User's Manual

EXA

CE

Model PH202G [Style: S3], PH202S [Style: S3]

2-wire Type pH/ORP(Redox) Transmitter

IM 12B07D02-01E

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 12B07D02-01E
11th Edition

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PREFACE

In this manual a **mA** sign appears if it concerns the PH202G (S)-E, -C, -U, -N, -K

IM 12B07D02-01E
11th Edition: Oct. 2009(YK)

DANGER

Electric discharge

The EXA analyzer contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using
grounded soldering irons and wrist straps to avoid electrostatic discharge.

Installation and wiring

The EXA analyzer should only be used with equipment that meets the relevant international and regional standards. Yokogawa accepts no responsibility for the misuse of this unit.

CAUTION

The instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

Although the instrument has a weatherproof construction, the transmitter can be harmed if it becomes submerged in water or becomes excessively wet.

Do not use an abrasive material or solvent when cleaning the instrument.

Do not modify the PH202 transmitter.

WARNING

Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, e.g., rubbing with a dry cloth.

Warning label

Because the enclosure of the pH/ORP transmitter Type PH202S-E, -P, -F are made of aluminium, if it is mounted in an area where the use of category 1 G Zone 0 apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

Notice

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

- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

Yokogawa is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Improper operation by the user.
- Use of the instrument in improper applications
- Use of the instrument in an improper environment or improper utility program
- Repair or modification of the related instrument by an engineer not authorized by Yokogawa.

Safety and Modification Precautions

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

The following safety symbols are used on the product as well as in this manual.

DANGER

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

WARNING

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

CAUTION

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

This symbol indicates Protective Ground Terminal

This symbol indicates Function Ground Terminal (Do not use this terminal as the protective ground terminal.)

This symbol indicates Alternating current.

This symbol indicates Direct current.

Warranty and service

Yokogawa products and parts are guaranteed free from defects in workmanship and material under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual sales organizations can deviate from the typical warranty period, and the conditions of sale relating to the original purchase order should be consulted. Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes are excluded from this warranty coverage.

In the event of warranty claim, the defective goods should be sent (freight paid) to the service department of the relevant sales organization for repair or replacement (at Yokogawa discretion). The following information must be included in the letter accompanying the returned goods:

- Part number, model code and serial number
- Original purchase order and date
- Length of time in service and a description of the process
- Description of the fault, and the circumstances of failure
- Process/environmental conditions that may be related to the installation failure of the device
- A statement whether warranty or non-warranty service is requested
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person who can be reached for further information.

Returned goods that have been in contact with process fluids must be decontaminated/disinfected before shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material safety data sheets should also be included for all components of the processes to which the equipment has been exposed.

ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτονργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

SK

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

LT

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës “Yokogawa” biuru arba atstovu.

LV

Visas ATEX Ex kategorijas izstrâdâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pârstâvi.

EST

Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima Iokagava (Yokogawa) kontori või esindaja poole.

PL

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v anglišèini, nemšèini ter francošèini. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

H

Az ATEX Ex mûszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

BG

Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

RO

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

M

Il manwali kollha ta 1 istruzzjonijiet għal prodotti mmarbuta ma’ ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma’ Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffiċċju ta’ Yokogawa

1. INTRODUCTION AND GENERAL DESCRIPTION

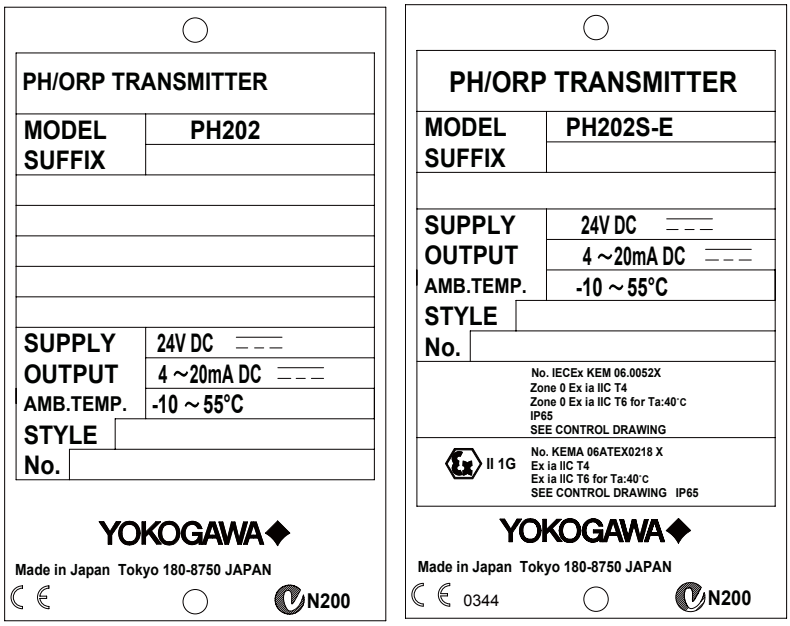
The Yokogawa EXA 202 is a 2-wire transmitter designed for industrial process monitoring, measurement and control applications. This user's manual contains the information needed to install, set up, operate and maintain the unit correctly. This manual also includes a basic troubleshooting guide to answer typical user questions.

