
Instruction Manual

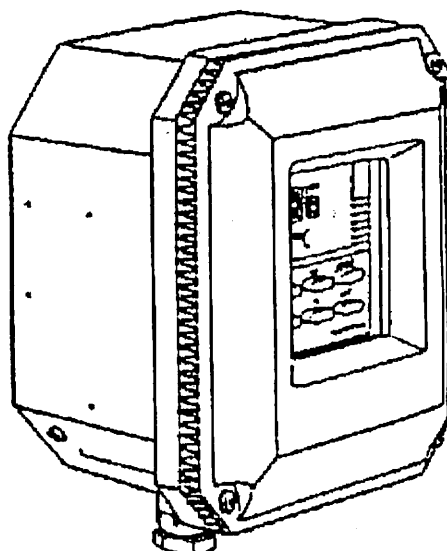
EXA PH

Model PH200G

Model PH200S

Intelligent 2-wire pH Transmitter

IM 12B7D1 - 01E



INTRODUCTION

The intelligent 2-wire pH Transmitter (Models PH200G and PH200S) is a transmitter with a pH sensor diagnosis function. This transmitter can configure any measurement system to satisfy a wide range of applications when combined with various pH sensors, as doing so enables highly reliable pH measurement in general solutions, pure water and fermented food.

This instruction manual describes all intelligent 2-wire pH transmitter operations from installation to inspection and maintenance. In order to display and maintain their performance completely, read the instruction manual thoroughly.

Note also that, this instruction manual does not describe each device configuring the "EXAPH Intelligent 2-wire Transmitter System", so if more information is required, refer to the appropriate instruction manual.

Instruction manual	IM No.	Equipment described	
General purpose pH sensor	IM 12B7J1 - 01E	PH8ERP PH8EFP PH8TBG PH8HG PH8HS, PH8HSF (PH8MV, PH8MVF) (PH8PU1) PH8HF, PH8HFF (PH8MV, PH8MVF) (PH8PU1) PH8USG PH8USF (PH8AL) PH8AX	KCl filling type pH sensor KCl refillable type pH sensor Terminal box Sensor suspension guide holder Submersion type holder Solenoid valve) Cleaning pump/tank) Flow-through type holder Solenoid valve) Cleaning pump/tank) Non-explosionproof ultrasonic oscillator Explosionproof ultrasonic oscillator Alarm box) Accessory
pH sensor for high-purity water	IM 12B7J2 - 01E	PH8EHP PH8TBG PH8HH PH8AX	pH sensor for high-purity water Junction terminal box Holder for high-purity water Accessory
Fermentation pH sensor	IM 12B7Q1 - 01E	Y/465	Fermentation pH sensor (Y/764 Holder) (Y/776 Holder)
Distributor	IM 19B1E4 - 01E	PH201G	Distributor
Distributor	IM 1B4T1 - 01E	SDBT, SDBS	Distributor
Rack instrument mounting	IM 1B4F2 - 01E	Rack mounting instrument	
Safety barrier	IM 1B4S1 - 01E	Safety barrier	

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1. OUTLINE

The Models PH200G and PH200S intelligent 2-wire pH transmitter are used when configuring the “EXAPH intelligent 2-wire pH transmitter”.

[Features]

- Sensor trouble can also be monitored, even during pH measurement.
- Three types of built-in standard solution tables enable easy automatic calibration.
- Electrode characteristic deterioration can be checked automatically during automatic calibration by standard solutions. Thus, the electrode replacement period, which has so far relied on intuition can be determined.
- Daily maintenance can be performed with the case closed, eliminating or reducing insulation deterioration.
- Any pH range can be set in the field if it is more than 1pH.
- The built-in washing timer function enables washing of the solenoid valve drive contacts in combination with a dedicated distributor.
- Operation panel with superior operability.

1.1 System Configuration

The basic “EXAPH intelligent 2-wire pH transmitter” system configuration can be roughly divided into the following 3 groups.

1.1.1 General pH measurement system

(1) Application examples

- Water solution pH control in various production processes.
- Water solution pH measurement and recording in water purification plants.
- Industrial water pH measurement.
- Steel surface treatment process plating line pH measurement and control.
- The pH measurement in flue gas desulfurization/waste gas treatment processes.
- The pH measurement in factory waste water and drainage treatment processes.

(2) General purpose pH measuring system configuration equipments

(a) pH sensor

- PH8ERP KCl filling type pH sensor
- PH8EFP KCl refillable type pH sensor

(b) Holder and holder with cleaning device

- PH8HG Sensor suspension guide holder
- PH8HS Submersion type holder
- PH8HSF Submersion type holder with explosionproof type ultrasonic cleaning device Flameproof construction (ultrasonic oscillator)
- PH8HF Flow-through type holder
- PH8HFF Flow-through type holder with explosionproof type ultrasonic cleaning device Flameproof construction (ultrasonic oscillator)

(c) pH Transmitter

- Model PH200G Intelligent 2-wire pH Transmitter
- Model PH200S Intelligent 2-wire pH Transmitter Intrinsically safety

(d) Distributor

- PH201G Distributor Intrinsic safety is available
- SDBS General purpose distributor (for 4 points)
- SDBT General purpose distributor (for 1 point)
- BARD400 Safety barrier Instrisically safety

(e) Accessories for cleaning

- PH8USG Ultrasonic oscillator
- PH8USF Explosionproof Ultrasonic oscillator Flameproof construction
(ultrasonic oscillator)
- PH8AL Alarm box Flameproof construction (ultrasonic oscillator)

(f) Solenoid valve

- PH8MV Solenoid valve
- PH8MVF Explosionproof solenoid valve Flameproof construction (Jet
cleaning / brush cleaning)



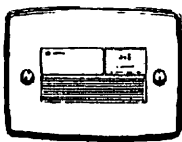
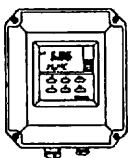
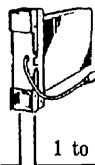
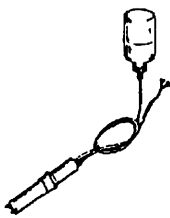

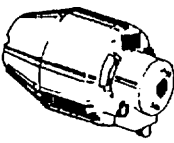
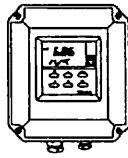
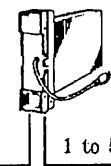
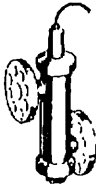

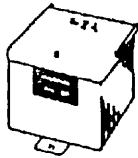
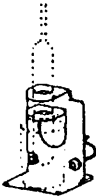

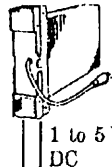
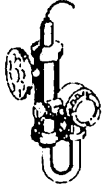



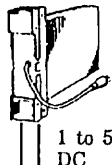
(g) Cleaning pump / tank

- PH8PU1 Cleaning pump / tank

(h) Junction terminal box

- PH8TBG Junction terminal box

General purpose pH measuring system configuration equipments

pH sensor	Holder	Accessory for cleaning	pH transmitter	Distributor
<ul style="list-style-type: none"> • KCl filling type PH8ERP 	<ul style="list-style-type: none"> • Sensor suspension guide holder PH8HG 	<ul style="list-style-type: none"> • Ultrasonic oscillator PH8USG 	<ul style="list-style-type: none"> • Intelligent 2-wire pH transmitter PH200G 	<ul style="list-style-type: none"> • Distributor PH201G  <p>1 to 5 V DC</p> <p>Contact output during maintenance Contact output during cleaning Contact output at trouble occurrence</p>
<ul style="list-style-type: none"> • KCl refillable type PH8EFP 	<ul style="list-style-type: none"> • Submersion type holder PH8HS 	<ul style="list-style-type: none"> • Explosionproof ultrasonic oscillator PH8USF 	<ul style="list-style-type: none"> • Intelligent 2-wire pH transmitter PH200S 	<ul style="list-style-type: none"> • Distributor SDBT, SDBS  <p>1 to 5 V DC</p> <p>• Safety barrier PH201G BARD400</p>
<ul style="list-style-type: none"> • Flow-through type holder PH8HF 	<ul style="list-style-type: none"> • Submersion type holder with explosionproof ultrasonic cleaning device PH8HSF 	<ul style="list-style-type: none"> • Alarm box PH8AL 	<p>PH8AX Accessory</p> <p>Sensor stand</p> 	  <p>1 to 5 V DC</p> <p>Contact output during maintenance Contact output during cleaning Contact output at trouble occurrence</p>
<ul style="list-style-type: none"> • Flow-through type holder with explosionproof ultrasonic cleaning device PH8HFF 		<p>Junction terminal box</p> <ul style="list-style-type: none"> • Junction terminal box PH8TBG 	<p>Calibration reagent and KCl</p> 	<ul style="list-style-type: none"> • Safety barrier PH201G BARD400 • Distributor SDBT, SDBS   <p>1 to 5 V DC</p>

1.1.2 pH Measurement System for High Purity Water

(1) Application example

- Drum water pH measurement of general purpose and thermal power generation boiler

(2) pH measurement system for high purity water configuration equipment

(a) pH sensor

- PH8EHP pH sensor for high purity water

(b) Holder

- PH8HH holder for purity water

(c) pH transmitter

- PH200G Intelligent 2-wire pH transmitter
- PH200S Intelligent 2-wire pH transmitter Intrinsically safety

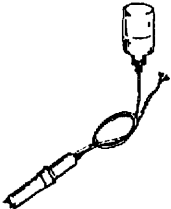
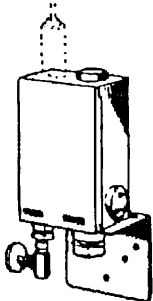

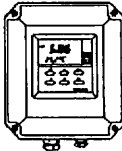
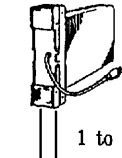
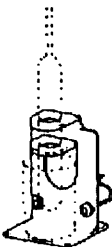

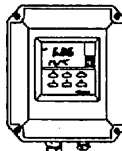
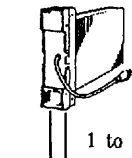
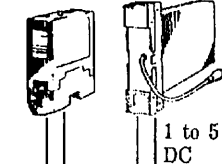
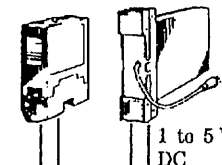
(d) Distributor

- PH201G Distributor Intrinsically safety is available
- SDBT Distributor
- SDBS Distributor
- BARD400 Safety barrier Intrinsically safety

(e) Junction terminal box

- PH8TBG Junction terminal box

pH measurement system for high purity water configuration equipment

pH sensor	Holder	Junction terminal box	pH transmitter	Distributor
<ul style="list-style-type: none"> For high purity water PH8EHP 	<ul style="list-style-type: none"> Holder for high purity PH8HH 	<ul style="list-style-type: none"> Junction terminal box PH8TBG 	<ul style="list-style-type: none"> Intelligent 2-wire pH transmitter PH200G 	<ul style="list-style-type: none"> Distributor PH201G  <p>1 to 5 V DC</p> <p>Contact output during maintenance Contact output during cleaning Contact output at trouble occurrence</p>
PH8AX Accessory				<ul style="list-style-type: none"> Distributor SDBT, SDBS
<p>Sensor stand</p>  <p>Calibration reagent and KCl</p> 			<ul style="list-style-type: none"> Intelligent 2-wire pH transmitter PH200S 	 <p>1 to 5 V DC</p> <p> <ul style="list-style-type: none"> Safety barrier BARD400 Distributor PH201G </p>  <p>1 to 5 V DC</p> <p>Contact output during maintenance Contact output during cleaning Contact output at trouble occurrence</p> <p> <ul style="list-style-type: none"> Safety barrier BARD400 Distributor SDBT, SDBS </p>  <p>1 to 5 V DC</p>

1.1.3 Fermentation pH Measuring System

(1) Application example

- Medium in fermentation tank

(2) Fermentation pH measuring system configuration equipment

(a) pH electrode

- Y/465 Fermentation pH electrode

(b) Holder

- Y/764 Holder
- Y/776 Holder

(c) pH transmitter

- PH200G Intelligent 2-wire pH transmitter

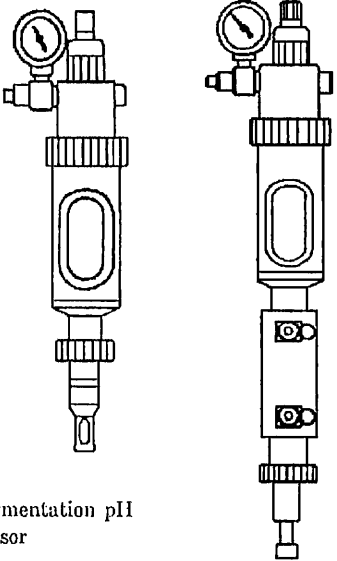

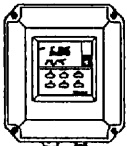
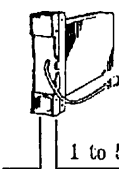
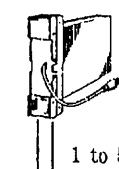
(d) Distributor

- PH201G Distributor
- SDBS Distributor

(e) Junction terminal box

- PH8TBG Junction terminal box

Fermentation pH measuring system configuration equipment

pH sensor	Junction terminal box	pH transmitter	Distributor
<ul style="list-style-type: none"> • Y/465, Y/764 • Y/465, Y/776  <p>Fermentation pH sensor</p> <p>Fermentation pH sensor (Removable type)</p>	<ul style="list-style-type: none"> • Junction terminal box PH8TBG 	<ul style="list-style-type: none"> • Intelligent 2-wire pH transmitter PH200G 	<ul style="list-style-type: none"> • Distributor PH201G  <p>1 to 5 V DC</p> <p>Contact output during maintenance Contact output during cleaning Contact output at trouble occurrence</p> <ul style="list-style-type: none"> • Distributor SDBT, SDBS  <p>1 to 5 V DC</p>

1.1.4 pH Measurement System Configuration Cautions

In order to achieve high-level functions and stability, as a rule, the EXAPH intelligent 2-wire pH transmitter can be combined with a standard (PH8EFP / PH8ERP), high purity water (PH8EHP) or fermentation pH sensor (Y / 465).

However, if an ordinary PH Σ pH sensor (PH8EFG / PH8ERG) or D602 pH sensor is used, an optional pH transmitter is available, but the following precautions should be taken in any case.

(1) When an ordinary PH Σ pH sensor (PH8EFG / PH8ERG) is used

- (a) The temperature sensor is set to 5.1 k Ω in the pH transmitter temperature sensor selection mode (service level) during manufacture.

Note : The customer cannot change the temperature sensor setting. If a change is required, please contact us.

- (b) One-point calibration is required, prior to using the temperature sensor built into the pH sensor. For details, see Section 5.1.3.

Note : One-point temperature calibration is required after pH sensor replacement.

- (c) pH transmitter functions and characteristics are different from those of the standard type. See Table 1.1.

(2) When the D602 pH sensor is used

- (a) The temperature sensor is set to 350 Ω in the pH transmitter temperature sensor selection mode (service level) at the factory.

Note : The customer cannot change the temperature sensor setting. If a change is required, please contact us.

- (b) One-point calibration is required, prior to using the temperature sensor built into the pH sensor. For details, see Section 5.1.3.

Note : One-point temperature calibration is required after pH sensor replacement.

- (c) pH transmitter functions and characteristics are different from those of the standard type. See Table 1.1.

Table 1.1 Characteristic Comparison Table

Combined pH sensor	(EXAPH) PH8EFP PH8ERG	(PHE) PH8EFG PH8ERG	D602
Temperature sensor	Pt 1000 Ω	5.1 k Ω	350 Ω
Liquid temperature measurement error*		7.5°C maximum at 100°C 2.5°C maximum at 50°C	7.5°C maximum at 100°C 2.5°C maximum at 50°C
Calibration error		0.02pH	0.02pH
Temperature compensation error		0.19pH at pH14 0.08pH at pH10 (100°C)	0.19pH at pH14 0.08pH at pH10 (100°C)
Temperature display	○	△	△
mA Output	○	○	○
E.m.f. display	○	○	○
Asymmetric potential	○	○	○
Slope display	○	○	○
RE impedance display	○	○	—
Automatic calibration	○	○	○
Manual calibration	○	○	○
Automatic temperature compensation	○	△	△
Manual temperature compensation	○	○	○
Standard temperature conversion	○	△	△
Automatic washing	○	○	○
GE selfdiagnosis	○	○	—
RE selfdiagnosis	○	○	—
Halfvalue width check	○	○	○
Response time check	○	○	○

* : When one-point calibration is made at 25°C.

○, △ : Executable function (△ : Indicates accuracy is worse than that of Pt 1000 Ω).

1.2 Standard Specification

Construction	: JIS C0920 waterproof construction Waterproof construction conforming to NEMA4. Non-explosionproof (for PH200G) or intrinsic safety (i3aG4) type (for PH200S)
Material	: Case : aluminum alloy diecast Window : polycarbonate
Paint	: Polyurethane resin, Baked finish
Paint color	: Cover : deep sea moss green (equal to Munsell 0.6G3.1/2.0) Case : frosty white (equal to Munsell 2.5Y8.4/1.2)
Weight	: Mainfram : approx. 2.4 kg Mounting bracket : approx. 0.7 kg
Mounting	: 50 A pipe mounting, wall or panel mounting
Ambient temperature	: -10 to 50°C
Storage temperature	: -30 to 70°C
Signal Cable inlet hole	: Plastic waterproof gland conforming to JIS A15 (Cable outer diameter : For 9 to 12 mm)
Measuring range	: pH-2 to pH15
Display method	: Digital (liquid crystal) display
Display range	: pH-2 to pH15
Transmission signal	: 4 to 20 mA DC, Isolated transmission output
Transmission signal range	: Any range is settable if span is more than 1pH and range is between pH-2 to pH15. (Set to 0 to 14pH prior to shipment.)
Power supply voltage	: 17 to 40 V DC For the relationship between power supply voltage and load resistance, see Figure 1.1. For intrinsically safe instrumentation, use Model SDBT or PH201G as a distributor.

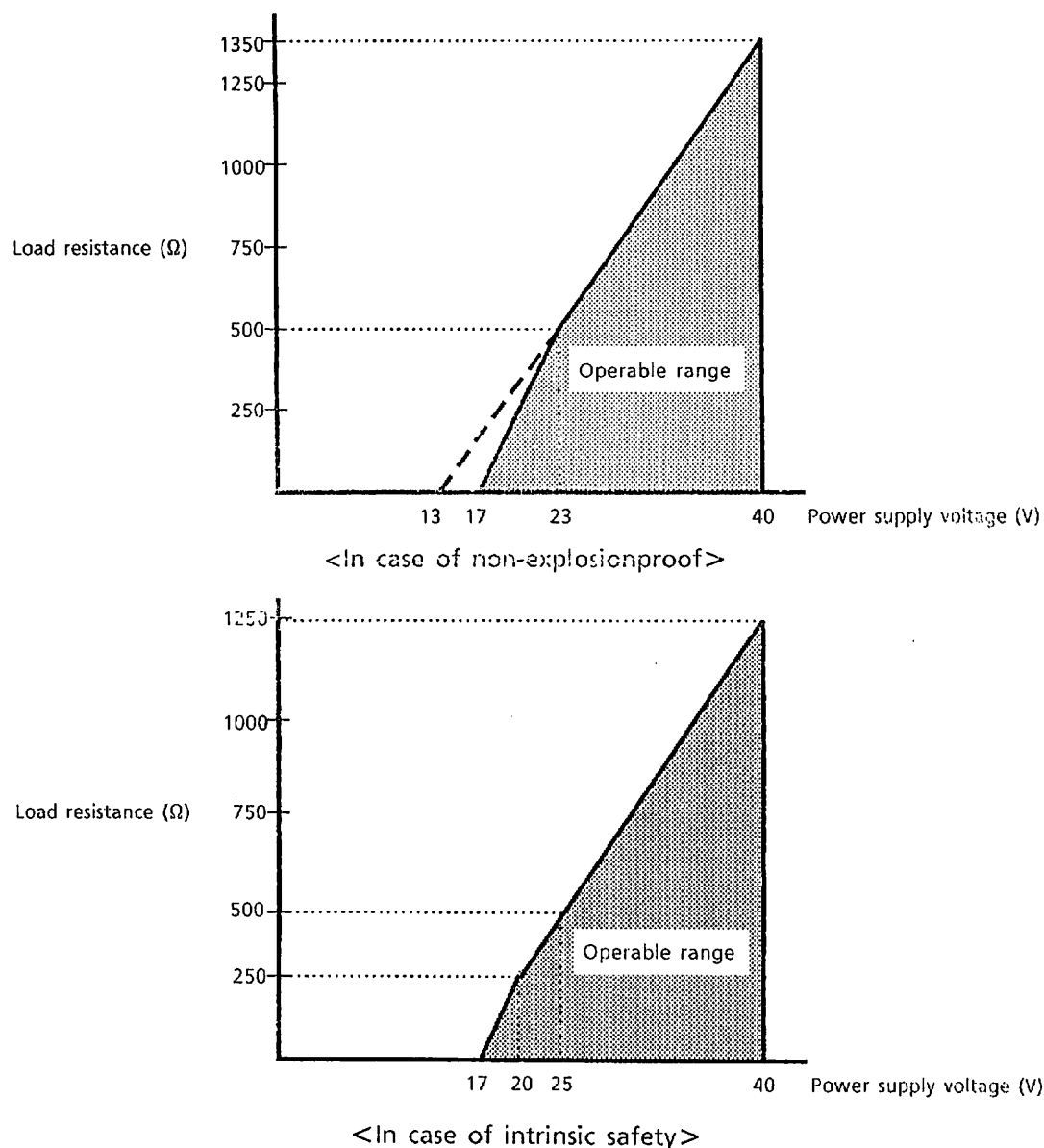


Figure 1.1 Operable range with respect to power supply voltage vs. allowable load resistance

<Functional specifications>

Input impedance : More than $10^{12} \Omega$

(Note). Sensor with liquid grounding pole is used due to the use of differential amplifier. (2 high input amplifiers are used.)

