1. Operation and Periodical Maintenance.

3-1-1. Buffer Solution Calibration.

Calibrate with buffer solution before starting normal operation because the emf of the glass electrodes differ a little from each other.

The emf of the glass electrode gradually changes due to electrode staining and electrode deterioration. Therefore, the buffer solution calibration must be performed periodically within a given period to keep the measurement error within tolerance.

Refer to the Section "OPERATION" in the instruction manul of the pH indicator, pH converter or two-wire transmitter for instructions for buffer solution calibration.

Note: Galss electrodes which have dried out do not show stable properties until some time after immersion in solution. Submerge the electrode in water for about 30 minutes to stabilize its characteristic before carrying out buffer solution calibration.

3-1-2. Pressurizing Reserve Tank.

When the pH 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 approximately 2 mℓ/day when the pressure difference between air and measured solution is 0.1 kg/cm^2 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 pH 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 M solution by dissolving 245 g of KCℓ powder in pure water to make exactly 1 ℓ 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 pH 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 flow of measured solution (see Figure 3-1) – first in the inlet then the outlet valves in the flow-through type holder.

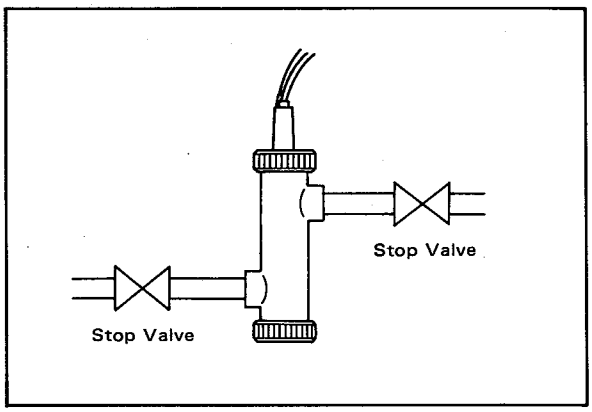


Figure 3-1. Process Piping of Flow-through Type Holder.

(2) Remove the socket connector on the reserve tank and stop the air pressurizing the tank (see Figure 3-2).

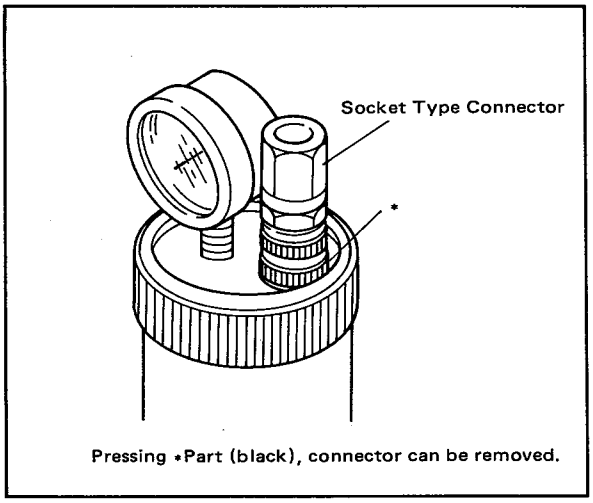


Figure 3-2. Socket Type Connector.

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

(4) Refill the tank with 3.3 M KCℓ solution (see Figure 3-3). The maximum solution level 3 to 4 cm lower than the top.

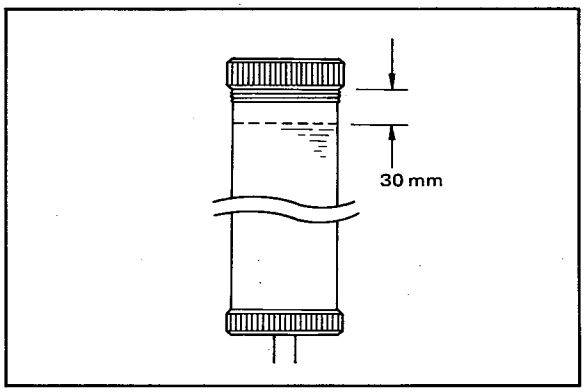


Figure 3-3. Maximum KCℓ Replenishment Level in the Reserve Tank.

(5) Retighten the nut to fix the cap in position. Connect the socket type connector and apply air pressure to the tank.
(6) Open the valve and let the measured solution flow through the holder.

3-1-4. Cleaning the "Glass Electrode" and "Liquid Junction".

Staining of the glass electrode or liquid junction can cause measurement error. Consequently, if the measured solution tends to stain the electrode, the glass electrode and liquid junction must be cleaned periodically – the period depending on the degree of staining.

Clean the glass electrode and liquid junction as per the following procedure:

- **Stains due to suspended solids, sticky material or microbes, etc.**

Using soft tissue paper, wipe the stains off the glass electrode and liquid junction. Further, clean off the remaining stains by rinsing with water.

- **Stains due to oily material.**

Wash off the stains by submerging in a neutral detergent solution in a beaker, etc.

- **Chemical stains such as due to metallic adsorption.**

Submerge the "glass electrode" and the "liquid junction" in a diluted hydrochloric acid solution (1 to 2%) for several minutes (acid washing).

When the pH sensor is used while it is installed in a holder with cleaner, the sensor is continuously (for ultrasonic cleaner) or intermittently (for jet or brush cleaner) cleaned automatically. Therefore, sensor cleaning is usually not necessary. However, if the sensor characteristics are affected by chemical staining, e.g. when the sensor is used for pH measurement of a highly alkaline solution, carry out acid washing.