Asymmetric potential : $\text{pH}7 \pm 2\text{pH}$

Slope adjustment range : +20% and -5% for deviation from pH7

Automatic temperature compensation range :

-10 to +130°C (Manual temperature compensation is also available.)

Reference temperature conversion factor (reference temperature : 25°C) :

0 prior to shipment

Settable range : -1.0 to 1.0 [pH/10°C]

(Note) Reference temperature conversion is used only when pure water pH measuring system is configured and measured liquid temperature coefficient is known.

<Reference performance> (Performance when combined with pH sensor)

Repeatability : 0.05pH (Electrode is immersed into the same standard solution 3 times.)




Responsibility : 10 s (response to 90% when pH sensor and standard solution stabilized at 20°C are used and also the solution is fully agitated.)
±0.15pH (When KCl diffusion type pH sensor is used.)

Temperature repeatability : 1°C

<Operational function>

Display : 3-1/2 digits (Data display)
6-digit numerics and alphanumerics (message or data display)

Display function :

- pH-value
- Temperature value
- mA output
- Reference electrode impedance
- E.m.f. slope
- Asymmetric potential
- mV (e.m.f.)
- Error display (at error occurrence)
- Interactive message
- Key operation request display
-  mark display
-  mark display
-  mark display
- Mode indicator

Function settable and executable in operation level:

Automatic calibration (Standard solution selection : manual, indication stability check : automatic)

Manual calibration

Message area display detail selection

Temperature parameter setting :

- Automatic temperature compensation / manual temperature compensation selection
- Manual temperature setting
- Temperature coefficient for reference temperature conversion setting
- Transmission compensation signal hold / release

Function settable and executable in setting level:

Output range setting

Hold, parameter setting : ● Selection of presence/absence hold
 ● Selection of hold of value just before hold/preset value
 hold preset value setting

Washing parameter setting and manual washing : ● manual washing
 ● Timer ON/OFF selection
 ● Washing cycle setting
 ● Relaxation time setting
 ● Washing time setting

Service level code input

Function settable and executable in service level:

Use/unuse of reference temperature conversion

°C/°F selection

Temperature sensor selection

Check item setting

pH-value display selection (0.1pH/0.01pH)

Half-value recovery time check ON/OFF

Communication (contact signal output) ON/OFF

Burn up ON/OFF (output overflow of more than 20 mA at trouble occurrence)

Electrode type selection (glass electrode, antimony)

Response stability determination parameter set (for automatic calibration)

One-point temperature calibration

Details of trouble detection by self-diagnosis function :

pH measuring range overflow

Temperature measuring range overflow

Reference electrode impedance trouble (Measured liquid: more than 50 μ S/cm)

Glass electrode impedance trouble (Measured liquid: more than 50 μ S/cm and less than 60°C)

Slope trouble

Asymmetric potential trouble

Stability trouble during standard solution calibration

Half-value recovery trouble during automatic cleaning

EEROM trouble

1.3 Model No. and Codes

1.3.1 PH200G Intelligent pH Transmitter Model Number and Codes

Model No.	Basic code	Additional code	Specification
PH200G			Intelligent pH transmitter
Explosionproof construction	- N		Non-explosionproof construction (Always - N for PH200G)
Combined sensor	- PT1		Pt 1000 Ω
Language used for warning	- E		English
Style Code	* A		Style A
Additional specification		/PI /W /PA /H /SCT /AFTG	Pipe mounting bracket Wall mounting bracket Panel mounting bracket Hood Stainless steel tag plate G 1/2 (PF 1/2 Female)
Mounting bracket			
Hood			
Tag plate			
Adapter for conduit installation work			

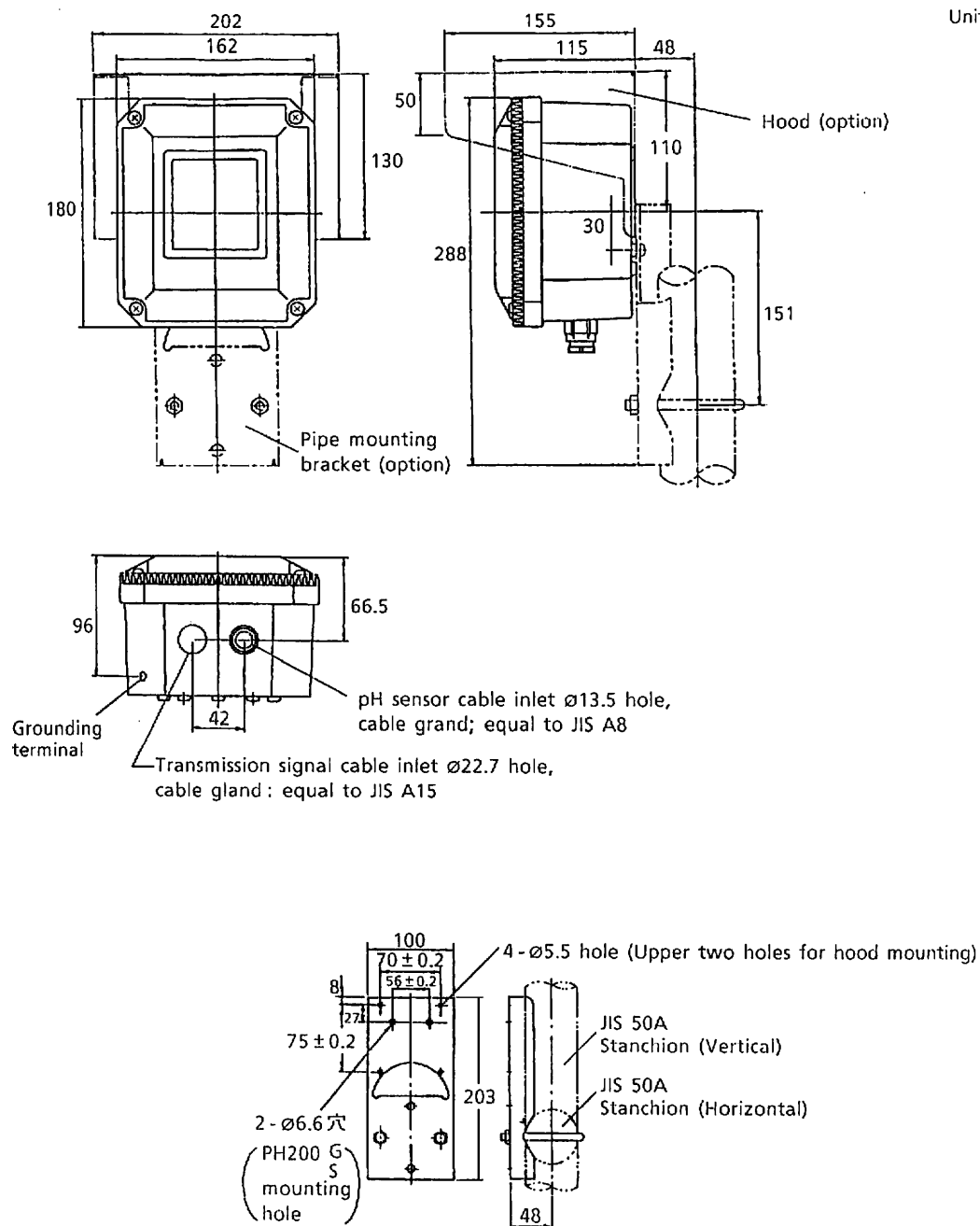
1.3.2 PH200S Intelligent pH Transmitter Model Number and Codes

Model No.	Basic code	Additional code	Specification
PH200S			Intelligent pH transmitter
Explosionproof construction	- J		JIS intrinsically safe explosionproof construction (i3aG4)
Combined sensor	- PT1		Pt 1000 Ω
Language used for warning	- E		English
Style Code	* A		Style A
Additional specification		/PI /W /PA /H /SCT /AFTG	Pipe mounting bracket Wall mounting bracket Panel mounting bracket Hood Stainless steel tag plate G 1/2 (PF 1/2 Female)
{ Mounting bracket }			
{ Hood }			
{ Tag plate }			
{ Adapter for conduit installation work }			

1.4 Dimensional Outline Drawing

(1) Pipe mounting

Unit : mm



<Pipe mounting bracket>

Figure 1.2 Dimensional Outline Drawing of Intelligent 2-wire pH Transmitter (Pipe mounting)

(2) Panel mounting and wall mounting

Unit : mm

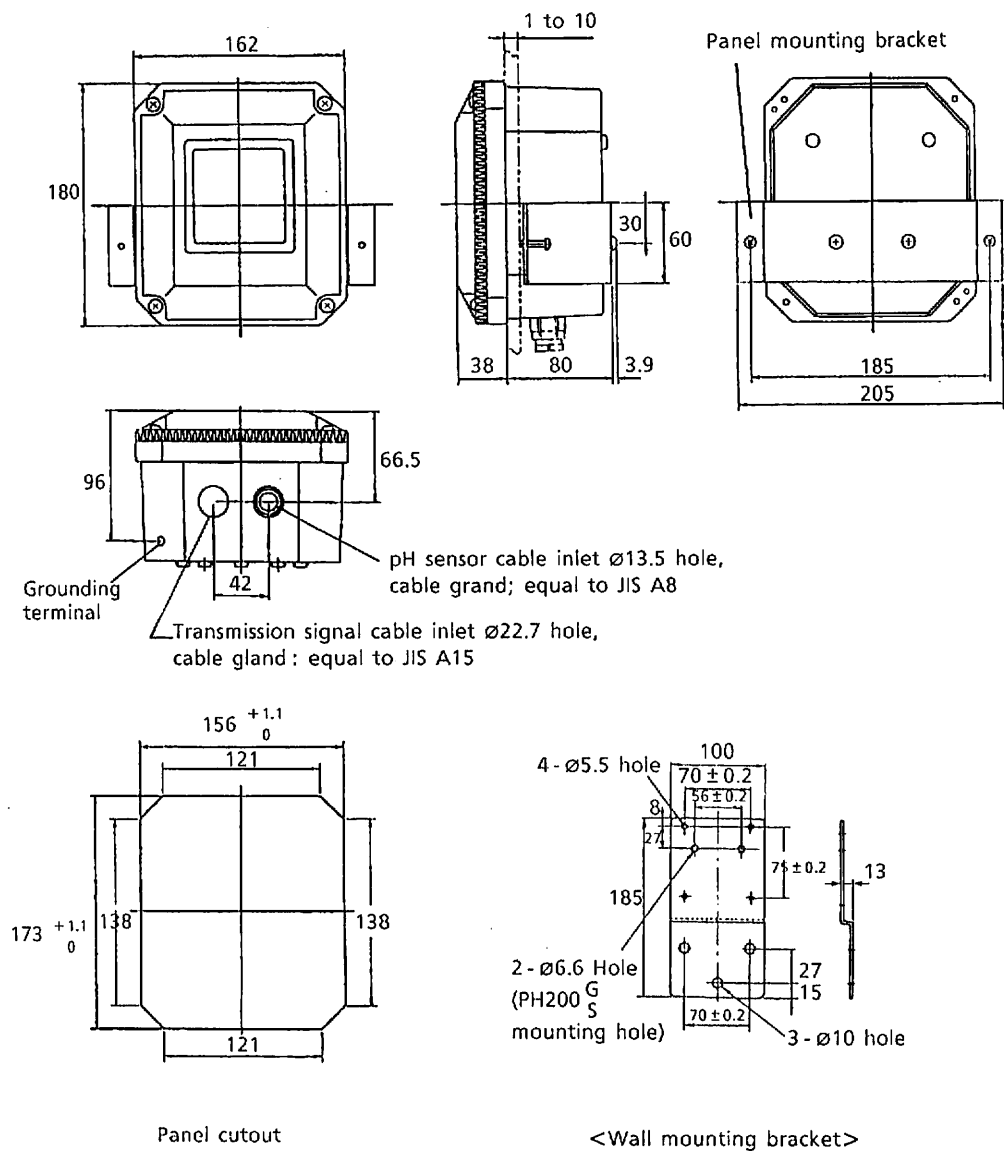


Figure 1.3 Dimensional Outline Drawing of Intelligent 2-wire pH Transmitter
(Panel Mounting and Wall Mounting)

1.5 Intrinsically Safe pH Transmitter Handling

The PH200S intelligent 2-wire pH transmitter is an instrument which has been confirmed as having explosionproof characteristics as a result of verification by a public organization under the Labor Safety Hygiene Act, and can therefore be used at hazardous locations. However, there are some limitations on handling and the environmental conditions in which it can be used, making it necessary to strictly observe the cautions marked on the product and given in the respective instruction manual.

1.5.1 Explosionproof Specifications of PH200S Intelligent 2-wire pH Transmitter

The PH200S intelligent 2-wire pH transmitter is of JIS intrinsically safe construction (i3aG4).

1.5.2 Explosionproof Specification Marking

Check the pH transmitter being used. The intrinsically safe pH transmitters explosionproof type, type verification approval No., explosionproof construction, relevant gas and operable ambient temperature range are printed on the instrument along with handling cautions (i3aG4).

1.5.3 Installation location limitation

The intrinsically safe pH transmitter can be installed and used at hazardous locations to generate the relevant gas in which the transmitter's explosionproofing has been confirmed.

However, avoid installing the transmitter at class 0 locations as much as possible.

1.5.4 Environmental conditions at installation location

Humidity and height above sea level must be in the following ranges. Use the transmitter at the temperature specified.

Humidity	:	45 to 85% RH
Height above sea level	:	Less than 1000 m

1.5.5 External Wiring work

Wiring to the intrinsically safe explosionproof block (pH transmitter, etc.) should not exceed the specified inductance and capacitance, and measures must be taken to prevent the mixing of intrinsically safe and non-intrinsically safe circuits and outer cable damage. For details, see "2. Installation and Wiring".

1.5.6 Maintenance

As a rule, part replacement and repair in the intrinsically safe explosionproof block should be done so as to return it to its original specification both electrically and mechanically, i.e., there should be no changes to the specification.

And repair the transmitter within the scope of not using a solder iron always in a hazardous location.

2. INSTALLATION AND WIRING

2.1 Installation and Wiring

2.1.1 Unpacking and Specification Check

The intelligent 2-wire pH transmitter is carefully packed after strict inspection at the factory so as to prevent damage during transportation.

Carefully handle the transmitter during unpacking, and when it has been unpacked, check it visually to confirm that there is no damage. Also, see if the transmitter is as ordered by checking it against the description on the nameplate.

○

pH TRANSMITTER

MODEL	PH200G
SUFFIX	- N - PT1 - J * A
/ PI / H / SCT / AFTG	
SUPPLY	24 V DC
OUTPUT	4 TO 20 mA DC
AMB. TEMP	- 10 TO 55 °C
NO.	
TAG No.	

YOKOGAWA ◆
Made in Japan

○

Figure 2.1 Nameplate Indication Example

2.1.2 Installation Location

Although the intelligent 2-wire pH transmitter is of waterproof construction, install it as much as possible where:

- (1) Corrosive gas concentrations are low.
- (2) Mechanical vibration is low.
- (3) At ambient temperature and where temperature change is small.
- (4) A humidity of between 45 and 85% RH is maintained.

(Extremely high or low humidity is bad for the transmitter.)

Also, if the temperature inside the transmitter is likely to exceed the operation limit due to exposure to direct sunlight, it is recommended that a hood (Optional) be installed.

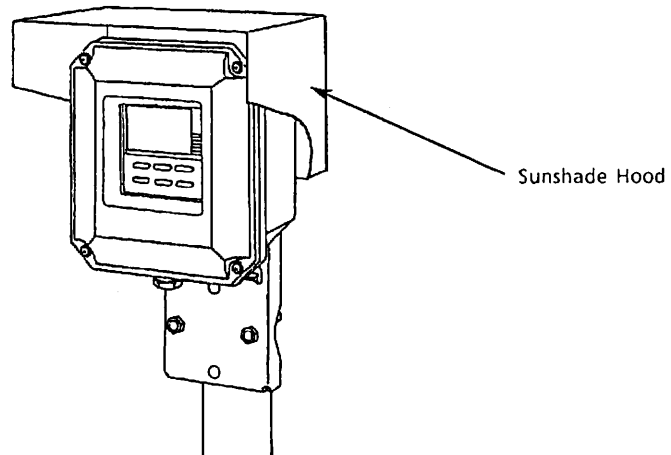


Figure 2.2 Sunshade Hood

2.1.3 Installation Procedure

The intelligent 2-wire pH transmitter can be mounted on a panel, wall or a pipe (nominal size 50 mm). However, special mounting brackets are required to mount the transmitter on a pipe or wall, and they are to be attached as specified.

(1) Panel Mounting

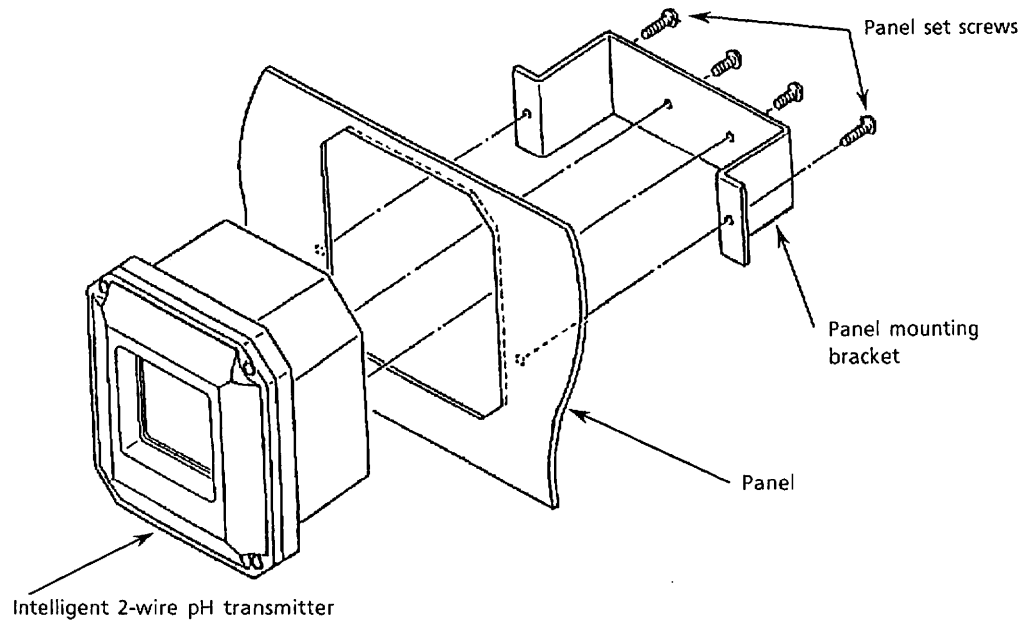
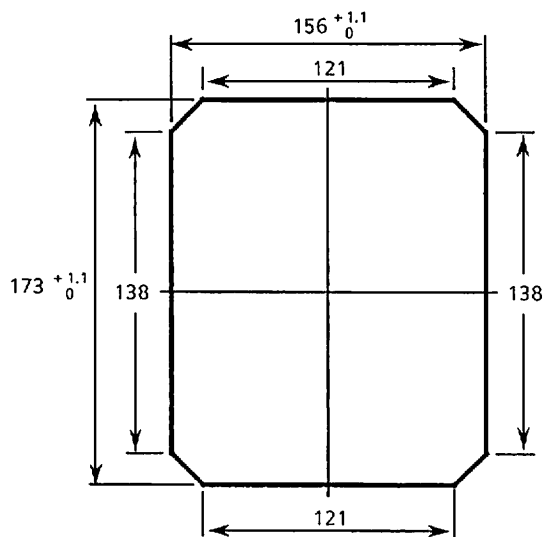


Figure 2.3 Panel Mounting Bracket and Installation Procedure



Unit : mm

Figure 2.4 Panel Cutout Dimensions

(2) Pipe Mounting

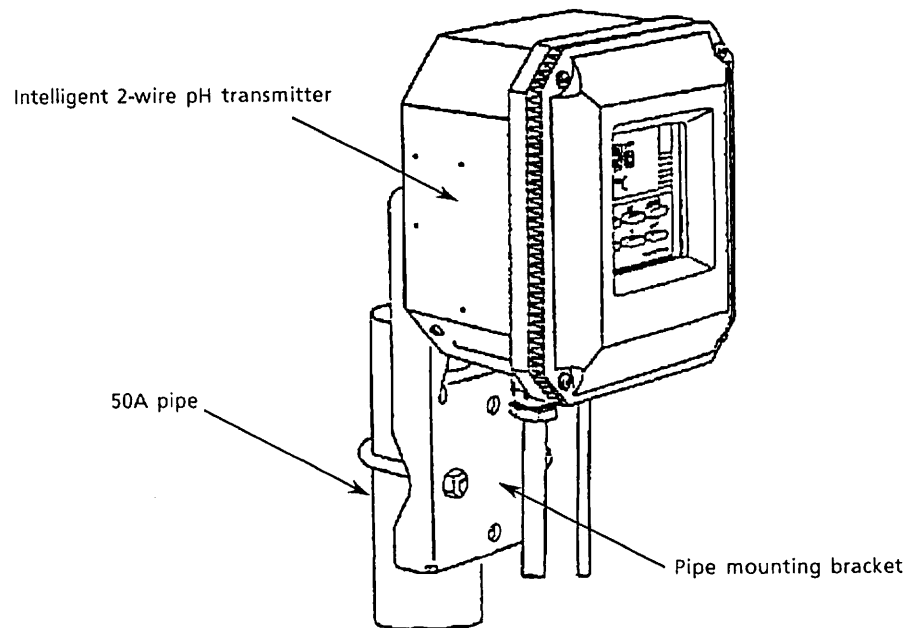


Figure 2.5 Pipe Mounting

(3) Wall Mounting

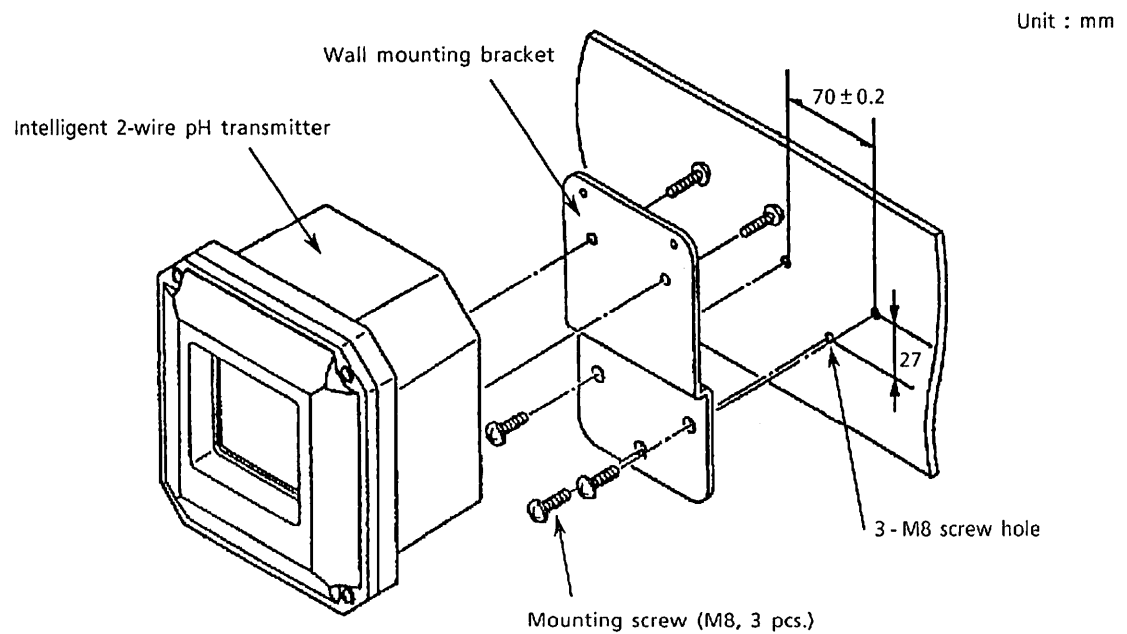


Figure 2.6 Wall Mounting

2.2 Wiring

Wiring is to be connected to the intelligent 2-wire pH transmitter as follows.

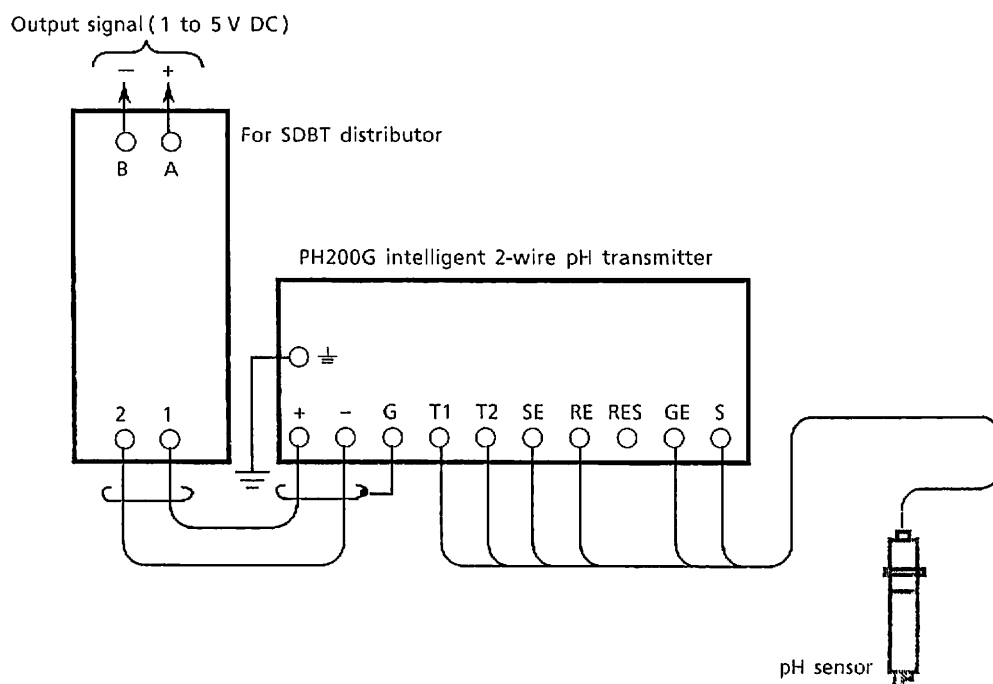
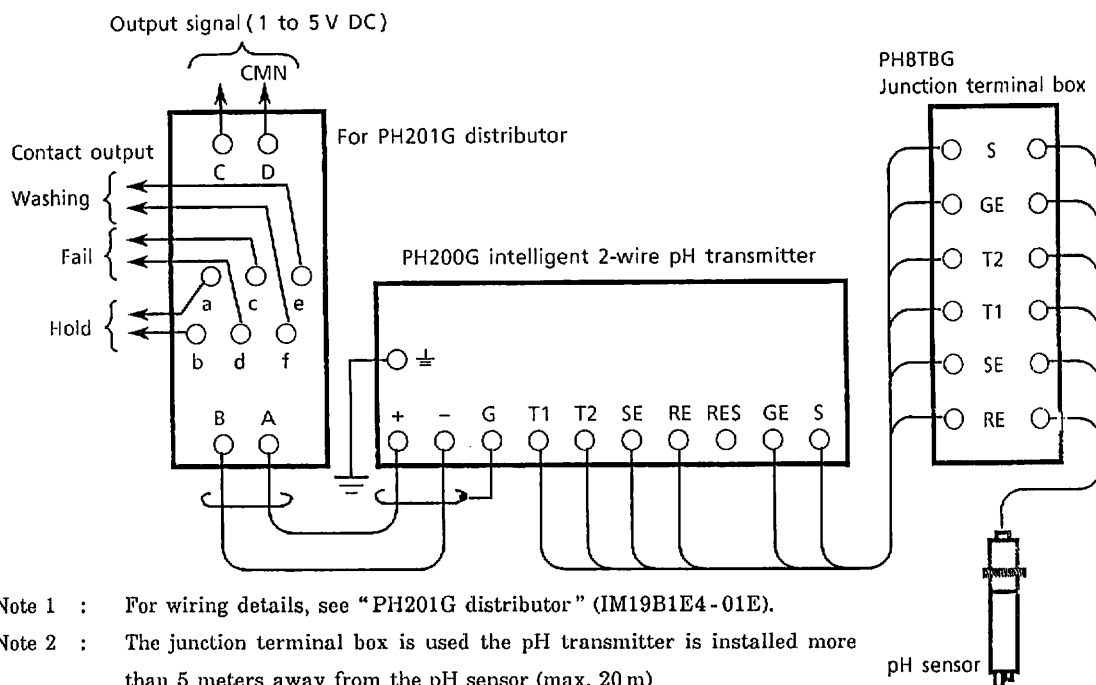
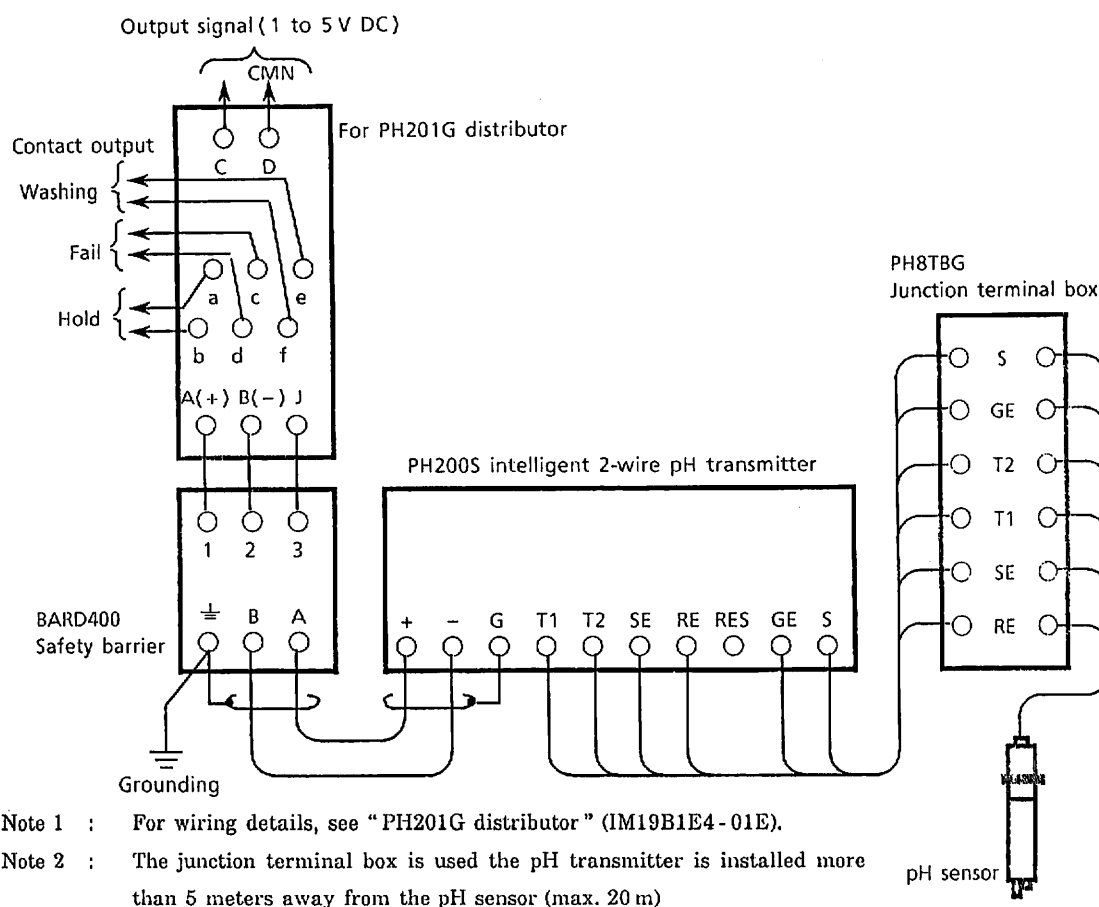


Figure 2.7 Cable Connected to Intelligent 2-wire pH Transmitter
(Example of non-explosionproof system)



Output signal (1 to 5 V DC)

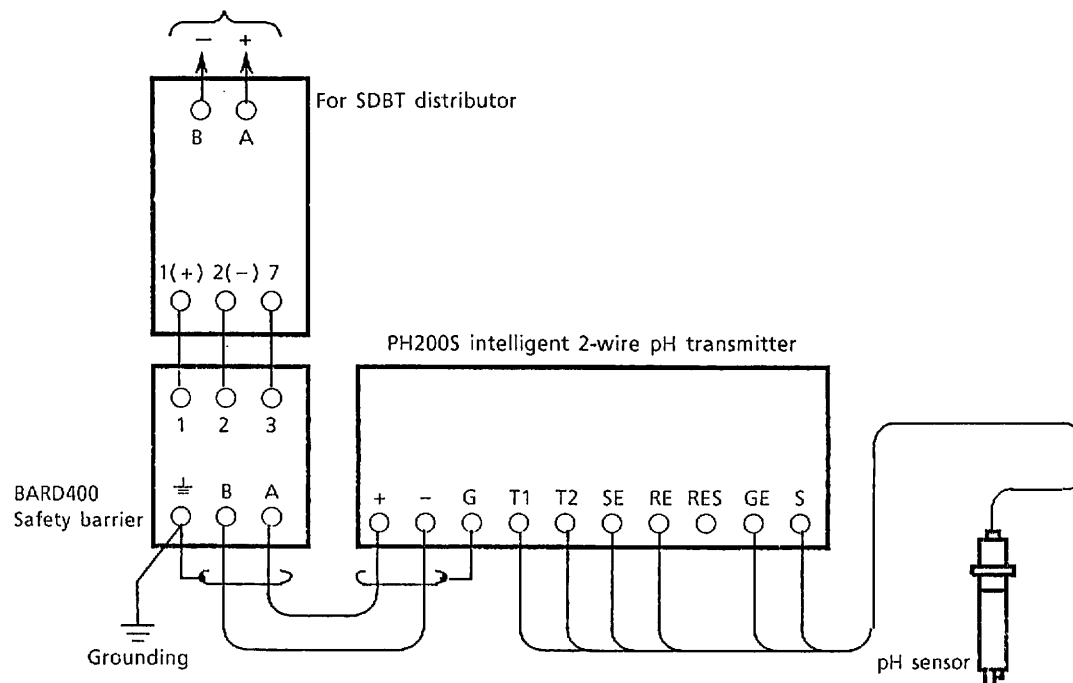


Figure 2.8 Cable Connected to Intelligent 2-wire pH transmitter
(Example of intrinsically safe explosionproof system)

2.2.1 Sensor Cable Connection

The following describes how to connect a pH sensor cable directly to the intelligent 2-wire pH transmitter.

When the cable is to be connected to a junction terminal box, first read the separately prepared "PH8TBG Junction Terminal Box (IM 12B7W1 - E)" instruction manual.

- (1) Remove the 4 screws and lift off the intelligent 2-wire pH transmitter cover.

Note : When the PH200S pH transmitter is used, lift off the terminal cover.

- (2) Connect the sensor cable to the relevant terminals.

First, remove the nut from the cable gland, then push the cable into the inside through a wiring hole on the left front. Pass the cable through the nut, then confirm each conductor symbol. Thus, connect the conductor to the relevant terminal.

Note : When the PH200S pH transmitter is used, put on the terminal cover.

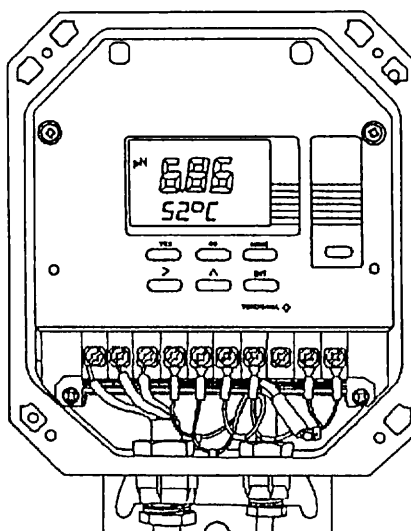


Figure 2.9 Sensor Cable Connection Status

- (3) Screw the cable gland into the wiring hole.
- (4) When the gland is secured, firmly secure gland packing to prevent moisture penetrating into the case. However, do not overtighten as doing so may damage the cable.
- (5) After wiring work is finished, close the transmitter cover firmly to prevent moisture from penetrating into the case.

2.2.2 Junction terminal box connection cable connection

When a junction terminal box is used, connect the junction terminal box to the intelligent 2-wire pH transmitter via a special cable attached to the box by following the procedure in item 2.2.1.

The junction terminal box is used only when the intelligent 2-wire pH transmitter is installed more than 5 m away from the pH sensor (up to 20 m).

2.2.3 Transmission signal cable connection

Connect the intelligent 2-wire pH transmitter to the distributor (for non-explosive systems) or safety barrier (for intrinsically safe systems).

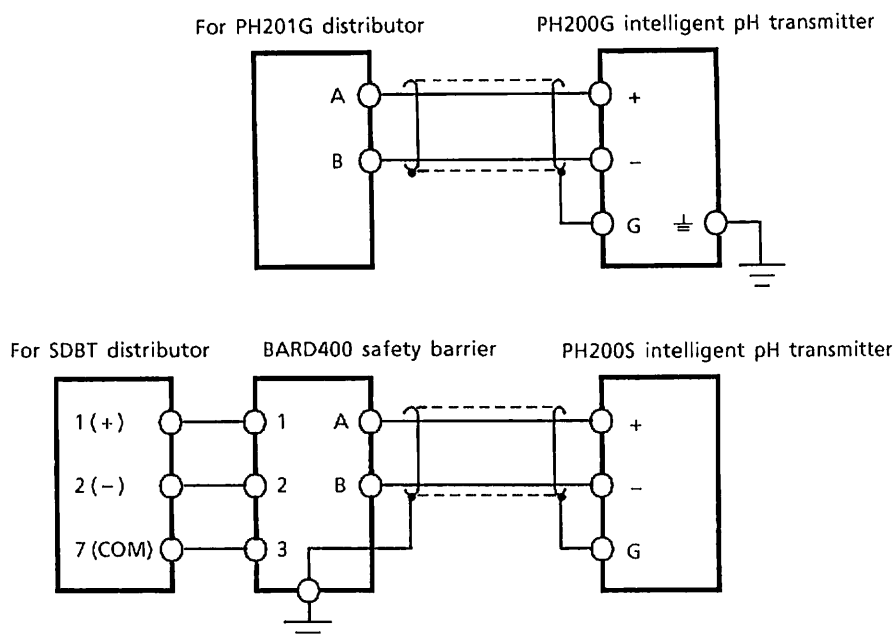


Figure 2.10 Example of Transmission Signal Cable Connection

Use a 2-conductor shielded cable with a finished outer diameter of $\varnothing 10$ to $\varnothing 12$ mm.

For non-explosive systems, use a maximum cable length of 2000 m (to obtain a minimum operating voltage for pH transmitters). For intrinsically safe systems use a maximum cable length of 700 m (see Note below). What's more, for the intrinsically safe systems, the leadwire inductance and capacitance must be 2.2 mH and 35 nF respectively. For the wiring connection to the safety barrier, connect a shielding wire to the safety barrier ground terminal and then ground it to conform to JIS Class 1 (ground resistance of up to 10 Ω).

Note : When using CEV-S cables. When CVV-S cables are used, a maximum cable length must be 350 m.

(1) Cable end treatment

Strip about 40 mm of cable insulation from each end, cut the exposed shield at its end, solder a grounding leadwire at this point, and then protect the soldered point by covering it with insulation tape.

Next, cut each leadwire end so that it is as long as the conductor, then attach a clamp-on terminal lug compatible with an M4 screw to each end of the leadwire and conductor.

Note : In intrinsically safe systems, use an fork type terminal or crimp contact terminal.

(2) Connect the cable to each terminal

Remove the cable gland from the intelligent 2-wire pH transmitter, then pass the cable through the gland with the nut removed. Pass the cable through the specified wiring hole into the inside of the case, then correctly connect each conductor to the relevant terminal.

When a conduit is used to protect the cable, replace the cable packing gland with an adapter.

Unit : mm

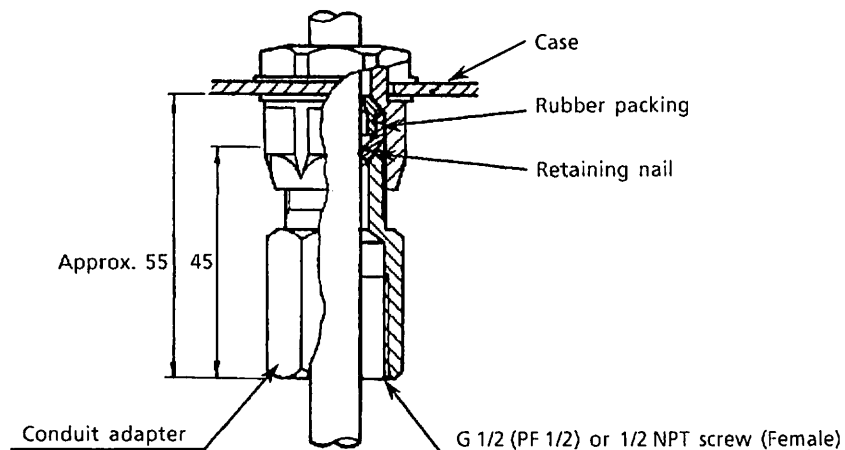


Figure 2.11 Conduit Connection Adapter

- (3) Screw the cable gland into the wiring hole.
- (4) When the gland is secured, firmly secure gland packing to prevent moisture penetrating into the case. However, do not overtighten as doing so may damage the cable.
- (5) After wiring work is finished, close the transmitter cover firmly to prevent moisture from penetrating into the case.

2.2.4 Case Grounding Terminal

For the non-explosionproof types, ground terminal

Ground the grounding terminal at the lower part of the intelligent 2-wire pH transmitter (JIS No. 3 grounding, grounding resistance : 100 Ω or less) using a thick conductor (nominal cross section : More than 2 mm²).

Be sure to insert the leadwire between the screw head and washer.

Note : For the intrinsically safe system, grounding is made on the BARD400 safety barrier side. That is, be sure not to ground on the pH transmitter side.

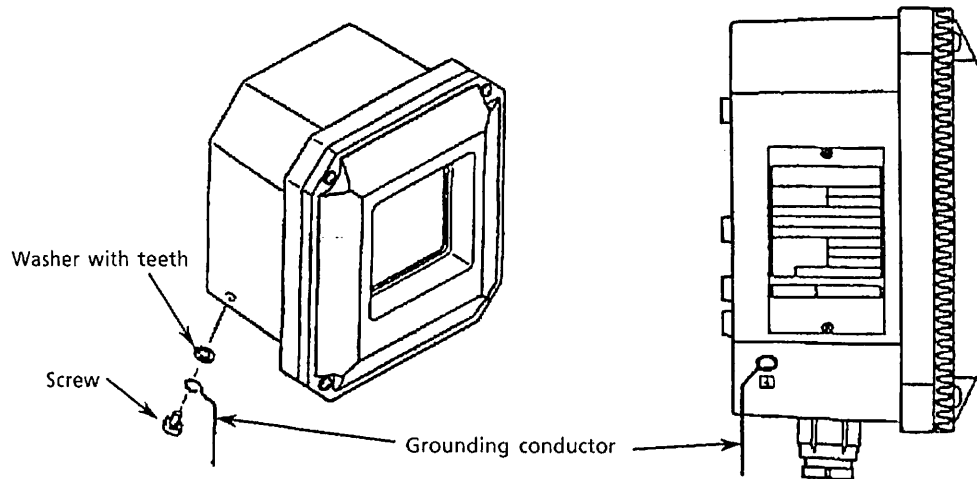


Figure 2.12 Grounding Wire Connection Procedure

3. FUNCTIONAL DESCRIPTION

3.1 Name of Each Section

Figures 3.1 and 3.2 show the functional description of the intelligent 2-wire pH transmitter.