3-2. Worn Out Part Replacement.

3-2-1. Glass Electrode Replacement.

When buffer solution calibration becomes impossible due to deterioration of the glass electrode, replace it with a new electrode. After the glass electrode is replaced, always carry out buffer solution calibration. However, a glass electrode whose glass membrane has dried out does not show stable properties until some time after immersion in solution. Submerge the electrode in water for about 30 minutes to stabilize its characteristic before carrying out buffer solution calibration.

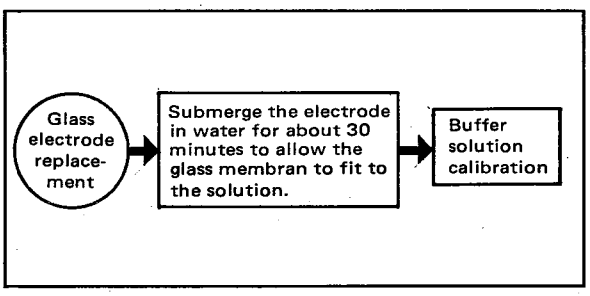


Figure 3-4. Treatment After Glass Electrode Replacement.

3-2-2. Liquid Junction Replacement.

Even after washing the liquid junction, if normal measurement is impossible, replace the liquid junction (see Figure 3-5).

When replacing the liquid junction, be careful not to allow much KCℓ solution to overflow – there must not be any air space in the sensor body.

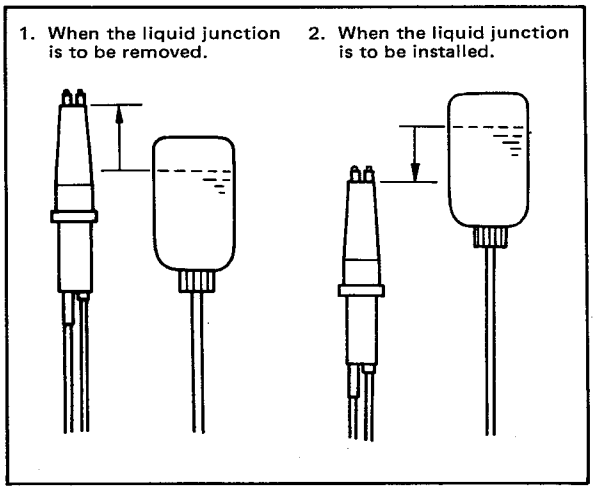


Figure 3-5. Liquid Junction Replacement.

3-2-3. Replacing O-ring to Seal "Glass Electrode".

As the inside of the glass electrode mounting hole must have high insulation resistance, FPM O-ring – with superior chemical and heat resistance – is used for sealing. Except for special use, this O-ring lasts a long time, so in general, the O-ring does not need replacement. If any change – which might cause trouble – is detected in the O-ring, as a rule, replace it together with the glass electrode.

If the O-ring deteriorates faster than the glass electrode, the O-ring alone may be replaced, however, in this case, use the O-ring recommended by Yokogawa. When installing the O-ring, wind a slip of paper or tape around the screw on the glass electrode and be careful not to scratch the O-ring – such scratches may prevent sealing (see Figure 3-6).

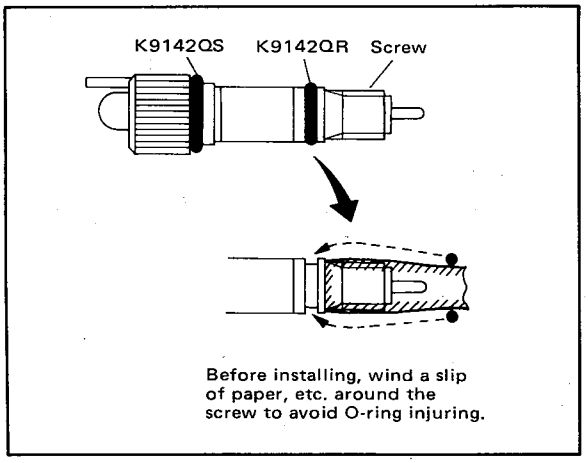


Figure 3-6. Installing the O-ring.

3-2-4. Sensor Body Replacement.

The life of the sensor body depends on the deterioration of the reference electrode installed in it.

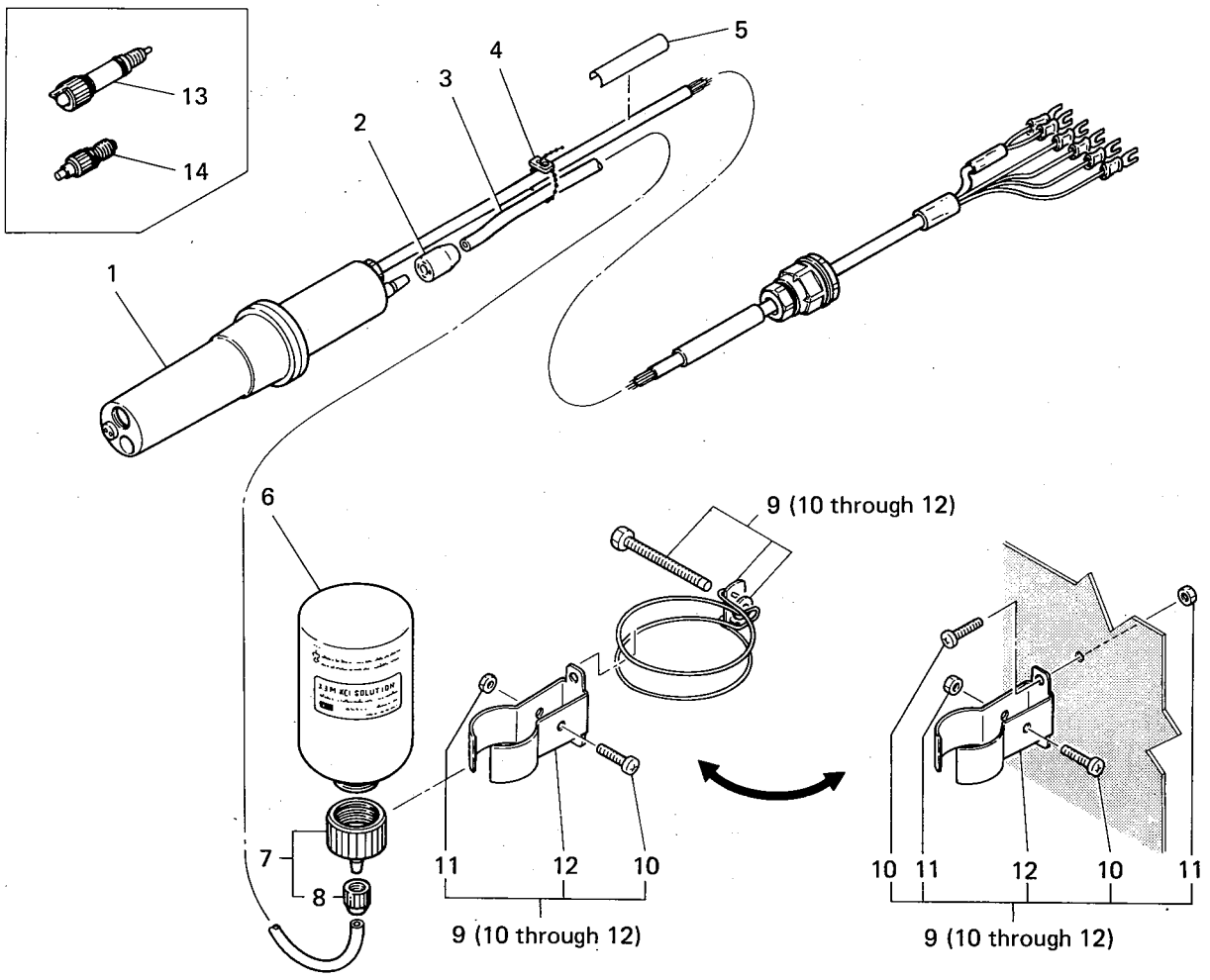
When a faulty part cannot be found at all even when the cause of abnormarity is clearly in the pH sensor, replace the sensor body.

Customer Maintenance Parts List

Model PH8EFG
KCl Filling Type pH Sensor

PHΣ

General Use Type



Item	Part No.	Qty	Description
1	Below	1	Body Assembly
	K9142BA		For Model PH8EFG-03-TN
	K9142BB		For Model PH8EFG-05-TN
	K9142BC		For Model PH8EFG-03-HC
	K9142BD		For Model PH8EFG-05-HC
2	K9142EJ	1	Cap
3	Below	1	KCl Filling Tube
	K9142PF		Length 3m } For general use
	K9142PG		Length 5m } For general use
	K9142PJ		Length 3m } For Medium Pressure
	K9142PK		Length 5m } For Medium Pressure
4	L9813UG	3 or 5	Clamp
5	K9142RB	1	Nameplate
6	K9084KQ	1	Bottle (for general use)
7	K9084KV	1	Connector Assembly (for general use)
8	K9084CG	1	Nut
9	K9142VE	1	Holder Assembly

Item	Part No.	Qty	Description
10	—	3	B.H. Screw, M4 x 18
11	—	3	Nut
12	—	1	Bracket
13	Below	1	Glass Electrode Assembly
	K9142TN		For general use
	K9142TP		For Approved Under the Measurement Law
—	K9142QR	1	O-Ring, 6mm ID x 9mm OD
—	K9142QS	1	O-Ring, 9mm ID x 12mm OD
14	K9142TH	1	Junction Assembly
—	K9142QR	1	O-Ring, 6mm ID x 9mm OD

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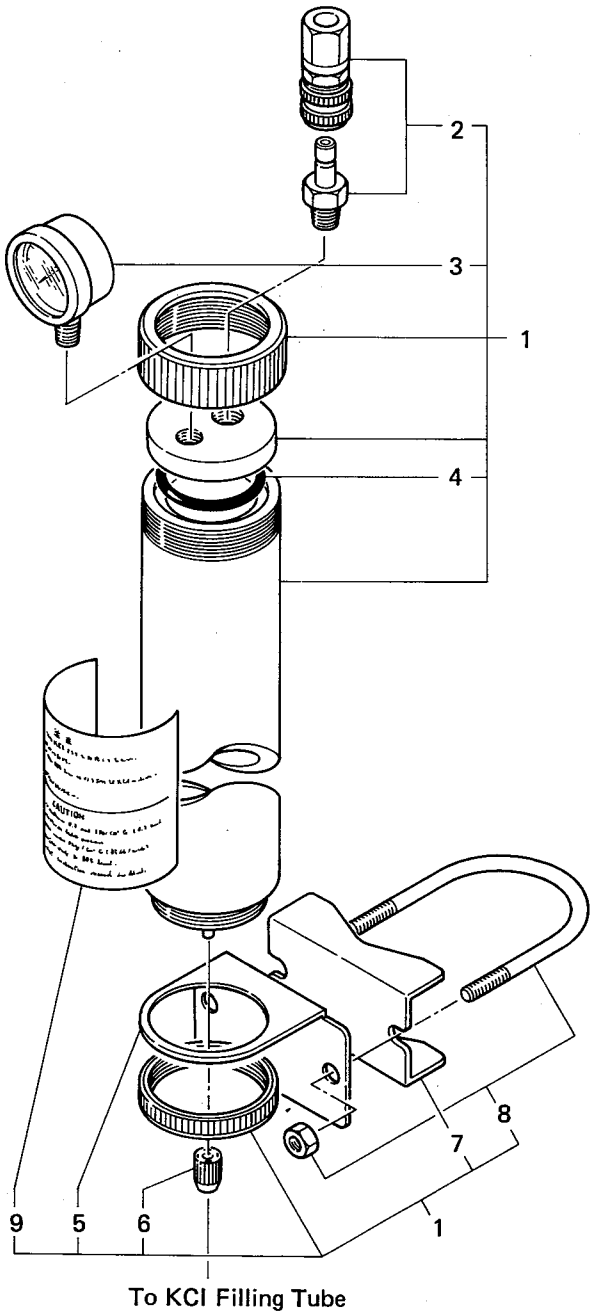
Medium Pressure Type