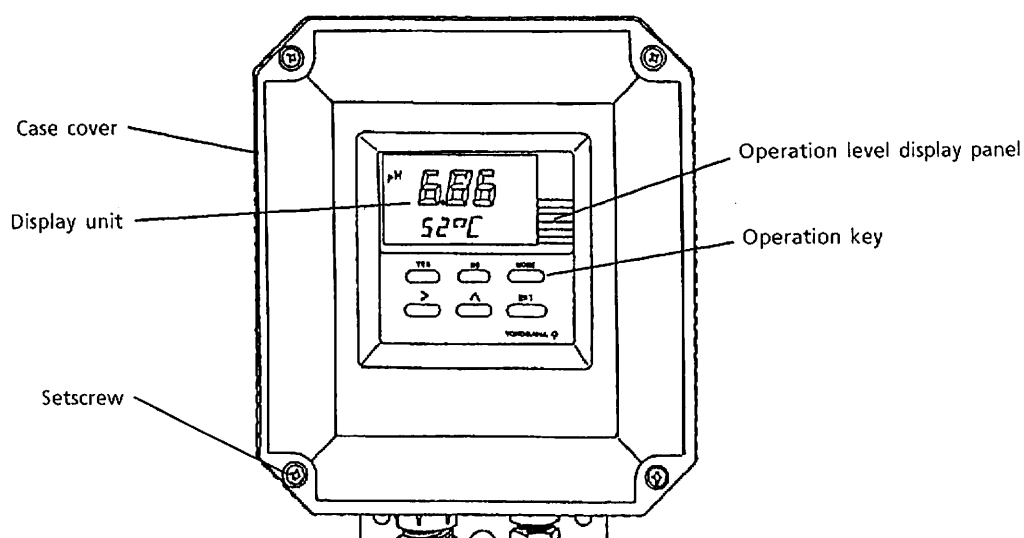


Figure 3.1 Functional Description of Intelligent 2-wire pH Transmitter (with the Cover Closed)

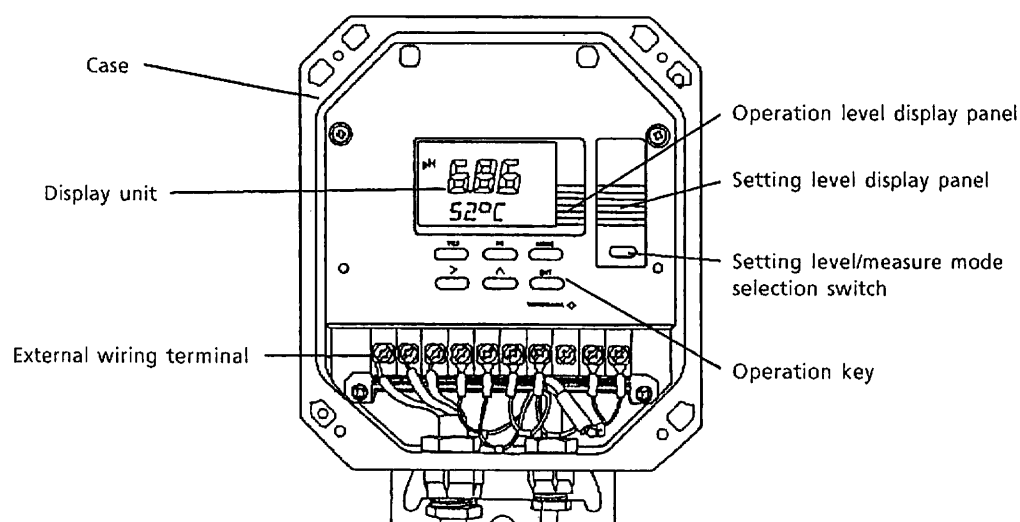


Figure 3.2 Functional Description of Intelligent 2-wire pH Transmitter (with the Cover Open)


3.2 Intelligent 2-wire pH Transmitter Operation

Intelligent 2-wire pH transmitter operation is determined by the following 3 operation levels.

- (1) Operation level
- (2) Setting level
- (3) Service level

In the daily inspection and maintenance operation level, it can be operated with the cover closed, while function selection and data setting are done in the setting and service levels. These levels are functions which are not usually used and are masked with a cover. Remove the cover to change these functions.




3.2.1 Mode Details in the Operation Level

The  key is used to enter and exit the operation level.

In the operation level, the following modes are available.

- (1) ▶ MEASURE : pH display and auxiliary display.
- (2) ▶ AUT. CAL : Automatic calibration, and selection of standard solutions pH4, pH7 or pH9.
- (3) ▶ MAN. CAL : Manual calibration and standard solution pH-value setting.
- (4) ▶ DISP : Selection of message area display details
Temperature / Output current / e.m.f. / Asym / Slope / Reference electrode impedance.
- (5) ▶ TEMP : Automatic temperature measurement / manual temperature measurement selection, manual temperature setting and temperature coefficient setting.
- (6) ▶ HOLD : Hold ON / OFF selection.
Note : If *HLD OFF is set in the setting level, it is impossible to enter the hold mode.




3.2.2 Mode Details in the Setting Level

The  key enables entry to the setting level, while the  and  keys enable exit from the same level.

In the setting level, the following modes are available.

- (1) ▶ *OUTPU : Range setting (pH value setting at 4 mA and 20 mA).
- (2) ▶ *SET. HD : Hold ON / OFF selection and selection of value just before hold / set-value at hold.
- (3) ▶ *WASH : Manual washing / timer selection, timer ON / OFF selection, washing interval, washing time and relaxation time settings.

3.2.3 Mode Details in the Service Level

The  key enables entry to the service level, while the  and  keys enable exit from the same level.

The following codes necessary for data setting are available for the service level.

(1) ▶ *SERVC

<Code>

01 *TEMP : Selection of reference temperature conversion ON/OFF and °C/°F.

02 *T.SENS : RTD for temperature compensation Pt 1000 Ω / Pt 100 Ω / 5.1 kΩ / 3 kΩ / 350 kΩ.

Note : Select any of the above values suitable for the RTD used, otherwise a malfunction may occur.

03 *CHECK : Selection of Asym ON/OFF, slope ON/OFF and Imp ON/OFF.

*IMP. LT : Impedance check high-limit value setting.

04 *DISP : Selection of display digit 0.01/0.1.

05 *HT. CHK : Selection of half-value recovery time check ON/OFF during washing.

*HT. min : Half-value recovery time setting during washing.

06 *COMM : Communication ON/OFF selection.

07 *BURN : Burn ON/OFF selection.

08 *Sb. SEN : Glass electrode/antimony electrode selection

09 *ΔT. SEC : Discrimination parameter ΔT setting during standard solution calibration.

*ΔpH : Discrimination parameter ΔpH setting during standard solution calibration.

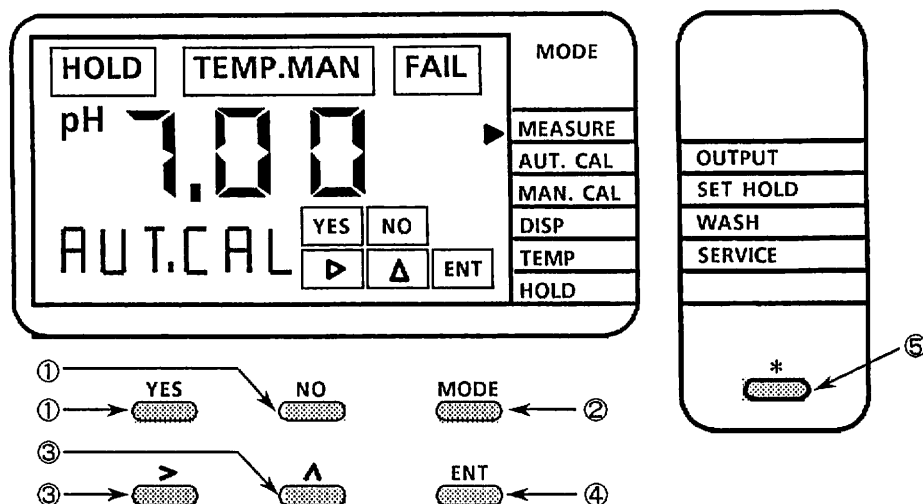
10 *TP. ADJ : One-point temperature calibration setting

Note : One-point temperature calibration can be done for RTDA other than Pt 1000 Ω and Pt 100 Ω, but when Pt 1000 Ω and Pt 100 Ω RTDA are used, do not set a one-point temperature calibration value.

4. OPERATION AND DISPLAY

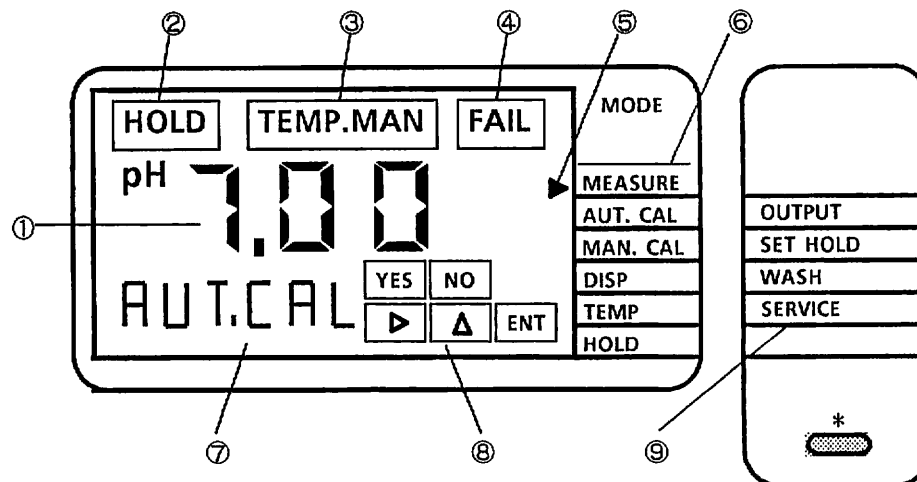
All the keys on the intelligent 2-wire pH transmitter operate interactively to enable easy operation in accordance with messages and the operation key indicator.

4.1 Operation Key



- ① YES NO : Used when replying YES/NO to a message.
- ② MODE : Used when the mode is selected.
- ③ : Used when data setting is made.
- ④ ENT : Set a input value when pressed this key.
- ⑤ * : Pressing this key sets the entered value used when setting level / measure mode is selected.

4.2 Display Unit



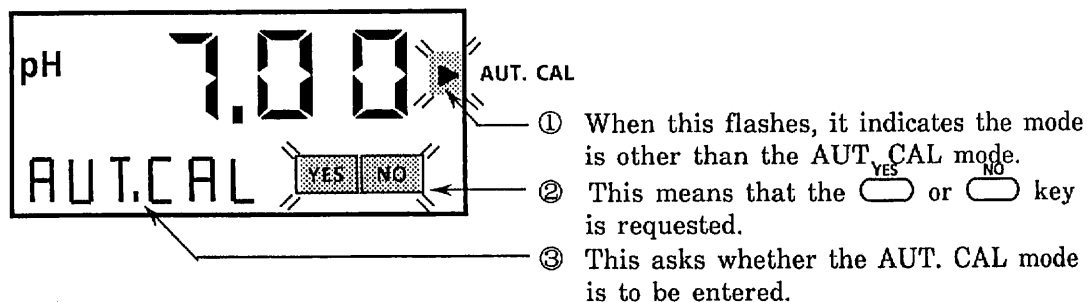
- ① Data area : Displays measured data, set data, etc.
- ② HOLD : Displayed during hold.
- ③ TEMP.MAN : Displayed during manual temperature compensation.
- ④ FAIL : Displayed when trouble occurs.
- ⑤ Mode pointer : Indicates the mode selected. When this pointer lights up, it indicates that the mode has been selected. When the pointer flashes, this indicates that a different mode has been selected.
- ⑥ Mode in operation level
- ⑦ Message area : Displays a message necessary for data other than pH measured value and interactive operation.
Note : When * is displayed at the head of a message, this indicates that the level is the setting/service level.
- ⑧ Operation key indicator : Indicates the key to be pressed for operation.
- ⑨ Mode in setting level/service level.

4.3 Basic Operation

4.3.1 Operation when the **YES** and **NO** Displays Flash

When **YES** or **NO** flashes on the operation key indicator (as in example ②), press the **YES** or **NO** key to respond to the message (example ③).

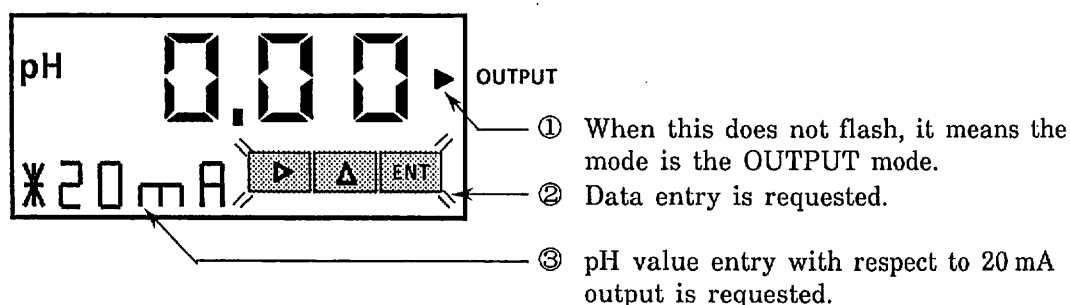
(Example)



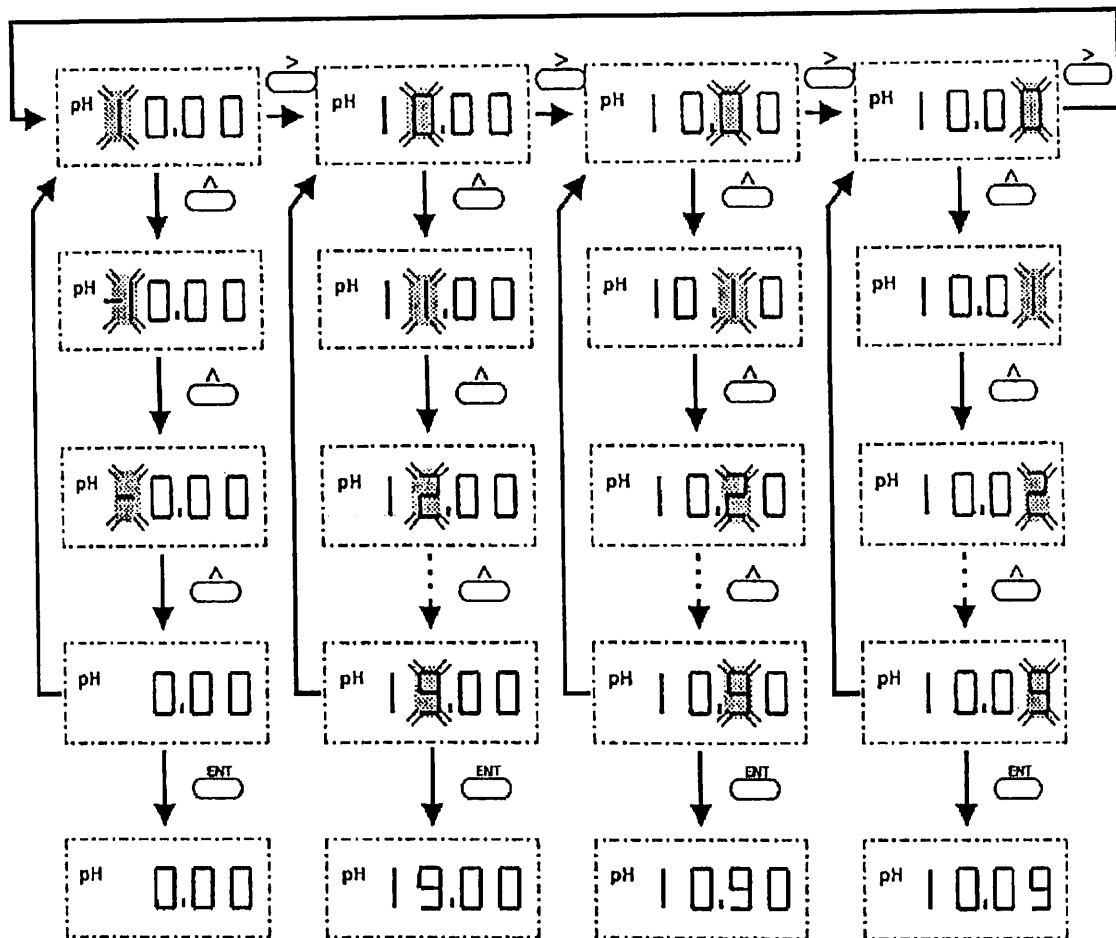
4.3.2 Operation Required the **▷**, **Δ** and **ENT** Displays Flash

When **▷**, **Δ** and **ENT** flash on the operator key indicator, it means that data entry for the message displayed in the message area is requested. Move the digit in the data area by pressing the **▷** key, increment the flashing digit by pressing the **Δ** key, and then press the **ENT** key to set it.


(Example 1)



(Example 2) Data setting by pressing the Δ and \triangleright keys.

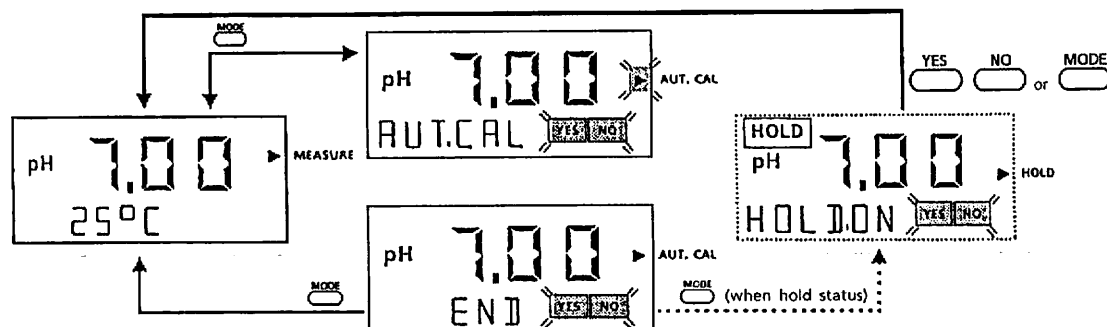


4.3.3 Mode Selection Operation


Press the  key when entering another mode from the measurement mode or returning to the latter from the former. With the following exceptions, all modes return to the measurement mode at any operation level status.




- (1) During calibration (not accepted until calibration ends).
- (2) Now in the hold status at the end of calibration (entry to the HOLD mode).

(Example)






4.3.4 Selection of Setting Level

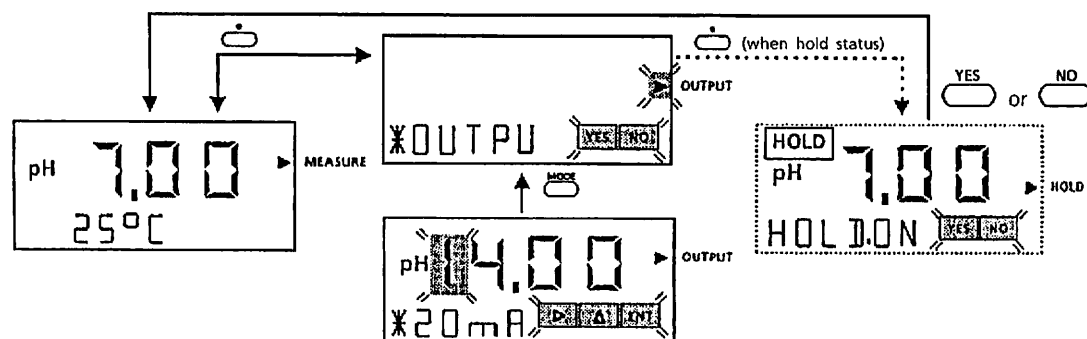
Remove the 4 screws and then take the front cover off the intelligent 2-wire pH transmitter. Press the  key to change to the setting level.

When returning to the operation level measurement mode from the setting level, press the  or  key, then the  key again.

However, in the hold status, the mode returns to HOLD.

Note : The  key only enables selection between the MEASURE and OUTPUT modes. Therefore, when entering the mode in the setting level, press the  key to set “*OUTPUT”, then press the  key to return to the measurement mode.

(Example)



4.3.5 Selection of Service Level

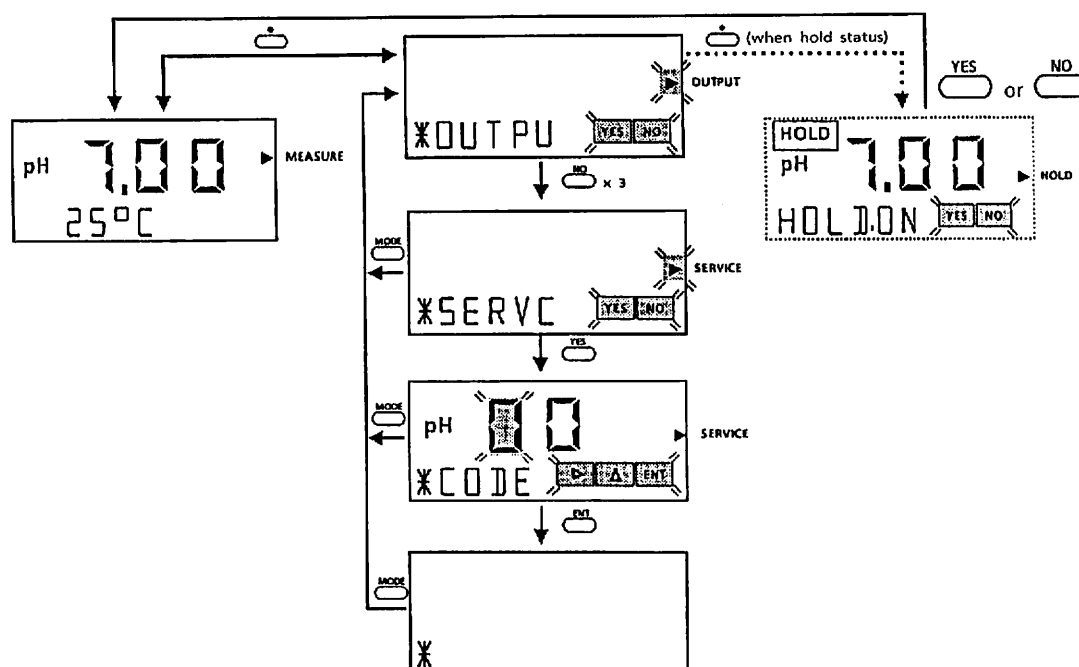
First, press the key to select the setting level.