Item	Part No.	Qty	Description
1	K9142VG	1	Tank Assembly (item 2 through 9)
2	L9835DD	1	Joint
3	L9867BS	1	Pressure Gauge
4	G9303AE	1	O-Ring
5	K9142VP	1	Bracket
6	K9142EJ	1	Cap
7	L9826AL	1	Bracket
8	D0117XL-A	1	U-Bolt Assembly
9	K9142RU	1	Label

Model PH8HG
GUIDE PIPE HOLDER

CONTENTS

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2-3.	Installing the Sensor	C1–2
●	Customer Maintenance Parts List	CMPL 12B5L1–01E

1. SPECIFICATIONS.

Model PH8HG guide pipe holder for the pH or ORP sensor is simply constructed, and permits ease of maintenance. It protects the sensor from damage and allows stable pH or ORP measurements.

1-1. Standard Specifications.

Mounting: Pipe mounting on a 50 mm pipe.
Weight: Approximately 3 kg.
Holder Lenght: 2 m.
Holder Material: PVC or polypropylene resin.
Temperature Limits:
–5 to 50°C(PVC holder).
–5 to 80°C (Polypropylene holder).

Note: If the measurement solution meets the following conditions, use the submersion type holder or flow-through type holder.

- If the solution temperature is greater than 80°C.
- If the solution is less than pH 2 or greater than pH 12
- If the solution contains aquaregia, chromic acid, phypochlorous acid, and perchloric acid.
- If the solution contains ammonia, chlorine, and hydrogen sulfide.
- If the solution contains a few percent of organic acid and grease.

1-2. Model and Suffix Codes.

Model	Suffix Code	Description
PH8HG	. . . . .	Guide Pipe Holder
Material	-PV	PVC
	-PP	Polypropylene
Style Code	*A	Style A

1-3. External Dimensions.

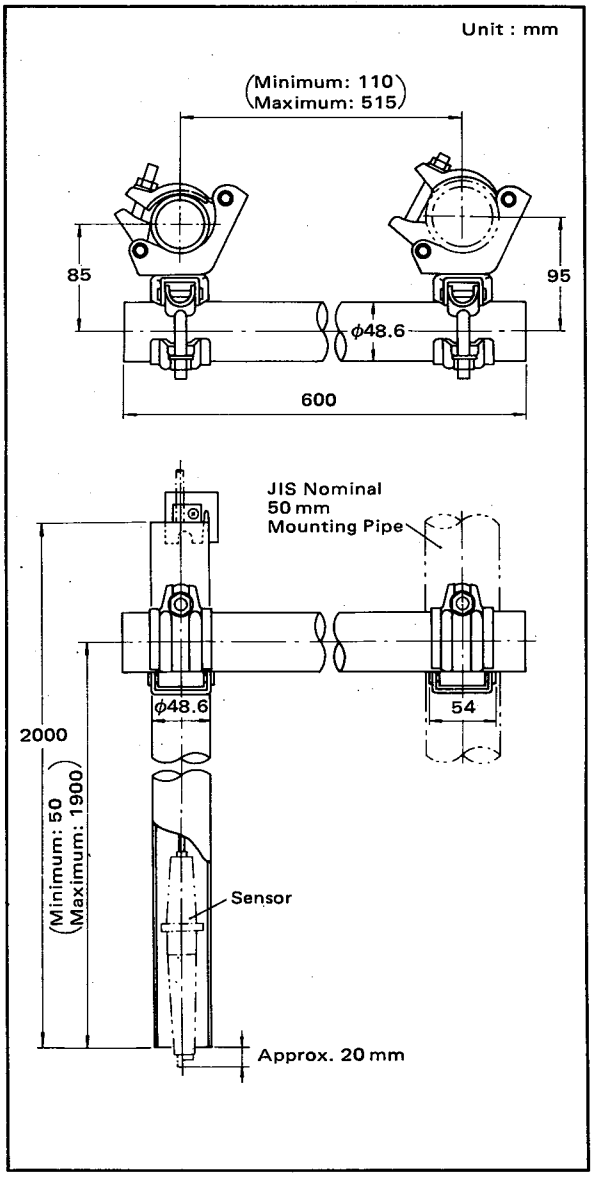


Figure 1-1. Guide Pipe Holder.