Next, press the and keys to enter the service mode, then enter the code.

Press the and keys when returning to the operation level measurement mode from the service level.

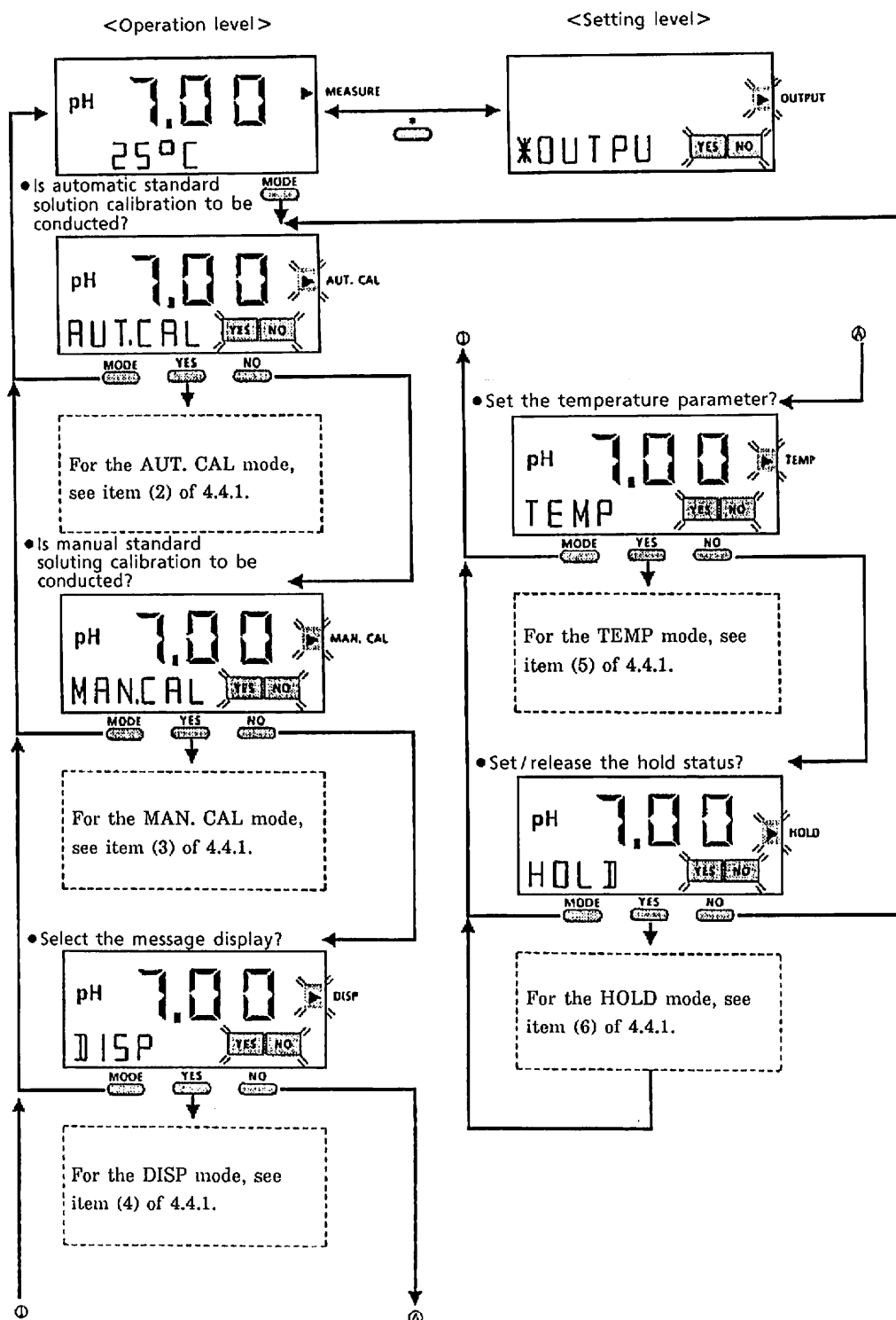
However, in the hold status, the mode returns to hold without changing to the measurement mode.

(Example)



4.4 Level and Mode Selection Procedures

4.4.1 Mode Selection in the Operation Level



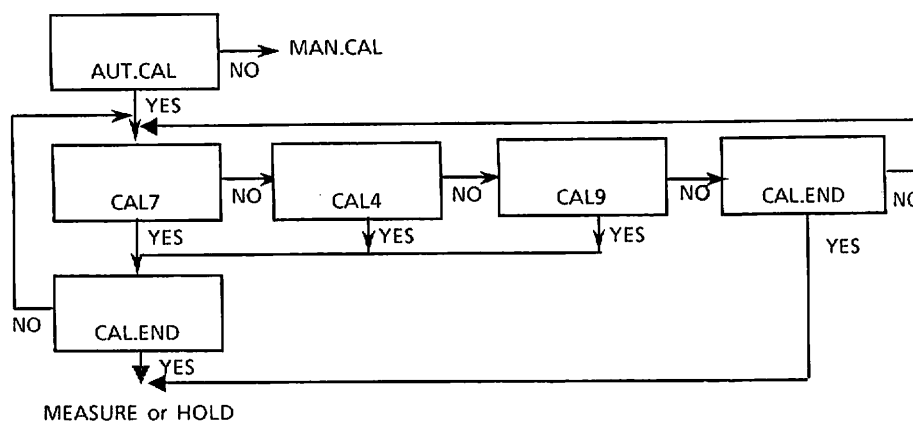
(1) MEASURE (Measurement mode)

pH and message (One of temperature, mA output, e.m.f., asymmetric potential, slope and impedance) are displayed.

(2) AUT, CAL (Automatic calibration mode)

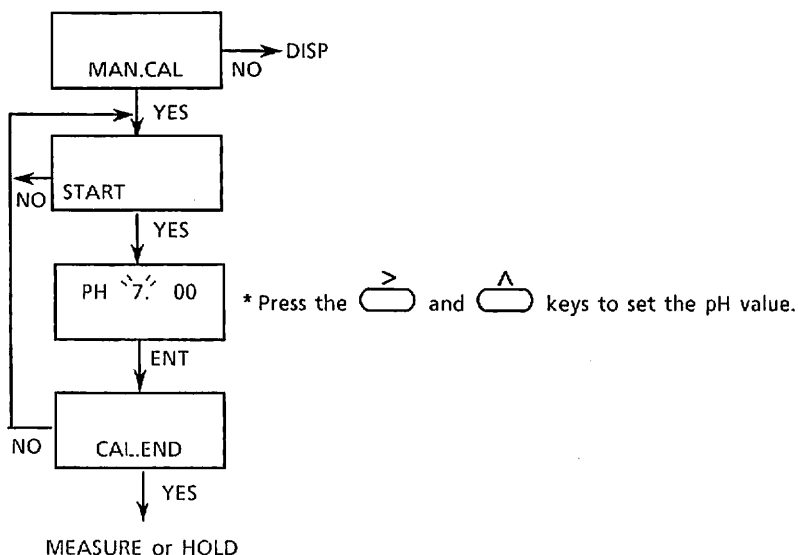
Press the key, then select AUT. CAL by pressing the and keys.

Select any of pH7, pH4 and pH9 standard solution calibration values by pressing the and keys. The pH displays then flashes to perform automatic calibration. CAL END is displayed at the end of AUT. CAL.

**(3) MAN, CAL (Manual calibration mode)**

Press the key, then select MAN. CAL by pressing the and keys.

Press the and keys to select the calibration solution value. Press the key to execute calibration.

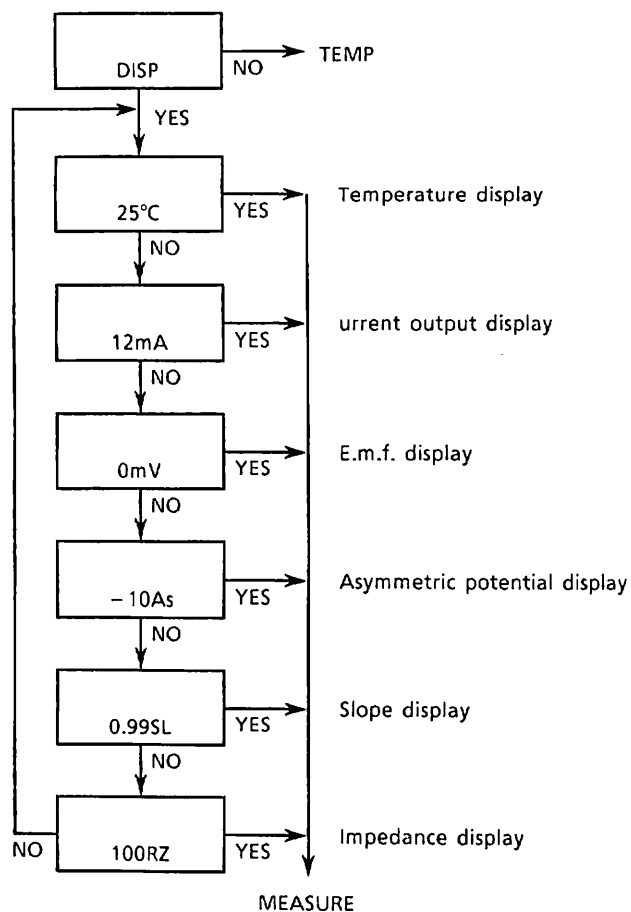


(4) DISP (Message display selection mode)

Press the key, then the and keys to select DISP.

Press the and keys to select the contents of the message display.

Temperature ($^{\circ}\text{C}/^{\circ}\text{F}$), current output (mA), e.m.f (mV), asymmetric potential (AS), slope (SL) and impedance (RZ) can be displayed.



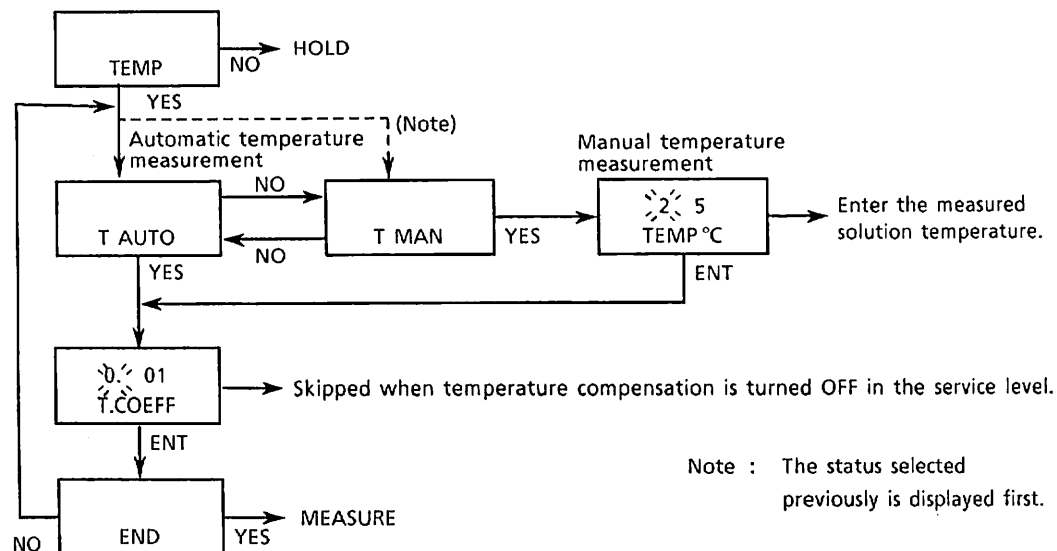
(5) TEMP (Temperature parameter setting mode)

Press the ^{MODE} key, then the ^{YES} and ^{NO} keys to select TEMP.

Select automatic temperature or manual temperature measurement. In manual temperature measurement, measure and set a calibration solution temperature.

When temperature compensation is turned ON in the service level, set a temperature coefficient.

When manual temperature measurement is selected, TEMP. MAN is displayed on the LCD.

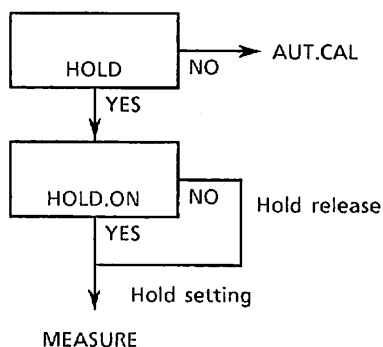
**(6) HOLD (Hold ON / OFF mode)**

Press the ^{MODE} key, then the ^{YES} and ^{NO} keys to select HOLD.

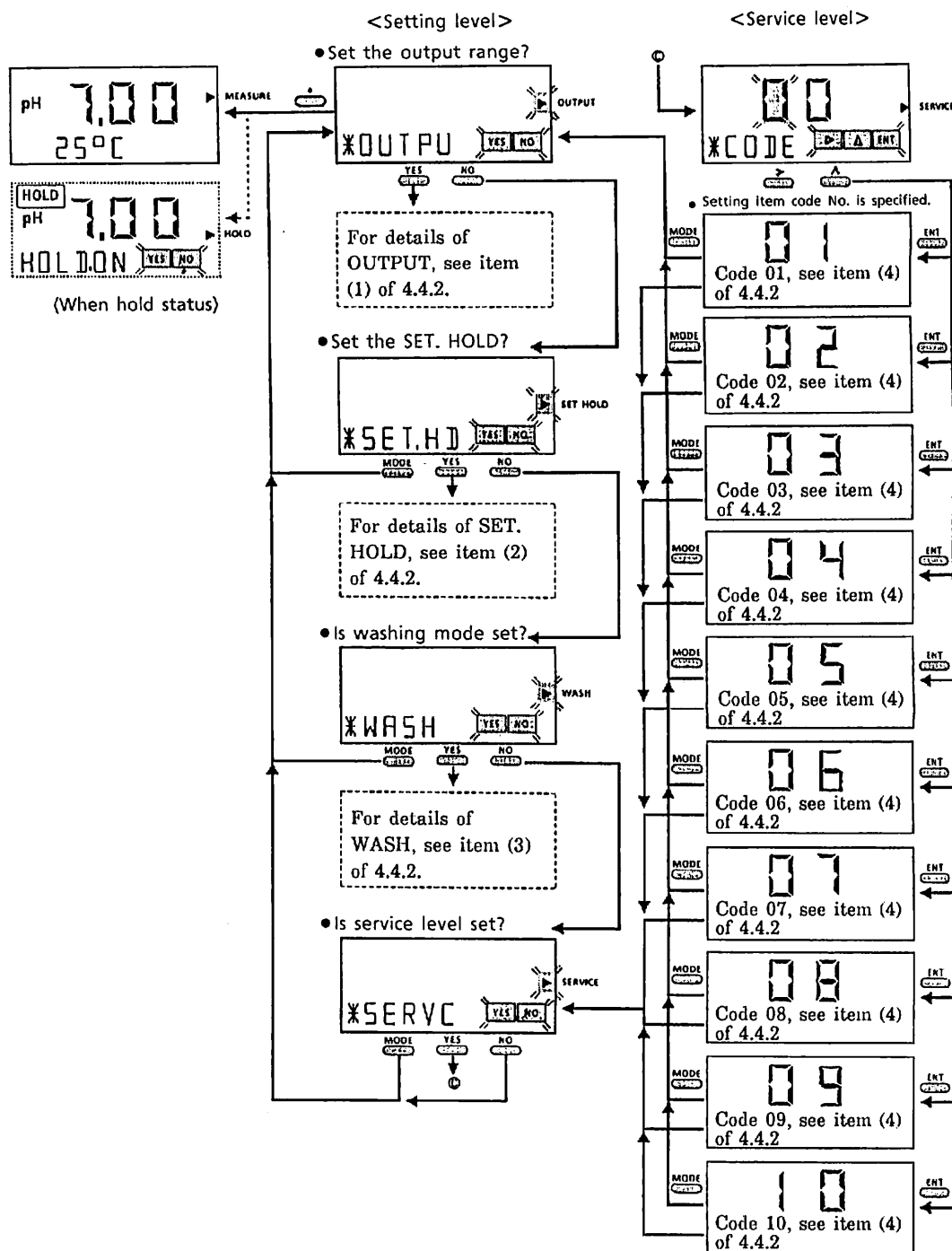
Select setting or release by pressing HOLD. ON. (Press the ^{YES} key to set and the ^{NO} key to release.)

No entry is made to this mode if it is not set to *HLD. ON in the setting level.

HOLD is displayed on the LCD during hold.



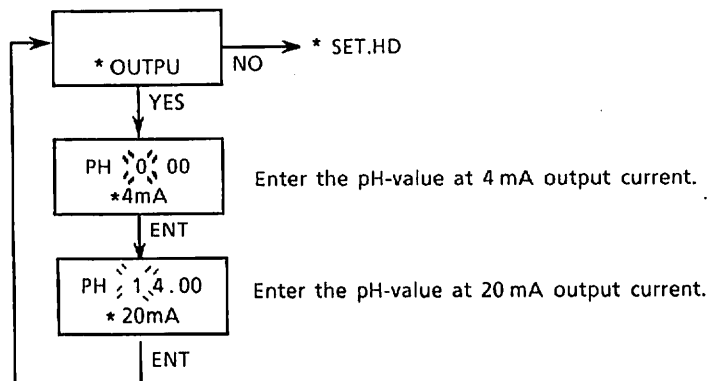
4.4.2 Mode and Setting Item Selection in the Setting/Service Level



(1) *OUTPUT (Output range setting mode)

Press the key to enter the setting level, then the and keys to select this mode.

Enter the pH-value at 4 mA and 20 mA. Also set the span to more than 1pH.



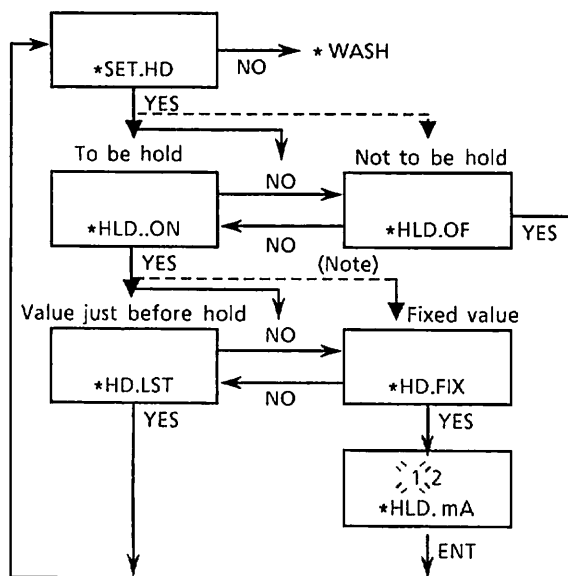
(2) *SET. HOLD (Hold parameter setting mode)

Press the key to enter the setting level, then the and keys to select this mode.

*HLD. OF inhibit output hold. *HLD ON enables automatic or manual calibration, and entry to the setting level holds the output automatically.

As a hold output value, set the value just before hold (*HD. LST) or the preset value (*HLD. mA).

Use the operation level hold setting/release mode to release hold.



(3) *WASH (Washing mode)

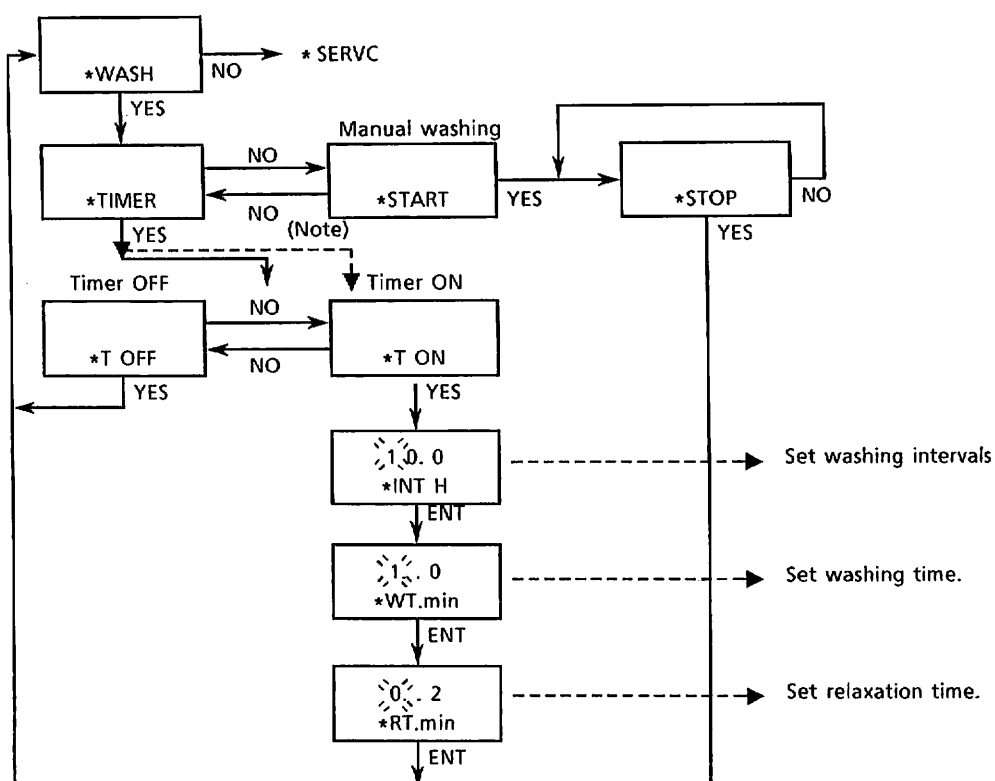
Press the key to enter the setting level, then the and keys to select this mode.