2. INSTALLATION.

2-1. Selection of Installation Site.

Install the guide pipe holder in the location where the most significant value is obtined, and avoid the area where the measurement value likely changes. Select an area in which the solution temperature, velocity, and the sensor and guide pipe holder meet the standard specifications. The installation site should provide ease of sensor maintenance.

2-2. Installation Procedures.

When unpacking the container, confirm that the accessories are accompanied with the guide pipe holder. Refer to the customer maintenance parts list CMPL 12B5L1-01E for details.

The guide pipe should be installed vertically and secured with a rigid 50 mm (2 inch) mounting pipe and a 40 mm arm pipe as shown in Figure 2-1. Fix the sensor cable with the cable clamp on the stopper so the sensor is submerged in the solution.

If only a horizontal 40 mm pipe is available (no vertical 50 mm mounting pipe available) at the user site, install the sensor guide pipe to it instead of the arm pipe.

2-3. Installing the Sensor.

For installing the sensor, refer to the relevant chapter in the instruction manual.

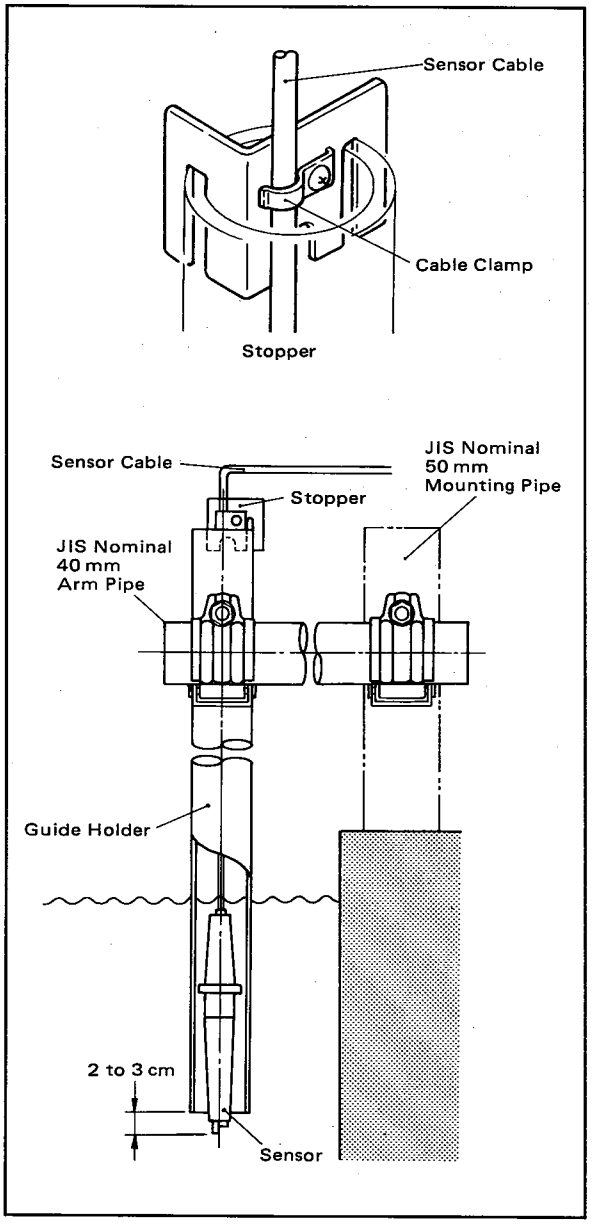
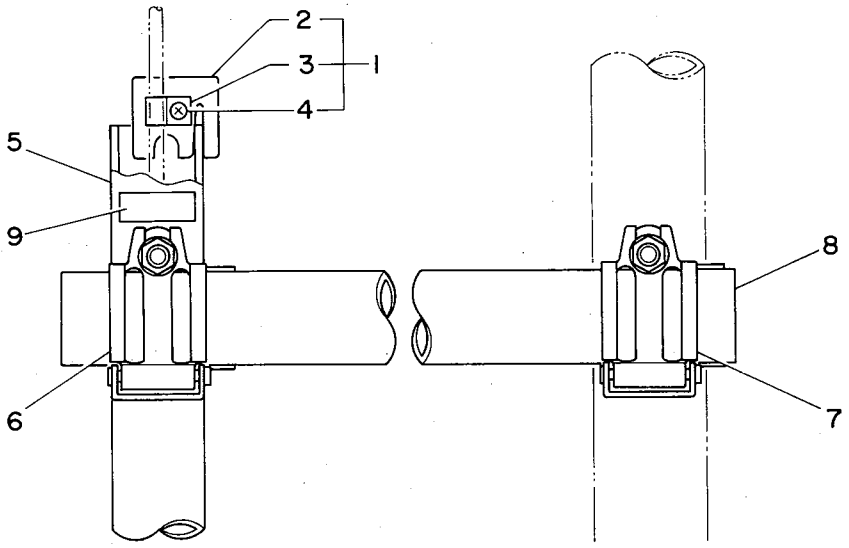


Figure 2-1. Installing the Guide Pipe Holder.