The washing function can be used when the dedicated PH201G distributor is combined with a washing device.

The timer is activated even if the device is not connected, so always set *T. OFF when the washing timer is not used.

TIMER START status manual washing and STOP stops manual washing.

Set washing interval *INT. H (Unit : Hour), washing time *WT. min, (Unit : min) and relaxation time *RT. min, (Unit : min) as the timer functions.



(Note) Status selected previously is displayed first.

(4) *SERVICE (Service level)

Enter the code No. (01 to 10) needed to set the various parameters in the service level.

Note : Never enter a code No. other than 01 to 10. However, if this is done inadvertently, immediately press the ^{MODE} key, as entering a code No. other than 01 to 10 may cause a malfunction.

• 01 *TEMP

0
0

*TEMP

{ 0 °C
 { 1 °F

{ 0 Reference temperature conversion OFF
 { 1 Reference temperature conversion ON

• 02 *T.SENS

0

*T.SENS

{ 0 Pt1000 Ω
 { 1 Pt100 Ω
 { 2 5.1 kΩ
 { 3 3 kΩ
 { 4 350 Ω

• 03 *CHECK

1
1
0

*CHECK

{ 0 Impedance check
 { 1 Impedance check

{ 0 Slope check
 { 1 Slope check

{ 0 Asymmetric potential check
 { 1 Asymmetric potential check

OFF
 ON

OFF
 ON

OFF
 ON

*IMP.LT

5
0
0

*IMP.LT

- High limit of impedance check (kΩ)
- Skipped at impedance check OFF in the previous item.

• 04 *DISP

0

*DISP

{ 0 0.01 display
 { 1 0.1 display

- 05 *HT.CHK

0

*HT.CHK

{ 0 Half-value recovery time check
 1 Half-value recovery time check

0 0 .1

*HT.min

- Half-value recovery time setting

OFF
ON

- 06 *COMM

0

*COMM

{ 0 ... Communication OFF
 1 ... Communication ON

- 07 *BURN

0

*BURN

{ 0 ... BURN OFF
 1 ... BURN ON

- 08 *sb.USE

0

*sb.USE

{ 0 ... Glass electrode
 1 ... Antimony electrode

- 09 *ΔT.SEC

0 5

*ΔT.SEC

- Automatic stop parameter ΔT setting during buffer check

- *ΔPH

0 . 0 2

*ΔPH

- ΔPH setting

- 10 *TP.ADJ

`3' 0 0

*TP.ADJ

Set temperature by ▷ and Δ keys, then press ENT key.

- One-point temperature calibration procedure

- (1) Fill a large container with city water, then put the pH sensor to be used into it.
- (2) When the solution temperature has stabilized, read it off the thermometer.
- (3) Press the ▷ and Δ keys to set the temperature, then enter it by pressing the ENT key.

5. OPERATION

5.1 Operation Preparation

5.1.1 Wiring Inspection

Check to see if all the wiring is connected correctly. (See Figures 2.7 and 2.8.)

When a ultrasonic oscillator is used, and for instructions on wiring the distributor and safety barrier, see the relevant equipment instruction manual.

5.1.2 Intelligent 2-wire pH Transmitter Operation

The intelligent 2-wire pH transmitter is operated with the power supplied to the distributor. Supply power meeting the distributor specification.

5.1.3 Data Setting

Various data is set in the setting and service levels so that operation conditions suitable for individual process pH control are achieved.

Also set the commands and data necessary for steady-state operation in the operation level.

Table 5.1 shows the setting item selection range and status set prior to shipment.

Note : For key operation and display, see "4. Operation and Display".

Table 5.1 Setting Items List (Set-value and setting range prior to shipment) (No. 1)


	Setting item	Initial value (prior to shipment)	Selection and setting range
Operation level	DISP (display) mode		
	Message area display detail selection	Temperature display	Temperature, output current, e.m.f., asymmetric potential, slope, reference electrode impedance
	TEMP (temperature parameter setting) mode		
	• Temperature compensation status selection	Automatic (T. AUTO)	Automatic, Manual (T. AUTO) (T. MAN)
	• Manual temperature setting	25 [°C]	10 to 130 [°C]
	• Temperature coefficient setting (converted to reference temperature 25°C)	0.00 [pH/10°C]	1.00 to 1.00 [pH/10°C]
Setting level	OUT PUT (output range setting) mode		
	• pH-value setting corresponding to 4 mA transmission output	pH0.00	pH - 2.00 to pH15.00
	• pH-value setting corresponding to 20 mA transmission output	pH4.00	pH - 2.00 to pH5.00
	SET HOLD (hold parameter setting) mode		
	• Selection of presence/absence of transmission output hold	Presence (*HLD. ON)	Presence, Absence (*HLD. ON) (*HLD. OF)
	• Hold output value selection	Value just before hold (*HD. LST)	Value just before hold, Fixed value (*HD. LST) (*HD. FIX)
	• Fixed value (*HD. FIX) setting	12 [mA]	4 to 20 [mA]
	WASH (washing) mode		
	• Washing timer ON/OFF selection	Timer OFF	Timer ON, Timer OFF
	• Washing interval setting (*INT. H)	[h]	0.1 to 24.0 [h]
	• Washing time setting (*WT. min)	[min]	0.1 to 10.0 [min]
	• Relaxation time setting (*RT. min)	[min]	0.1 to 10.0 [min]
Service level	Code No. 01 (*TEMP mode)		
	• Reference temperature conversion ON/OFF selection	OFF (0)	OFF (0), ON (1)
	• Temperature unit selection	°C (0)	°C (0), °F (1)
	Code No. 02 (*T. SENS mode)		
	• Temperature sensor selection	Pt 1000 (0)	Pt 1000 (0), Pt 100 (1), 5.1 kΩ (2), 3 kΩ (3), 350 Ω (4)
	Code No. 03 (*CHECK mode)		
	• Asymmetric potential check ON/OFF selection	ON (1)	OFF (0), ON (1)
	• Slope check ON/OFF selection	ON (1)	OFF (0), ON (1)
	• Impedance check ON/OFF selection	OFF (0)	OFF (0), ON (1)
	• Reference electrode impedance high limit setting	500 [kΩ]	50 to 1999 [kΩ]
	Code No. 04 (*DISP mode)		
	• pH-value display digit selection	0.01 display (0)	0.01 display (0), 0.1 display (1)
	Code No. 05 (*HT. CHK mode)		
	• Half-value recovery time check ON/OFF selection	OFF (0)	OFF (0), ON (1)
	• Half-value recovery time (HT. min) setting	0.1 [min]	0.1 to 10.0 [min]

Table 5.1 Setting Items List (Set-value and setting range prior to shipment) (No. 2)

	Setting item	Initial value (prior to shipment)	Selection and setting range
Service level	Code No. 06 (*COMM mode)		
	• Communication (contact signal output) ON/OFF selection	OFF (0)	OFF (0), ON (1)
	Code No. 07 (*BURN mode)		
	• Output signal overflow ON/OFF selection	OFF	OFF (0), ON (1)
	Code No. 08 (*Sb. USE mode)		
	• pH measuring electrode selection	Glass electrode (0)	Glass electrode (0), Antimony electrode (1)
	Code No. 09 (*ΔT. SEC, *ΔpH mode)		
	• Stability check parameter ΔT. SEC setting	5 [s]	5 to 30 [s]
	• Stability check parameter ΔpH setting	ΔpH 0.02	ΔpH 0.01 to ΔpH 0.05
	Code No. 10		
	• Set one-point temperature calibration procedure		-10 to 130°C

(1) Setting in the setting level

Remove the 4 screws, then take the front cover off the intelligent 2-wire pH transmitter.


Press the  key to select the setting level.


- (a) **Transmitter output range (OUTPUT mode) setting** Set pH-values corresponding to 4 to 20 mA transmission output. The pH-values at 4 mA and 20 mA transmission outputs can be set in the range of pH-2 to pH15 respectively. However, set the pH span to more than 1 pH. Prior to shipment, the pH0 to 14 range is set to correspond to 4 to 20 mA.

(b) Hold parameter (SET HOLD mode) setting

Various settings are made to hold transmission output during maintenance.

- **Selecting the presence/absence of transmission output hold**

Select *HLD. OF when in inhibiting transmission output hold, and  HLD. ON when it is necessary to hold transmission output during maintenance.

If *HLD. ON is selected, entry to the setting level during standard solution calibration (AUT. CAL mode and MAN. CAL mode), during automatic washing and pressing the  key holds transmission output automatically.

Further, transmission output can be manually hold in the operation level HOLD mode.

Note : If *HLD.OF is selected in the setting level, no entry can be made to the HOLD mode in the operation level.

- **Hold output value selection (when *HLD. ON is selected)**

When the hold output value is set at the output value just before hold, select *HD. LST, and when it is set, the fixed current value (preset) is *HD. FIX.

- **Fixed current value setting (When *HD. FIX is selected)**



Set the fixed current value in the 4 to 20 mA range.

It is set to 12 mA prior to shipment.

(c) Washing parameter (WASH mode) setting

The washing timer parameter is set. However, the washing function is used only when the dedicated PH201G distributor is combined with the washing device.

- **Washing parameter setting/manual washing selection**

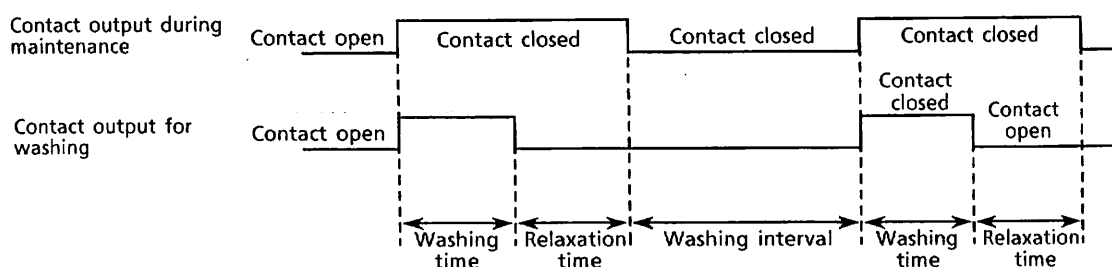
When setting various washing timer parameters, select *TIMER. When washing manually, select *START. Pressing the  key starts washing to display the *STOP message. To stop washing, press the  key once.

- **Washing timer ON/OFF selection**

When not using the washing timer, (including when the dedicated PH201G distributor is used). Always select *T. OFF. Select *T. ON only when the washing timer is used.

Note : When the washing timer is used, use service level code No.06 to set the communication function to ON in order to extract washing contact output from the dedicated PH201G distributor.

- Washing interval setting (when *T ON is selected)
Washing interval : Set *INT. H from 0.1 to 24.0 Ω. This is set to 10 hours prior to shipment.
 - Washing timer setting (when *T. ON is selected)
Washing time : Set *WT. min from 0.1 to 10.0 min.
This is set to 0.1 minute prior to shipment.
 - Relaxation time setting (when *T. ON is selected)
Relaxation time : Set *RT. min (time to eliminate influence of washing liquid) from 0.1 to 10.0 min.
This is set to 0.2 min prior to shipment.
- Note : Contact output status during dedicated PH201G distributor washing becomes as shown in the following diagram.



(d) Service level code input (SERVICE mode)

Enter the code No. (01 to 10) needed to set various parameters in the service level.

(2) Setting in the service level

Enter the code No. in the service level to enter the service mode.

(a) Reference temperature conversion and temperature unit selection
(code No. 1).

● Reference temperature conversion ON/OFF selection

Set to 0 (OFF) unless otherwise required.

This is also set to 0 (OFF) prior to shipment. When configuring a pure water pH measurement system, set this ON/OFF to 1 (ON) if the measured solution temperature coefficient is known and reference temperature conversion is required. Thus, reference temperature conversion is automatically made with the reference temperature set to 25°C and the temperature coefficient set in the TEMP mode (operation level).

● Temperature unit (°C/°F) selection

When °C is used, set this mode to 0, and when °F is used, set it to 1.

This is set to 0 (°C) prior to shipment.

(b) Temperature sensor selection (code No. 02)

This mode is used to select the pH electrode temperature sensor.

For the standard sensor (generally a PH8EFP refillable KCl type, a PH8ERP KCl diffusion type or a PH8EHP pure water pH sensor is used), this mode is set to 0. (Pt1000 : Platinum RTD.)

Do not change the set-value in this mode.

When it is necessary to change the set-value, please contact us.

Note : When a custom ordered pH sensor with another built-in RTD is used, RTD value is set to the respective value.

- For pH sensor (PH8EFG/PH8ERG/PH8EHG) : 2 (5.1 k Ω)
- For D602 pH sensor : 4 (300 Ω)
- When using the sensor with the built-in RTD, conduct 1-point temperature calibration using code No. 10.

(c) Check item selection (code No. 03)

Use / no-use of each pH-meter electrode self-diagnostic function check item is selected.

- Asymmetric potential check ON/OFF selection

Set this mode to 1 when asymmetric potential (e.m.f. at pH7) is checked during standard solution calibration, otherwise set it to 0.

If this mode is set to 1 (asymmetric potential check ON), an error is displayed when asymmetric potential exceeds ± 120 mV as a result of standard solution calibration.

This mode is set to 1 prior to shipment.

- Slope check ON/OFF selection

When a slope (potential gradient) check is conducted during standard solution calibration, set this mode to 1. Otherwise, set it to 0.

If this mode is set to 1 (slope check ON), an error is displayed when the slope is not between 70 and 115% of the theoretical value as a result of standard solution calibration.

This mode is set to 1 prior to shipment.

- Impedance check ON/OFF selection

This mode selects the presence or absence of glass and reference electrode impedance checks under usual measurement (measurement mode).

Set this mode to 1 when carrying out an impedance check. Otherwise, set it to 0.

If this mode is set to 1 (impedance check ON), an error is displayed when the glass electrode is damaged and/or disconnected and reference electrode impedance exceeds the set-value (any setting) to overscale the transmission signal (at code No. 07 output signal overscale ON setting) and output an abnormality contact (when the dedicated PH201G distributor is used).

Note 1: When measured liquid conductivity is less than 50 μ S/cm, set the impedance check to OFF.

Note 2: When a pH sensor without a solution earth, such as a fermentation pH sensor (Y/465) is used, impedance cannot be measured correctly, so always set the mode to impedance check OFF.

Note 3: If liquid temperature exceeds 60°C, no impedance check can be done, even with impedance set to check ON.

- Reference electrode impedance high limit setting (When the mode is set to impedance check ON : 1)

The impedance high-limit of the reference electrode junction is set in the 50 to 1999 [kΩ] range. This is set to 500 [kΩ] prior to shipment.

Note : Reference electrode impedance varies with application. Therefore, the reference electrode impedance high limit needs to be set for each application after first checking secular impedance change.

(d) pH-value display digit selection (code No. 04)

The pH-value digit displayed on the liquid crystal display unit (LCD) is selected.

When displaying 0.01 (2 digits below the decimal point), set the mode to 0, and when displaying 0.1 (1 digit below the decimal point, set it to 1.

The mode is set to 0 (2-digit display below the decimal point) prior to shipment.

Note : Even if the pH display digit (1 digit below the decimal point) is set to 1, the pH-value is displayed down to 2 digits below the decimal point (0.01) when data setting is required, such as for manual calibration (MAN. CAL mode) and range setting (OUTPUT mode).

(e) Half-value recovery time check ON / OFF selection and half-value recovery time setting (code No. 05)

- Half-value recovery time check ON / OFF selection

When the time allowed for the pH-value to recover to the half-value (intermediate value between washing solution pH-value and measured solution pH-value) is checked, set this mode to 1. Otherwise set it to 0.

The mode is set to 0 (half-value recovery time check OFF) prior to shipment.

When half-value recovery time exceeds the set-value due to deterioration of pH electrode response with half-value recovery time check ON set, an error is displayed the transmission signal overscales (when output signal overflow ON is set) and an abnormality display contact signal is output. (When dedicated PH201G distributor is used.)

Note : Do this selection only when washing liquid pH-value differs widely from the measured liquid pH-value, such as in half-value recovery check chemical solution (acid) washing, etc.

- Half-value recovery time (HT. min) setting

(When set to half-value recovery time ON : 1)

Set the allowable half-value recovery time in the 0.1 to 10.0 [min] range.

This time is set to 0.1 [min] prior to shipment.

(f) Communication function ON/OFF selection (code No. 06)

The communication function can be used only when the dedicated PH201G distributor is used.

If the communication function is set to ON : 1, contact output at abnormality, contact

output at maintenance and contact output at washing can be output from the dedicated distributor.

Since this function is set to OFF : 0 prior to shipment, set it to 1 when contact signals

are output from the dedicated distributor.

Note 1 : When using the washing timer function, always set the communication function to On.

Note 2 : When a dedicated distributor is not used, leave the 0 (communication function OFF) status as is.

(g) Output signal overscale ON/OFF selection (code No. 07)

When transmission output signal at abnormality overscales (22 mA), set this mode to 1. Otherwise set it to 0.

This is set to 0 : Output signal overscale OFF prior to shipment.

Note : When an error (Err.5 to Err.8) occurs during standard solution calibration, no signal overscales even with output signal overscale set to ON. For more details on trouble, see Table 8.1.

(h) pH measurement electrode selection (code No. 08)

When a glass electrode is used as a pH measurement electrode, set this mode to 0, and when an antimony electrode is used, set it to 1.

The mode is set to 0 (glass electrode) prior to shipment. Set 1 (antimony electrode) only when the antimony electrode is used.

Note : When the mode is set to the antimony electrode, asymmetric potential check, self diagnosis of slope check and electrode temperature compensation are not done.

(i) Stability parameter setting (code No. 09)

In order to check electrode stability during standard solution calibration, set a parameter ($\Delta\text{pH}/\Delta\text{T}$).

If the electrode does not stabilize after a change of more than $\pm\Delta\text{pH}$ during ΔT sec. 3 minutes later, an error is displayed.

- ΔT . SEC (stability check time) setting

Set stability check time (ΔT . SEC) in the 5 to 30 [s] range. The time is set to 5 [s] prior to shipment.

- ΔpH (allowable pH change) setting

Set allowable pH change (ΔpH) in the 0.01 to 0.05 [pH] range. This is set to ΔpH 0.02 prior to shipment.



(j) One-point temperature calibration (code No. 10)

No one-point temperature calibration can be performed for the standard (PH8ERP and PH8EHP general purpose pH sensor, PH8EHP pure water pH sensor) or when


temperature compensation is done manually.

When the pH sigma pH sensor (PH8EFG / PH8ERG / PH8EHG) or D602 pH sensor is used, always do one-point RTD calibration at the actual temperature.

This ends data setting in the setting and service levels.

Press the  key and then the  key to return the mode to MEASURE or HOLD. Next, secure the front cover of the intelligent 2-wire pH transmitters with the 4 screws.

(3) Setting in the operation level

Press the  key to enter the operation level.

(a) Standard solution calibration


Calibrate a standard solution in the automatic calibration (AUT. CAL) or manual calibration (MAN. CAL) mode. For details on standard solution calibration, see "6. Standard Solution Calibration".

(b) Message area (DISP mode) display details selection

Select the details displayed in the display unit from the following items message area during normal operation (MEASURE mode).

- Measured solution temperature (°C / °F)
The measured solution temperature is displayed, but if manual temperature compensation is set in the TEMP mode, the temperature value set is displayed.
- Output current value (mA)
The output signal value (mA) now being transmitted is displayed.
- E.m.f. display (mV)
The present pH electrode e.m.f. (mV) is displayed.
- Asymmetric potential display (A5)
The present asymmetric potential (e.m.f. at pH7 : mV) is displayed.
- Slope display (SL)
The present slope ratio with respect to the theoretical slope (potential gradient) is displayed.
- Reference electrode impedance display (RZ)
The present junction resistance (kΩ) is displayed.
Note : When a pH sensor without a solution earth such as a fermentation pH sensor is used, 0 RZ is displayed.
The measured solution temperature display is set prior to shipment.

(c) Temperature (TEMP mode) setting

- Automatic temperature compensation / manual temperature compensation selection.
For automatic temperature compensation (when a pH sensor with an RTD is used), set the mode to T. AUTO, and for manual temperature compensation (when a pH sensor without an RTD is used), set the mode to T. MAN, when a pH sensor without an RTD, such as the fermentation pH sensor (Y / 465) is used, set the mode to T. MAN. The mode is set to T. AUTO (automatic temperature compensation) prior to shipment.
Note : When the mode is set to T. MAN,  is displayed on the LCD.

● Manual temperature setting (when T. MAN is selected)

For manual temperature compensation, measure the measured liquid temperature and set that temperature.

The setting range is between -10.0 and 130.0°C (14 and 266°F).

This is set to 25.0°C (77°F) prior to shipment

● Temperature coefficient (T. COEF) setting

This is settable only when reference temperature conversion is turned ON at service level code No. 01. For reference temperature conversion (reference temperature: 25°C), set the coefficient between -1.00 and 1.00 ($\text{pH}/10^{\circ}\text{C}$).

This is set to 0.00 $\text{pH}/10^{\circ}\text{C}$ prior to shipment. Calculate the solution temperature coefficient with the following equation by measuring the pH value of a constant-solute measured liquid with a different temperature.

$$\left\{ \frac{(\text{pH at high temperature} - \text{pH at low temperature}) \times 10^{\circ}\text{C}}{\text{Temperature difference of measured liquid}} \right\} = \text{Temperature coefficient}$$

For example, if the value is pH9.20 at 20°C , and pH8.92 at 30°C .

$$\left\{ \frac{(\text{pH } 8.92 - \text{pH } 9.20) \times 10^{\circ}\text{C}}{30^{\circ}\text{C} - 20^{\circ}\text{C}} \right\} = -0.28 \text{ pH}$$

The value of -0.28 (pH span changes correction with changes in 10°C of measured liquid) is the temperature coefficient to be set.