Customer Maintenance Parts List

Model PH8HG
DROP-IN GUIDE PIPES

PHΣ



Item	Part No.	Qty	Description
1	K9144AA	1	Stopper Assembly
2	K9144AB	1	Bracket
3	K9144AC	1	Clamp
4	Y9408JU	1	Pan H. Screw, M4 x 8
5	Below	1	Pipe
	K9144AK		Hard Polyvinyl Chloride
	K9144AL		Polypropylene
6	L9813VN	1	Clamp
7	L9813VP	1	Clamp
8	K9144AM	1	Pipe
9	K9145NA	1	Nameplate

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CMPL 12B5L1-01E

Model PH8AX
ACCESSORIES

CONTENTS

Section	*Title*	*Page*
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1-2.	Use of the Accessories	D1−1
2.	**SPARE PARTS**	D1−3
2-1.	Spare Parts List	D1−3

1. PH8AX ACCESSORIES.

1-1. Model and Suffix Codes.

Model	Suffix Code		Description
PH8AX	. . . . .		PHΣ Accessories
Contents	-L		200 mℓ polyethylene cups (two) Washing bottle (one), Each containing 250 mℓ of buffer solution of pH7 and pH4
	-P		200 mℓ polyethylene cups (two), Washing bottle (one), 500 mℓ polyethylene bottles (two), pH standard reagent of pH7 and pH4 (12 bags each)
———	*A		Style A
		/STD	Sensor stand
		/KCLL	3.3M KCℓ solution (250 mℓ)
		/KCLP	KCℓ powder (for preparing buffer solution 250 mℓ × 3 bags)
		/TMP	Thermometer (0 to 100°C)

1-2. Use of the Accessories.

1-2-1. 200 mℓ Polyethylene Cups (two).

These cups are used to put in buffer solution of pH7 or pH4 (or pH9) when buffer solution calibration.

1-2-2. Washing Bottle.

This is used to clean a stained pH sensor when buffer solution calibration.

1-2-3. 500 mℓ Polyethylene Bottles (two).

These bottles are supplied with PH8AX-P Accessories. These are used to prepare buffer solution of pH7 and pH4 (or pH9).

1-2-4. Buffer Solution of pH7 and pH4 (250 mℓ each).

These are supplied with PH8AX-L Accessories as calibrating buffer solution.

The pH values of the buffer solution could change a little due to solution storage conditions. So store the bottle in a cool and dark place with the cap screwed tight and use as soon as possible.

1-2-5. Standard Reagent of pH7 and pH4 (12 bags each).

These are supplied with PH8AX-P Accessories. To use the powder reagent, dissolve one bag of reagent in pure water to make exactly 500 mℓ of solution.

1-2-6. Sensor Stand.

This is used to hold the sensor submerged in buffer solution when buffer solution calibration. Mount this stand on a nominal 50 mm dia. pipe of the sensor installation site.

This stand is supplied when specified in a sales order.

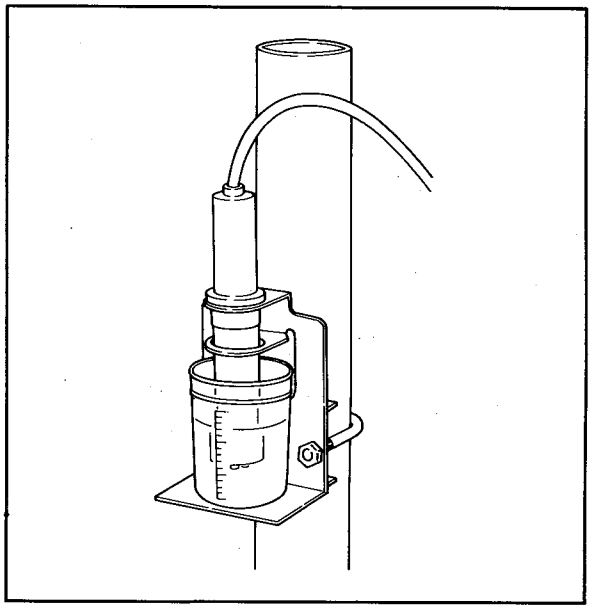

Figure 1-1. An Example of Using the Sensor Stand.

1-2-7. KCℓ Solution (250 mℓ).

This 3.3M KCℓ solution is used to replenish KCℓ solution in reserve tanks of the KCℓ filling type pH sensor and the pure water pH sensor. The general purpose reserve tank can be replaced with a new tank in its entirety.

This solution is supplied when specified in a sales order.

1-2-8. KCℓ Powder (3 bags).

These are used to make 3.3M KCℓ solution for the KCℓ filling type pH sensor and the pure water pH sensor, and are supplied when specified. When using, dissolve one bag of KCℓ powder in pure water to make exactly 250 mℓ solution.

1-2-9. Thermometer.

This is used to measure the buffer solution temperature when performing buffer solution calibration.

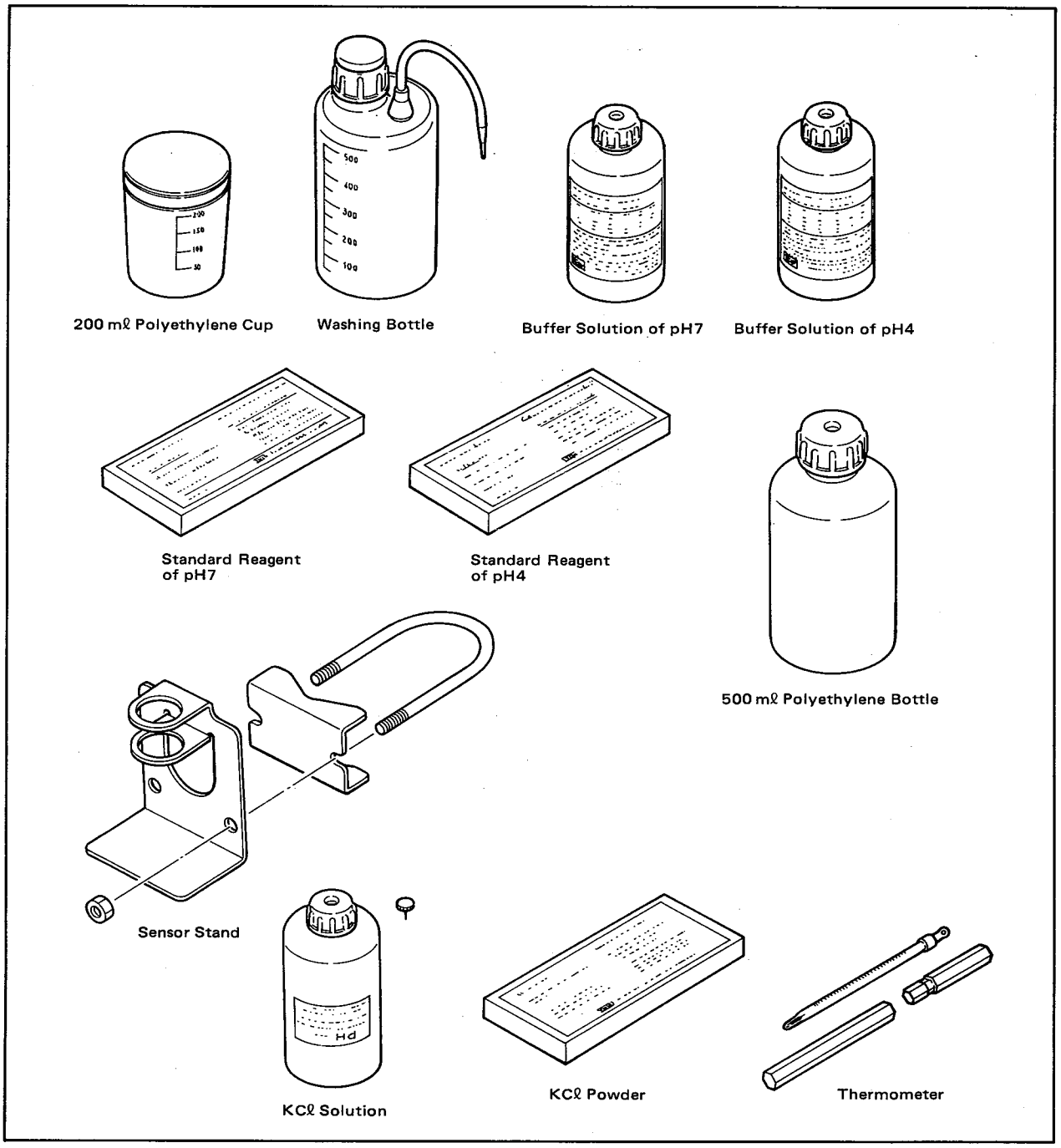

Figure 1-2. PH8AX Accessories.

2. SPARE PARTS.

2-1. Spare Parts List.

Part Name		Part No.	Description
Glass Electrode	General Purpose	K9142TN	1
	With Certification According to Japanese Measurement Laws	K9142TP	1
Liquid Junction	For KCℓ Refillable Type/ Filling Type Sensor	K9142TH	1
	For Pure Water Sensor	K9142TK	1
Desiccant		K9020XR	1 bag (contains 30 g)
KCℓ Solution (3.3M)	For KCℓ Filling/Pure Water Sensor	K9084LP	6 polyethelene bottles containing 250 mℓ each
KCℓ Powder	For KCℓ Filling/Pure Water Sensor	K9020XU	8 bags each forpreparing 3.3M solution 250 mℓ
Internal Solution Set	For KCℓ Refillable Type Sensor	K9142UT	1 set (KCℓ powder 2 bags, KCℓ solution 50 mℓ, injector)
Buffer Solution for Calibration*1	pH4	K9084LL	6 polyethylene bottles containing 250 mℓ each
	pH7	K9084LM	6 polyethylene bottles containing 250 mℓ each
	pH9	K9084LN	6 polyethylene bottles containing 250 mℓ each
Standard pH Reagent (for Buffer Solution)	pH4	K9020XA	12 bags each for preparing buffer solution 500 mℓ
	pH7	K9020XB	12 bags each for preparing buffer solution 500 mℓ
	pH9	K9020XC	12 bags each for preparing buffer solution 500 mℓ
Brush Element (for a Holder with Brush Cleaner)		K9143KM	1

*1: The pH value of the calibration buffer solution may change a little due to solution storage conditions. Liquid reagents should be stored in a cool and dark place with a cap screwed tight.

2-1-1. Glass Electrode.

Life of a glass electrode varies from a few months to one or two years depending using conditions. Note this point when buying the spares.

The effective date of glass electrode with certification by Japanese authority is one year from first day of month after certification. Keep a note of this date, and the date you must order replacement electrodes.

2-1-2. Liquid Junction.

A clogged liquid junction can cause measurement error. If stains are not washed out or the liquid junction is clogged by being dry, replace it with a new one.

When storing a liquid junction, keep it in a bag not to dry it.

2-1-3. Desiccant.

Desiccants are placed in pH converter, pH transmitter and preamplifier to prevent insulation fault. When the desiccants lose their absorption power, exchange them with new ones.

2-1-4. KCℓ Solution.

This solution is used to replenish KCℓ solution in reserve tanks of the KCℓ filling type sensor and the pure water pH sensor.

The flow rate of the KCℓ solution from the sensor liquid junction is 3 mℓ/day maximum when the pressure difference between air and the solution is 0.1 kg/cm^2. The flow rate increases in proportion to the pressure difference.