(*):pH measurement of measured liquid (pure water) is impossible with an ordinary pH meter as the liquid easily absorbs CO_2 gas and therefore, is inappropriate as a means of measuring pH-value by sampling the liquid. Therefore, it is necessary to measure pH in the actual process. However, the disadvantage of this measurement is that it is impossible to determine whether changes in pH are caused by a change isolate density or liquid temperature. Therefore, when measuring pay a close attention to the above.

Although the actual measurement procedure varies with individual process conditions, refer to the following example as guidance.

<Example>

When liquid density has stabilized, change the measured liquid temperature by turning the sample line cooler ON and OFF. Measure pH-value and liquid temperature after the liquid temperature has completely stabilized. Then, obtain the temperature coefficient from the above equation.

(d) Transmission output (HOLD mode) hold

When *HOLD. ON is selected in the setting level *SET. HD mode, transmission output can be held or hold-released manually. For hold, press the ☐ key in the *HOLD. ON mode, and for release, press the ☐ key in the same mode.

When transmission output is hold, the display unit shows HOLD.

The hold value becomes that set in the setting level *SET. HD mode.

Note : It is impossible to enter the HOLD mode if it is set to *HLD. OFF in the setting level *SET. HD mode.

5.1.4 Standard Solution Calibration

Glass electrode e.m.f. varies slightly from electrode to electrode. Therefore, always do standard solution calibration prior to starting steady state operation.

Also, note that glass electrode e.m.f. changes gradually due to growth of stains and other forms of deterioration. Therefore, standard solution calibration needs to be done periodically at intervals that do not allow measurement error to exceed acceptable values.

For the standard solution calibration execution procedure, see "6. Standard solution calibration".

5.1.5 Reserve Tank Pressurization

This applies when a pH sensor with a medium pressure reserve tank built into the flow through holder is used.

Pay attention to the following when setting reserve tank air pressure.

- (1) Make sure that the measured liquid doesn't flow backward in the reserve tank.
- (2) KCl solution consumption should be as small as possible.

For details, see "3.1.2 reserve tank pressurization" in the pH sensor instruction manual.

5.1.6 Measured Liquid Characteristic and Submerged Sensor Status Inspections

Prior to starting steady-state operation, re-check the holder installation status along with the following.

- (1) The measured liquid characteristic during measurement should satisfy the conditions required by the pH sensor and holder specifications.
- (2) When an immersion sensor guide and submersion holders are used, the sensor tip should always be immersed in the measured liquid, even if the liquid level changes.

The main check points are described in the following

(1) Measured liquid temperature

The PH8EFP KCl filling type pH sensor can be used with measured liquid between -5 and 105°C only when the sensor tip is immersed, (for the pH8ERP KCl refillable type pH sensor: -5 to 80°C), or between -5 and 80°C when the section down to the sensor cable is immersed. Note, however, that maximum measured liquid temperature is restricted by holder type, wetted part material and measured liquid pressure.

- Maximum measured liquid temperature is 50°C when sensor suspension a guide holder made of hard chloride vinyl resin is used.
- The maximum measured liquid temperature is 80°C when the polypropylene resin sensor suspension guide holder is used.
- The maximum measured liquid temperature is 100°C or allowable maximum sensor operating temperature whichever is smaller, when the polypropylene resin submersion type holder is used.
- When the SUS316 flow-through type holder is used, maximum measured liquid temperature corresponds to the maximum sensor limitation temperature.
- When the polypropylene flow-through type holder is used, measured liquid temperature is up to 80°C at measured liquid pressure of up to 0.1 MPa $\{1\text{ kgf/cm}^2\}$. It should be reduced in steps of 2°C every time the pressure increases by 9.8 kPa $\{0.1\text{ kgf/cm}^2\}$.

- If a washing device is attached to the holder, the maximum measured liquid temperature is 80°C.
- When the PH8EHP pH sensor for high-purity water is used, take into account the fact that measured liquid temperature in the PH8HH pure water holder becomes less than 50°C.

(2) Measured liquid pressure

- When using the sensor suspension guide holder or submersion type holder, measured liquid pressure is atmospheric.
- When the PH8ERP KCl diffusion type pH sensor built into the flow-through type holder is used, pressure can be increased up to 0.2 MPa {2 kgf/cm²}.
- When a general purpose pH sensor with a reserve tank is used with the sensor built into the flow-through type holder, pressure can be increased up to 9.8 kPa {0.1 kgf/cm²}, but as a rule it should be atmospheric.
- Maximum measured liquid pressure when general purpose a pH sensor with a reserve tank is used with the sensor built into the flow-through holder is 0.5 MPa {5 kgf/cm²}. However, when a polypropylene resin holder is used, the pressure is restricted to that lower than 0.5 MPa {5 kgf/cm²} in accordance with measured liquid temperature and ambient temperature.
Also, measured liquid pressure should be less than the air pressure at which the reserve tank is pressurized.
- When pH measurement is conducted using the holder for high-purity water, the pressure shown be atmospheric in the holder.

(3) Sensor immersion depth

When even the sensor cable is immersed in the measured liquid, as happens when the sensor is installed on the sensor suspension guide holder, sensor immersion depth is limited to 3 ms.

(4) Measured liquid flow velocity

Flow velocity at a measured point when the submersion sensor guide holder and subimmersion holder are used is as a rule, limited to up to 2 m/s.
Also avoid remarkable turbulence flow and pulsation flow.

(5) Measured liquid flow rate

Measured liquid flow rate passing through the flow-through holder should be between 3 to 11 l/min.

- When the holder for high-purity water is used, set the relationship between measurement liquid flow rate and conductivity as shown in Figure 5.1.

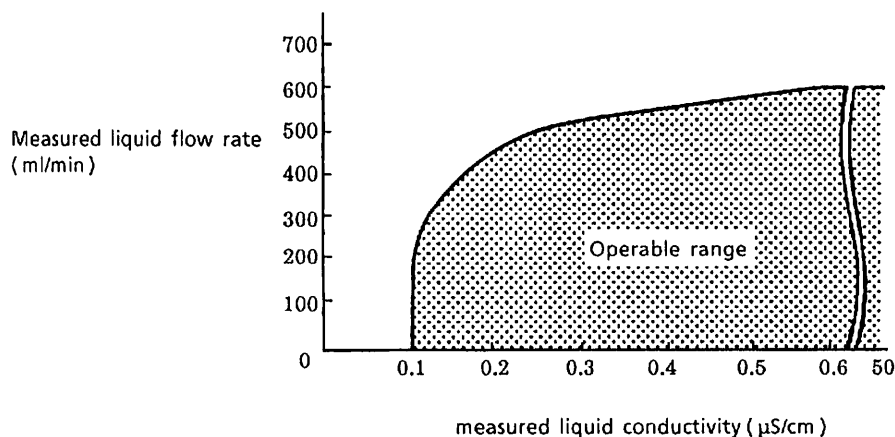


Figure 5.1 Appropriate Flow Rate with Respect to Measured Liquid Conductivity

5.1.7 Ultrasonic Oscillator Operating Procedure

This applies when ultrasonic cleaning is done.

In the non-explosionproof system, first make sure that the power supply satisfies the ultrasonic oscillator specification, then turn the power switch on.

In the explosionproof system, connect a power supply satisfying the specification to an alarm box, then turn on the power switch in the box.

5.1.8 Cleaning Utility Supply

This applies when brush or jet water cleaning is done.

During cleaning, be sure to supply cleaning water or air to the cleaning device at the specified pressure.

5.1.9 System Trial Operation

After having confirmed that the intelligent 2-wire pH transmitter is operating normally, observe the operation status for a while to see if there are any problems.

5.2 Steady State Operation

For data display, manual temperature setting and standard solution calibration in the operation level, it is not necessary to operate this instrument other than when changing the set value in the setting and service levels.

Maintain good operation by carrying out the daily maintenance inspection described in chapter 7.

When an error display appears, a contact signal at abnormality occurrence is output and/or the signal overscales, check the cause in accordance with "8. Troubleshooting", then take the appropriate steps immediately.

5.3 Operation Suspension and Re-open

Data set to this instrument is reserved even with the power turned off. Also, there is no limitation on power-off timing.

When suspending operation, stop supplying power to this instrument.

If power is supplied to re-start this instrument, the instrument starts from the initial operation by resetting the status at operation stop. Therefore, if automatic cleaning is to be down, do it after the lapse of cleaning time.

6. STANDARD SOLUTION CALIBRATION

It is normal for the pH sensor e.m.f. characteristic to differ from the reference value due to manufacturing dispersion and secular changes. This is especially the case if the sensor has been used once, as the characteristic widely differs with operating conditions, even after a short period of time. Therefore, it is necessary to make correction on the electric circuit to ensure that the correct pH-value is indicated.

Standard solution calibration involves calibrating the pH meter so that the measured liquid pH-value becomes the same as the pH-value of a solution with a known pH-value.

The following 2 standard solution calibration types are available.

- (1) Automatic calibration (AUT. CAL) Calibrates using standard solutions of pH4, pH7 and pH9.
- (2) Manual calibration (MAN. CAL) Calibrates using standard solutions other than the above.

6.1 Cautions Relating to Standard Solution Calibration

- (1) Use standard solutions with correct pH-values. The use of deteriorated standard solutions with different pH-values makes it impossible to calibrate correctly.
- (2) Changes in standard solution temperatures do not stabilize measured value. Keep standard solution temperature constant during calibration.
- (3) Do not manipulate the AUT. CAL and MAN. CAL modes unless it is otherwise required. Data obtained as a result of calibration may vary.
- (4) When a sensor without a built-in automatic temperature compensation RTD, such as a fermentation pH sensor, is used, it is necessary to set standard solution temperature to this instrument.
- (5) When an antimony electrode is used, accurate calibration cannot be conducted if there is a difference between standard solution and measured liquid temperatures, since this instrument does not perform temperature compensation.

6.2 Automatic Standard Solution Calibration

This instrument executes calibration automatically on the basis of the standard solution data shown in Table 6.1 if any of the standard solution values (pH4, pH7 and pH9) are selected in the automatic calibration (AUT. CAL) mode.

Both 2-point calibration (adjustment of asymmetric potential and slope) using two standard solutions and 1-point calibration (adjustment of only asymmetric potential) using only one standard solution are available. The latter is a simplified calibration method which can be employed when liquid with a pH-value almost the same as that of the standard solution is used for calibration. Therefore, usually, 2-point calibration should be

done. This instrument sets the value at the present calibration point as the second data and that at the previous calibration point, as the first data.

If the pH-values at the first and second points are the same, 1-point calibration is executed. On the other hand, if the pH-values at the first and second points differ, 2-point calibration is executed. Therefore, calibration is done at the first and second points using a standard solution of the same type, and 1-point calibration is using the second point data.

Table 6.1 Standard Solution Calibration pH vs. Temperature Characteristic (JIS Z8802)

Temperature (°C)	Standard solution		
	pH4 (Phthalic acid base)	pH7 (Neutral phosphate base)	pH9 (Boric acid base)
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.83	9.04
50	4.06	6.83	9.01
55	4.08	6.84	8.99
60	4.10	6.84	8.96
65	4.11	6.84	8.94
70	4.12	6.85	8.93
75	4.14	6.85	8.91
80	4.16	6.86	8.89
85	4.18	6.87	8.87
90	4.20	6.88	8.85
95	4.23	6.89	8.83
100	4.25	6.90	8.81

6.3 Automatic Standard Solution Calibration Procedure

6.3.1 Preparation

Prepare standard pH solutions pH4 and pH7*, included in the separately purchased PH8AX accessory, two clean 200 ml containers and pH sensor washing water such as high-purity water.

Also, in automatic standard solution calibration at manual temperature compensation, prepare a thermometer to measure standard solution temperature.

(*) More accurate measured values can be obtained for sensors used for alkalic solution measurement if calibration is done with a standard solution of pH9 instead of pH4. For 1-point calibration, prepare either of these standard solutions.

When powder is used, dissolve one pack in pure water so that the total solution volume becomes 500 ml.

Note : When an accessory with a sensor stand is used, install the sensor stand (for PH8EFP and PH8ECP sensor) on a pipe (50 mm nominal diameter) as shown in Figure 6.1.

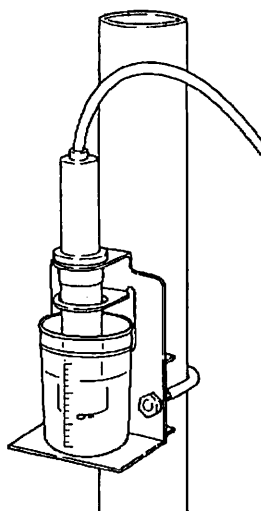


Figure 6.1 Example of Using Sensor Stand

6.3.2 Automatic Standard Solution Calibration Procedure for Automatic Temperature Compensation

- (1) Press the key on the intelligent pH transmitter. The message area displays "AUT. CAL ", so press the key to set the transmitter to the AUT. CAL (automatic calibration) mode. The display unit shows to hold transmission output.
 Note : If *HLD. OF is selected in the setting level *SET. HD mode, no output signal is held.
- (2) Next, remove the pH sensor from the installation during operation.
- (3) Pour the standard solution used for 1-point calibration into a 50 to 100 ml container.

- (4) Wash the end of the removed pH sensor with water and wipe any water drops off the sensor.
- (5) Immerse the end of the pH sensor into a container filled with the standard solution.
- (6) The message area on the intelligent 2-wire pH transmitter displays "CAL 7 ☐ YES ☐ NO" and therefore, if the standard solution pH7 is used for calibration, press the ☐ YES key. Otherwise, (if using a pH4 or pH9 standard solutions) press the ☐ NO key to select the display in the message area until you get the same pH-value, then press the ☐ YES key.
Note : Pressing the ☐ NO key changes the display in the message area in the order of "CAL7" → "CAL4" → "CAL9" → "CAL. END" → "CAL7".
- (7) At this point, the pH-value on the display unit flashes to enter automatic detection of pH sensor stability. If it detects that the pH sensor has stabilized, the pH-value on the display unit stops flashing and automatic calibration is performed, after which the calibrated pH-value is displayed.
- (8) The message area displays "CAL. END ☐ YES ☐ NO" to indicate that calibration at the first point has ended, so press the ☐ NO key to start calibration at the second point.
Note : When trouble occurs during calibration, the message area displays "END. E* ☐ YES ☐ NO" (*: 5, 6, 7 or 8). If this happens, see item "6.6 Measures to be Taken when an Error Occurs" in this chapter.
- (9) Pour the standard solution used for calibration at the second point into a 50 to 100 ml container.
- (10) Wash the standard solution off the end of the pH sensor with water, then wipe any remaining waterdrop off the sensor.
- (11) Immerse the pH sensor end in the standard solution at the second point.
- (12) The message area shows "CAL4 ☐ YES ☐ NO" when the standard solution at the first point is pH7, or "CAL7 ☐ YES ☐ NO" when the standard solution at the first point is other than pH7.
For standard solutions with the same pH-value as that displayed in the message area, press the ☐ YES key.
For standard solutions with the same pH-value as that displayed in the message area, press the ☐ NO key to select the same pH-value as that shown in the message area, then press the ☐ YES key.
If, as with calibration at the first point, it is detected that the pH sensor has stabilized, automatic calibration is done to display "CAL. END ☐ YES ☐ NO" in the message area.
Note : When trouble occurs during calibration, the message area displays "END. E* ☐ YES ☐ NO" (*: 5, 6, 7 or 8). If this happens, see item "6.6 Measures to be Taken when an Error Occurs" in this chapter.
- (13) Press the ☐ YES key to end standard solution calibration.
- (14) Return the pH sensor to the installation condition during operation.
- (15) The message area displays "HOLD. ON ☐ YES ☐ NO", so press the ☐ NO key to release the transmission signal hold status and return the transmitter to the measured status (MEASURE mode).
Note 1 : Pressing the ☐ YES key returns the transmitter to the MEASURE mode with the transmission signal held.
Note 2 : If *HLD. OF is selected in the setting level *SET. HD mode, "HOLD. ON ☐ YES ☐ NO", but the transmitter returns to the MEASURE mode automatically.

6.3.3 Automatic Standard Solution Calibration Procedure for Manual Temperature Compensation

- (1) Set the intelligent pH transmitter to the HOLD mode to hold the transmission signal. (For HOLD mode operation procedure, see "4. OPERATION AND DISPLAY". The display unit shows to hold transmission output.

Note 1 : These operations are not required if the transmission signal does not need to be held. Remove the pH sensor from installation during operation.

Note 2 : When *HLD. OF is selected in the setting level *SET.HD mode, the transmitter cannot be set to the HOLD mode.

- (2) At this point, remove the pH sensor from installation during operation.
 (3) Pour the standard calibration solution into a 50 to 100 ml container.
 (4) Remove the pH sensor wash the end with water, and then wipe the sensor surface dry.
 (5) Immerse the end of the pH sensor in the standard solution in the container.
 (6) Measure standard solution temperature using a thermometer.
 (7) Set the intelligent 2-wire pH transmitter to the TEMP mode, then manually set the temperature thus measured. (For the TEMP mode operation procedure, see "4. Operation and display".)
 (8) Set the intelligent 2-wire pH transmitter to the AUT. CAL mode.

When the message area of the intelligent 2-wire pH transmitter shows "CAL7 ", press the key when the standard solution used for calibration is pH7.

For any standard solution other than the above (pH4 or pH9), press the key to select the pH-value in the message area so as to be the same as the pH-value, then press the key.

Note : Pressing the key changes the display in the message area in the order of "CAL7" → "CAL4" → "CAL9" → "CAL. END" → "CAL 7".

At this time, the pH-value on the display unit flashes to indicate the start of automatic pH sensor stability detection. If it is detected that the pH sensor has stabilized, the pH-value on the display unit stops flashing, automatic calibration is done and the pH-value calibrated is displayed.

- (9) The message area displays "CAL. END ". Press the key to manually set standard solution temperature and end calibration.

Note : If any trouble occurs during calibration, the message area displays "END. E* " (*: 5, 6, 7 or 8).

In this case, see "6.6 Measures to be Taken when an Error Occurs" in this chapter.

- (10) The message area displays "HOLD. ON ", so press the key to perform manual temperature setting and calibration at the second point with the transmission signal held.
 (11) Pour the standard calibration solution at the second point into a 50 to 100 ml container.
 (12) Go through steps (4) to (10) described above in the same way as for calibration at the first point.
 (13) The message area displays "CAL. END " to indicate that calibration at the second point has ended. Press the key to end standard solution calibration.

Note : When trouble occurs during calibration, the message area displays "END. E* " (*: 5, 6, 7 or 8). In this case, see "6.6 Measures to be Taken when an Error Occurs".

(14) Return the pH sensor to the installation status during operation.

(15) The message area displays "HOLD. ON ", so, in order to release the transmission signal hold status, press the key to return the pH transmitter to the measuring status (MEASURE mode).

Note 1 : Pressing the key returns the transmitter to the MEASURE mode with the transmission signal held.

Note 2 : If *HLD. OF is selected in the setting level *SET. HD mode, the message area does not display "HOLD.ON " and the transmitter returns to the MEASURE mode automatically.

Note 3 : If standard solution calibration ends, always set the manually measured liquid temperature.

6.4 Manual Standard Solution Calibration

When a standard solution is other than pH4, pH7 or pH9, set the transmitter to the manual calibration (MAN. CAL) mode.

Note : Manual calibration can be performed using standard solutions of pH4, pH7 or pH9, but automatic calibration is much simple. therefore, automatic calibration is usually used with these standard solutions.

6.4.1 Caution for Manual Calibration

The difference in the pH-values of the two standard solution used for 2-point calibration must be more than 1.5pH. If the difference is less than 1.5pH, do not use 2-point calibration, do 1-point calibration using data at the second point instead.

6.5 Manual Standard Solution Calibration Procedure

6.5.1 Preparation

Prepare standard solutions with pH-value deferencies of more than 1.5pH, 2 clean 200 ml containers and pH sensor washing liquid such as pure water.

For manual standard solution calibration at manual temperature compensation, also prepare a thermometer to measure standard solution temperature.

6.5.2 Manual Standard Solution Calibration Procedure for Automatic Temperature Compensation

(1) Press the key on the intelligent pH transmitter. Set the transmitter to MAN. CAL (manual standard solution calibration) by pressing the keys. The display unit shows to shown that transmission output is being held.

(2) At this time, remove the pH sensor from installation during operation.

Note : When *HLD. OF is selected in the setting level *SET. HD mode, the output signal is not held.

(3) Pour the standard calibration solution into a 50 to 100 ml container.

(4) Remove the pH sensor wash the end with water, and then wipe the sensor surface dry.

(5) Immerse the end of the pH sensor in the standard solution in the container.

- (6) The message area on the intelligent 2-wire pH transmitter displays "START
- to request calibration start. When the pH-value shown on the display unit has fully stabilized, press the key.
- Note : Automatic pH-value stability detection is not done in the manual standard solution calibration mode.
- (7) The message area displays standard solution temperature and " " flashes to request data setting. Check the standard solution pH-value against the standard solution temperature being displayed, then set it by pressing the keys and make an entry by pressing the key.
- (8) Calibration at the first point ends when the key is pressed. The message area then displays "CAL. END
- , so press the key in order to perform calibration at the second point.
- (9) Pour the standard calibration solution at the second point into a 50 to 100 ml container.
- (10) Go through steps (4) to (8) described above in the same way as for calibration at the first point.
- (11) Calibration at the second point ends when the key is pressed. The message area then shows "CAL. END
- , so press the key to end standard solution calibration.
- Note : If there is any trouble during calibration, the message area shows "END. E*
- " (*: 5, 6, 7 or 8). In this case, see "6.6 Measures to be Taken when an Error Occurs" in this chapter.
- (12) Return the pH sensor to the installation status during operation.
- (13) The message area then shows "HOLD. ON
- , so press the key in order to release the transmission signal hold status and return the transmitter to the measuring status (MEASURE mode).
- Note 1 : Pressing the key returns the transmitter to the MEASURE mode with the transmission signal held.
- Note 2 : When *HLD. OF is selected in the setting level *SET. HD mode, the message area does not display "HOLD. ON
- " and the transmitter returns to the MEASURE mode automatically.