2-1-5. KCℓ Powder.

This is used to make 3.3M KCℓ solution for the KCℓ filling type sensor and the pure water pH sensor.

2-1-6. Internal Solution Set for KCℓ Refillable Type Sensor.

The concentration of the KCℓ solution slowly decreases, since the KCℓ solution diffusing from the liquid junction cannot maintain its saturated concentration. Since the sensor performance will be deteriorated if it decreases, replenish the sensor internal solution. The replenishment period depends on using condition, but generally replenishment should be carried out once every half to one year.

2-1-7. Buffer Solution for Calibration.

Buffer solution calibration before measuring error exceeds the tolerance. Calibrating period varies widely with permissible difference or degree of the glass electrode stain, but in general, calibration should be carried out once every one to three months. pH9 buffer solution is used to measure alkaline solution more accurately in place of pH4 buffer solution.

2-1-8. pH Standard Reagent.

The pH value of the buffer solution may change a little due to solution storage conditions. If buffer solution is rarely used, for higher accuracy it is better to make buffer solution when it is necessary.

When preparing, dissolve one bag of the powder in pure water to make exactly 500 mℓ solution.

Each buffer solution requires 50 to 100 mℓ solution. Store the remaining solution in a cool and dark place with a cap screwed tight.

2-1-9. Brush Element.

Brush of the brush cleaner for submersion type holder or flow-through type holder rotates scraping the glass electrode during cleaning. Therefore, the brush is gradually worn out. The brush element must be replaced with a new one when the brush does not enough wash stain off.

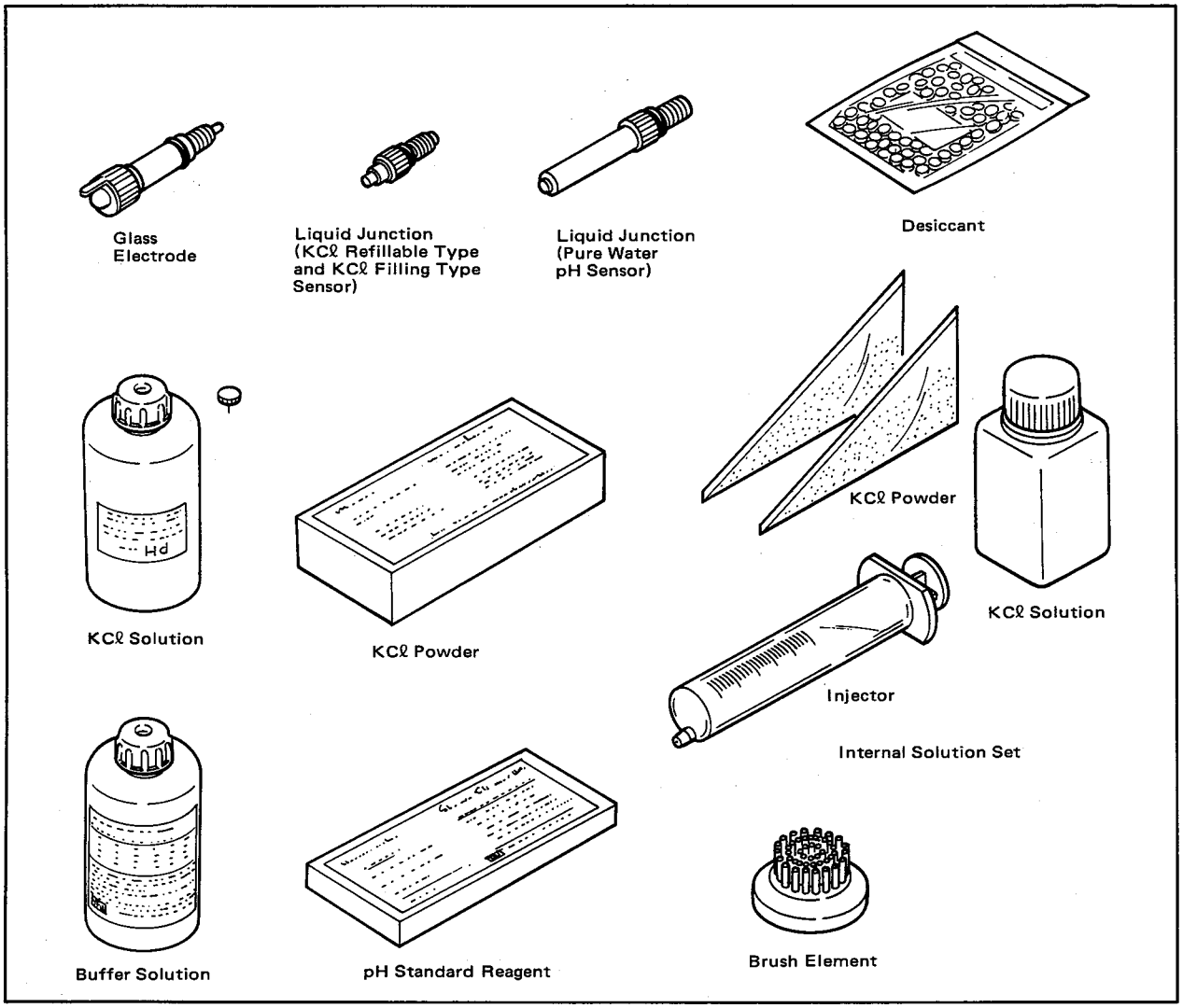

Figure 2-1. Spare Parts.