6.5.3 Manual Standard Solution Calibration Procedure for Manual Temperature Compensation

- (1) Set the intelligent pH transmitter to the HOLD mode to hold the transmission signal. (For the HOLD mode operation procedure, see "4. Operation and display".) The display unit shows
- Note 1 : If the transmission signal doesn't need to be held, these operations are not required. Remove the pH sensor from the installation status during operation.
- Note 2 : When *HLD. OF is selected in the setting level *SET. HD mode, the transmitter cannot enter the HOLD mode.
- (2) At this time, remove the pH sensor from the installation status during operation.
- (3) Pour the standard calibration solution into a 50 to 100 ml container.
- (4) Remove the pH sensor wash the end with water and then wipe the sensor surface dry.

- (5) Immerse the end of the pH sensor the standard solution in the container.
- (6) Measure standard solution temperature with a thermometer.
- (7) Set the intelligent 2-wire pH transmitter to the TEMP mode, then manually set the measured temperature. (For the TEMP mode operation procedure, see "4. Operation and display")
- (8) Press the key on the pH transmitter, then set the transmitter to the MAN. CAL (manual standard solution calibration) mode by pressing the and keys.
- (9) The message area on the intelligent 2-wire pH transmitter shows "START " to request calibration start. When the pH value on the display unit has fully stabilized, press the key.

Note : Automatic pH-value stability detection is not done in the manual standard solution calibration mode.

- (10) The message area displays standard solution temperature and " " flashes to request data setting. Check the standard solution pH-value against the standard solution temperature being displayed, then set it by pressing the keys and make an entry by pressing the key.
- (11) Calibration at the first point ends when the key is pressed. The message area then displays "CAL. END ", command the end of manual standard solution calibration. Then press key once to calibration end in order to perform manual temperature setting of standard solution.

Note : If any trouble occurs during calibration, the message area displays "END. E* " (*: 5, 6, 7 or 8).

In this case, see "6.6 Measures to be Taken when an Error Occurs" in this chapter.

- (12) The message area displays "HOLD. ON ", so press the key to perform manual temperature setting and calibration at the second point with the transmission signal held.
- (13) Pour the standard calibration solution at the second point into a 50 to 100 ml container.
- (14) Go through steps (4) to (12) described above in the same way as for calibration at the first point.
- (15) Pressing the key ends 2-point calibration work.

The message area then displays "CAL. END ", command the end of manual standard solution calibration.

Note : If any trouble occurs during calibration, the message area displays "END. E* " (*: 5, 6, 7 or 8).

In this case, see "6.6 Measures to be Taken when an Error Occurs" in this chapter.

- (16) Return the pH sensor to the installation status during operation.
- (17) The message area displays "HOLD. ON ", so, in order to release the transmission signal hold status, press the key to return the pH transmitter to the measuring status (MEASURE mode).

Note 1 : Pressing the key returns the transmitter to the MEASURE mode with the transmission signal held.

Note 2 : If *HLD. OF is selected in the setting level *SET. HD mode, the message area does not display "HOLD. ON ☐ YES ☐ NO" and the transmitter returns to the MEASURE mode automatically.

Note 3 : If standard solution calibration ends, always et the manually measured liquid temperature.

6.6 Measures to be Taken when an Error Occurs During Standard Solution Calibration

The display unit on the intelligent 2-wire pH transmitter shows ☐ FAIL when an error occurs during standard solution calibration and any of the following error messages is issued.

- | | | | | |
|-------------|------------------------------|-----------------------------|-----|--|
| (1) END. E5 | <input type="checkbox"/> YES | <input type="checkbox"/> NO | ... | Slope trouble (Err. 5) |
| (2) END. E6 | <input type="checkbox"/> YES | <input type="checkbox"/> NO | ... | Asymmetric potential trouble (Err. 6) |
| (3) END. E7 | <input type="checkbox"/> YES | <input type="checkbox"/> NO | ... | Stability trouble (Err. 7) |
| (4) END. E8 | <input type="checkbox"/> YES | <input type="checkbox"/> NO | ... | Standard solution temperature range trouble (Err. 8) |

Note : If two or more problems occur, that with the highest priority is displayed.
Display priority is as follows.
ERR.5 > Err.6 > Err.7 > Err.8

6.6.1 Measures to be Taken when an Error Occurs

- (1) Press the ☐ NO key to re-calibrate, then check to see if the error occurs again.
However, always conduct 2-point calibration after slope trouble or asymmetric potential trouble occurs.
- (2) If an error still occurs after re-calibration, remove the cause of the error by referring to "8. Troubleshooting".

Note : If the transmitter is returned to the measuring status without removing the cause of the trouble, the pH-value is displayed using calibration in data in use before entering standard solution calibration. (No calibration data is updated at trouble occurrence.)

However, the error message and ☐ FAIL are displayed even in the measuring mode and the display itself doesn't disappear until the cause of the trouble is removed.

7. MAINTENANCE

7.1 Periodic Maintenance

7.1.1 Electrode Washing

Stains on the pH sensor glass membrane and/or liquid junction may cause measured-value instability and drift and reduce response speed. Therefore, it is essential that the electrode be washed periodically as part of regular maintenance.

However, when the PH8EFP KCl refillable pH sensor is used and automatic continuous (for ultrasonic cleaning) or intermittent (cleaning with a water jet or brush) washing is done, most stains are removed. Therefore, usually it is not necessary to perform manual washing in addition to the above automatic washing. Even if acid washing becomes necessary to remove chemical stains caused by metal attachments, the maintenance man-hours required are very small compared with if no automatic washing is done.

For the actual washing procedure, see "pH sensor maintenance".

7.1.2 Standard Solution Calibration

pH sensor e.m.f. varies with electrode deterioration and staining of the electrode both of which may cause measurement error. Therefore, do standard solution calibration periodically to maintain accurate pH measurement.

Standard solution calibration intervals vary widely with operating conditions. At the initial stage of operation, do standard solution calibration once a week to gather data to be used in determining calibration intervals.

Note : For the standard solution calibration execution procedure see "6. STANDARD SOLUTION CALIBRATION".

7.1.3 Refilling the pH Sensor with KCl Solution

When the PH8EFP KCl filling type pH Sensor or PH8EHP pH sensor for high-purity water is used, refill it with KCl solution if the reserve tank gets empty. Also, when the fermentation pH sensor is used, pour the solution directly into the electrode if the inner solution level has fallen when viewed through the holder window.

For, the KCl solution top up procedure, see item Maintenance of the relevant pH sensor.

7.2 Inspection and Maintenance to Prevent Trouble

7.2.1 Inspection of Intelligent 2-wire pH Transmitter Drying Status

If the GE terminal is not isolated with a resistance value of more than $10^{12} \Omega$, an abnormal measured-value may be displayed.

Once or twice a year, check to see if the inside of the intelligent 2-wire pH transmitter is wet, as moisture may cause insulation resistance deterioration.

When closing the front cover after inspection, check to see if there is any dust on the gasket sealing surface.

Note : However, the front cover should not be removed frequently.

7.2.2 Inspection of Intelligent 2-wire pH Transmitter Window

Wipe any stains off the intelligent 2-wire pH transmitter window (polycarbonate weather-proofed sheet) with soft paper such as tissue paper, etc.

When the window is badly stained, neutral detergent may be used, but not organic solvent.

If stains and scratches greatly hinder key operation and display checking, replace the window. (Part No. : K9311JN)

7.2.3 Wetted Part Sealing O-ring Inspection

When the KCl filling type pH sensor is used, wetted part sealing O-rings are used at the glass electrode, liquid junction and sensor installation section when the sensor is installed on the immersion holder or flow-through holder. They are also used for the fermentation pH sensor at the holder electrode contact and fermentator holder insertion holes.

Check to see if the O-ring sealing characteristic has deteriorated. Note, however, that frequent O-ring checks may damage the O-ring sealing characteristic.

Note 1 : As a rule, use the replacement O-ring recommended by us.

Note 2 : When inspecting KCl filling type pH sensor's the glass electrode O-ring, do not wet the mounting hold.

Note 3 : It is recommended that the seal O-ring be replaced at fixed intervals. Pay close attention to this, especially when measured liquid is strongly influenced by faulty O-ring seals (for example, when the fermentation pH sensor is used, the medium in the fermentation process may be greatly influenced).

7.2.4 Ultrasonic Washing Element Corosin Inspection

This applies when the holder with as ultrasonic washing device (refillable KCl pH sensor) is used. Ultrasonic washing element material is selected so as to resist corrosion by the measured liquid, but sometimes corrosion may occur. If this happens, the element should be replaced before the measured liquid penetrates into the ultrasonic washing element.

7.2.5 KCl Solution Refilling Tube Inspection

This applies when the KCl filling type pH sensor or pH sensor for high-purity water is used.

If the tube is damaged and the KCl solution leaks through this damaged section, it will drain a lot of the KCl solution from the reserve tank.

Therefore, check the tube sometimes and, if it is deteriorating, replace it.

8. TROUBLESHOOTING

If any trouble occurs, the display unit shows an error message.

Table 8.1 shows error messages and error details.

Table 8.1 Error Message List

Error No.	Details of trouble	
Err. 1	pH measuring range (−2 to 15 pH) overflow	At occurrence
Err. 2	Temperature measuring range (−10 to 130°C) overflow	
Err. 3	Reference electrode impedance trouble (when exceeding the set-value)	
Err. 4	Glass electrode impedance trouble (Cracked or deteriorated electrode)	
Err. 5	Slope trouble (when exceeding 70 to 115% of theoretical value)	During standard solution calibration
Err. 6	Asymmetric potential trouble (when exceeding +120 mV)	
Err. 7	Stability trouble during standard solution calibration (When it does not stabilize within 3 minutes.)	
Err. 8	Standard solution temperature range (0 to 100°C) overflow	
Err. 9	Half-value recovery trouble during automatic washing (When exceeding setting time)	During automatic washing
Err. 10	EEROM trouble	At occurrence
NOTE.01	Input data setting range overflow	During data setting
NOTE.02	Input data setting trouble (when input pH span is less than 1 in the OUTPUT mode)	

Errors are roughly divided into the following 3 types.

(1) When an Error Occurs During Measurement and Automatic Washing

The display unit shows an error message and FAIL. Also, a trouble contact output signal (Note 1) is output to inform the operator of trouble with the overscaled transmission signal. (Note 2) (22 mA).

Note 1 : when communication function ON (service level code No. 06) is set using the dedicated pH201G distributor.

Note 2 : When set to output signal overflow ON (service level code No. 07)

(2) Error occurring during standard solution calibration

When an error occurs during standard solution calibration, the display unit shows an error message and FAIL to inform the operator of the trouble.

(3) Error occurring during data setting

When data set during data setting is not normal, an error message (Note 1 or Note 2) is displayed for about 2 s to catch the operator's attention. In this case, the data set is not updates, so reset it with the correct data.

8.1 Measures

When an error occurs, check the corresponding message and take the following steps.

The error message will not disappear until the cause of the error is eliminated (other than for errors occurring during data setting.)

8.1.1 "Err. 1 (pH Measuring Range Trouble)"

"Err.1" is displayed when measured liquid pH-value is out of the -2 to 15 pH range. If this message appears, check to see if there are any stains and/or moisture at the cable connection that will cause insulation deterioration, as this trouble more likely to be caused by sensor trouble than by problems with the measured liquid pH-value itself, so check the sensor for faults.

8.1.2 "Err.2 (Temperature Measuring Range Trouble)"

"Err.2" is displayed when measured liquid temperature is out of the -10 to 130°C range, so keep the measured liquid temperature between -10 and 130°C .

If the error message does not disappear, even if the temperature is kept between -10 and 130°C , it is likely that the RTD is faulty (broken). If this is the case, replace the pH electrode.

8.1.3 "Err.3 (Reference Electrode Impedance Trouble)"

"Err.3" is displayed when reference electrode impedance exceeds the set-value as a result of an impedance check.

This is mainly caused by clogging of the liquid junction, so check to see if stains have been removed by washing. If recovery cannot be expected, replace the liquid junction.

Check to see if the reference electrode impedance high-limit setting in code No. 03 is appropriate.

Note : The impedance check is done when the service level code is No. 03 and an impedance check is set to ON.

8.1.4 "Err.4 (Glass Electrode Impedance Check Trouble)"

"Err.4" is displayed when glass electrode impedance value is abnormal as a result of an impedance check.

This is mainly causes by checking and/or disconnection of the glass electrode. If this happens, replace the glass electrode.

Note : An impedance check is done when the service level code is No. 03 and the impedance check is set to ON.

8.1.5 "Err.5 (Slope Trouble)"

"Err.5" is displayed when the e.m.f. slope is not within 7 to 115% of theoretical value as a result of slope check during computation.

When standard solutions used for 2-point calibration are old and do not show correct pH-values, or the glass or reference electrode has deteriorated, this display appears.

If this display appears, even after standard solution re-calibration using correct standard solutions, the electrode needs to be replaced.

Note : A slope check is done when the service level code is No. 03 and the slope check is set to ON.

8.1.6 "Err.6 (Asymmetric Potential Trouble)"

"Err.6" is displayed when asymmetric potential exceeds +120 mV as a result of an asymmetric potential check done during computation.

When standard solutions used for 2-point calibration are old and do not show correct pH-values, or the glass or reference electrode has deteriorated, this display appears.

If this display appears, even after standard solution re-calibration using correct standard solutions, the electrode needs to be replaced.

Note : An asymmetric potential check is done when the service level code is No. 03 and the asymmetric potential check is set to ON.

8.1.7 "Err.7 (Stability Trouble During Standard Solution Calibration)"

"Err.7" is displayed when the pH-value does not stabilize within 3 minutes during standard solution calibration.

First, check to see if there are any stains or performance does not recover, even after acid washing. Also, check to see if the set-values of the stability check parameters ΔT and ΔpH are appropriate.

If there is no problem, this error is caused by deterioration in glass electrode response, so as a rule, replace the glass electrode.

Note : Stability can be checked by setting stability parameters ΔT and ΔpH with service level code No. 09.

8.1.8 "Err.8 (Standard Solution Temperature Range Overflow)"

"Err.8" is displayed when standard solution temperature is not between 0 and 100°C during automatic standard solution calibration.

Do automatic standard solution calibration using a standard solution with a temperature between 0 and 100°C.

8.1.9 "Err.9 (Half-value Recovery Trouble During Automatic Washing)"

This is displayed when half-value recovery time exceeds the set-value as a result of a half-value recovery check.

Check to see if there are any stains or performance does not recover after acid washing. Also check to see if the half-value recovery time set by service level code No. 05 is appropriate.

If there is no problem, this error is caused by deterioration in glass electrode response, so as a rule, replace the glass electrode.

8.1.10 "Err.10 (EEROM Trouble)"

This is intelligent 2-wire pH transmitter trouble, so please contact us.

8.1.11 "NOTE 01 (Input Data Setting Range Overflow)"

This error appears when the set-value exceeds the setting range when data is set in the operation, setting and service levels.

If this error message appears, data is not updated, so enter the correct set-value again.

8.1.12 "NOTE 02 (Input Data Setting Trouble)"

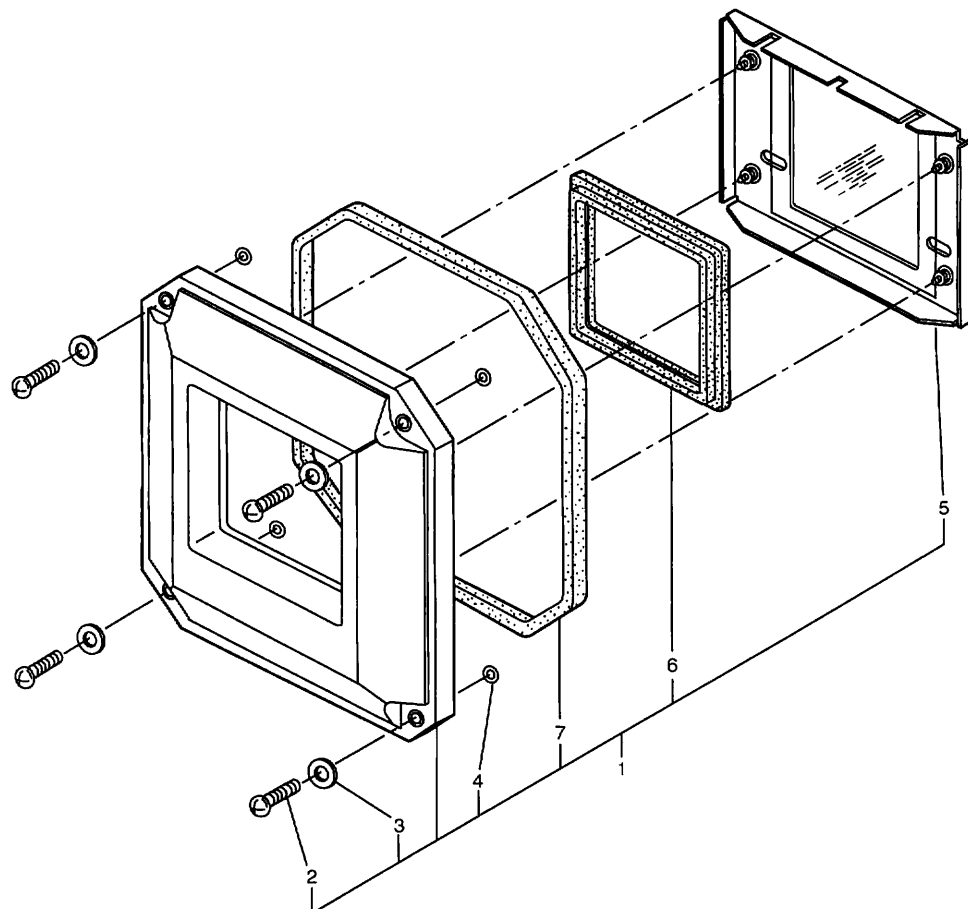
This error appears when the set-value span between the pH-value at 4 mA signal output and that at 20 mA signal output becomes less than 1pH.

If this error message appears, data is not updates, so re-enter the correct set-value so that the span becomes more than 1pH.

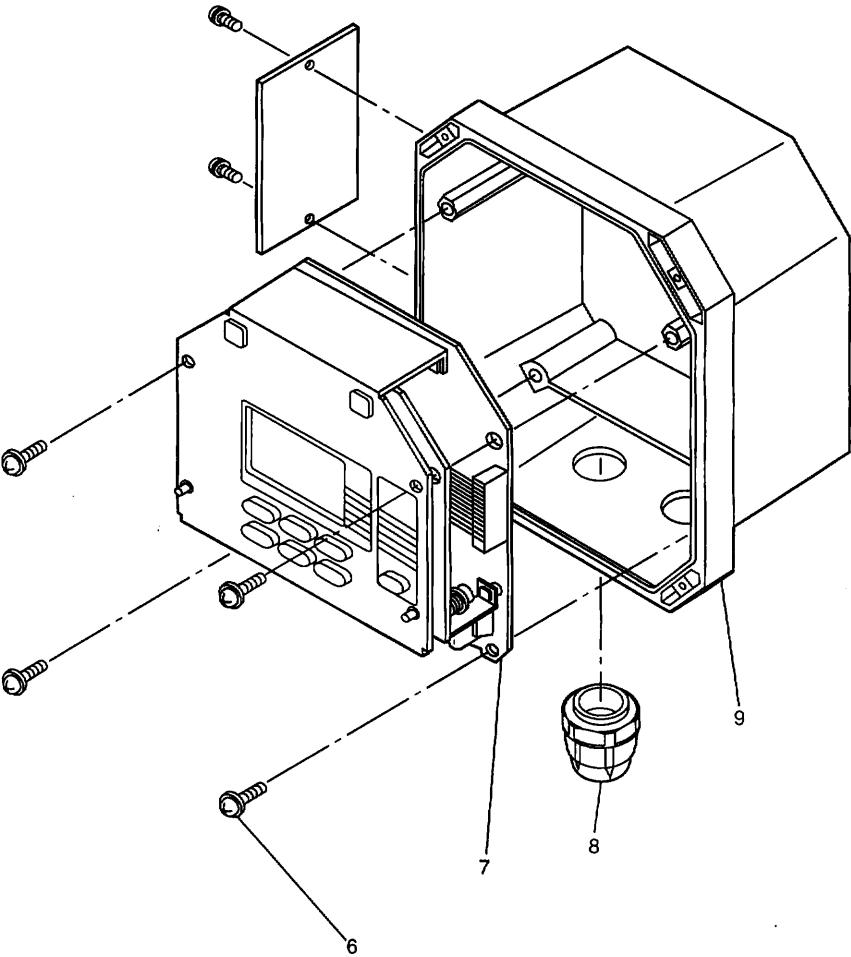
Note : The pH-value at 4 mA signal output is updates, but not at 20 mA signal output.

Customer Maintenance Parts List

Model PH200G and PH200S 2-wire pH Transmitter



Item	Part No.	Qty	Description
1	K9311MA	1	Cover Assembly
2	Y9520JU	4	Pan H . Screw,M5 × 20
3	Y9500WU	4	Washer
4	Y9102XA	4	O-Ring
5	K9311JN	1	Window Assembly
6	K9311JK	1	Gasket
7	F9557JH	1	Gasket



Item	Part No.	Qty	Description
6	Y9406LB	4	B.H. Screw, M4 × 6
7	K9311DB	1	Amp. Assembly
8	B1002JZ	1	Cable gland
9	K9311MB	1	Case Assembly