Yokogawa can not be responsible for the performance of the EXA analyzer if these instructions are not followed.

1-1. Instrument check

Upon delivery, unpack the instrument carefully and inspect it to ensure that it was not damaged during shipment. If damage is found, retain the original packing materials (including the outer box) and then immediately notify the carrier and the relevant Yokogawa sales office.

Make sure the model number on the textplate affixed to the side of the instrument agrees with your order. Examples of nameplates are shown.



mA

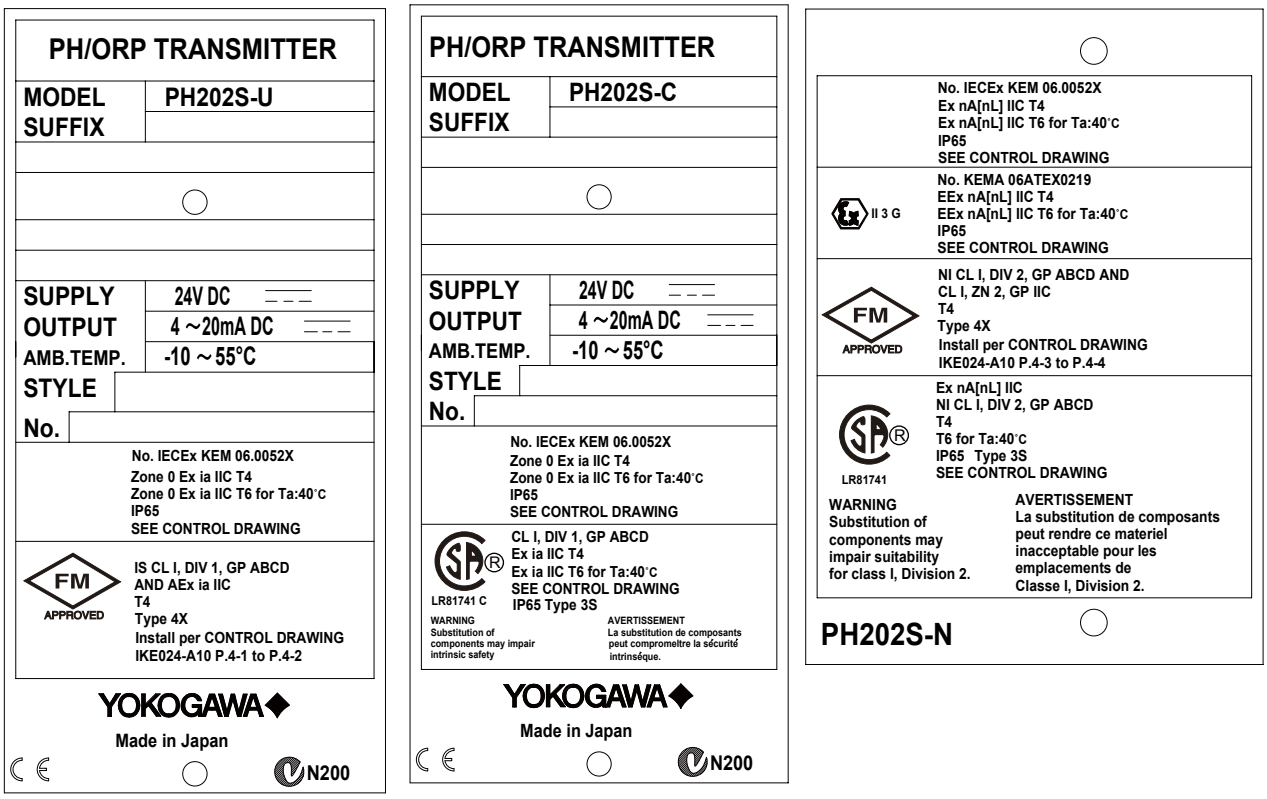


Figure 1-1. Nameplate

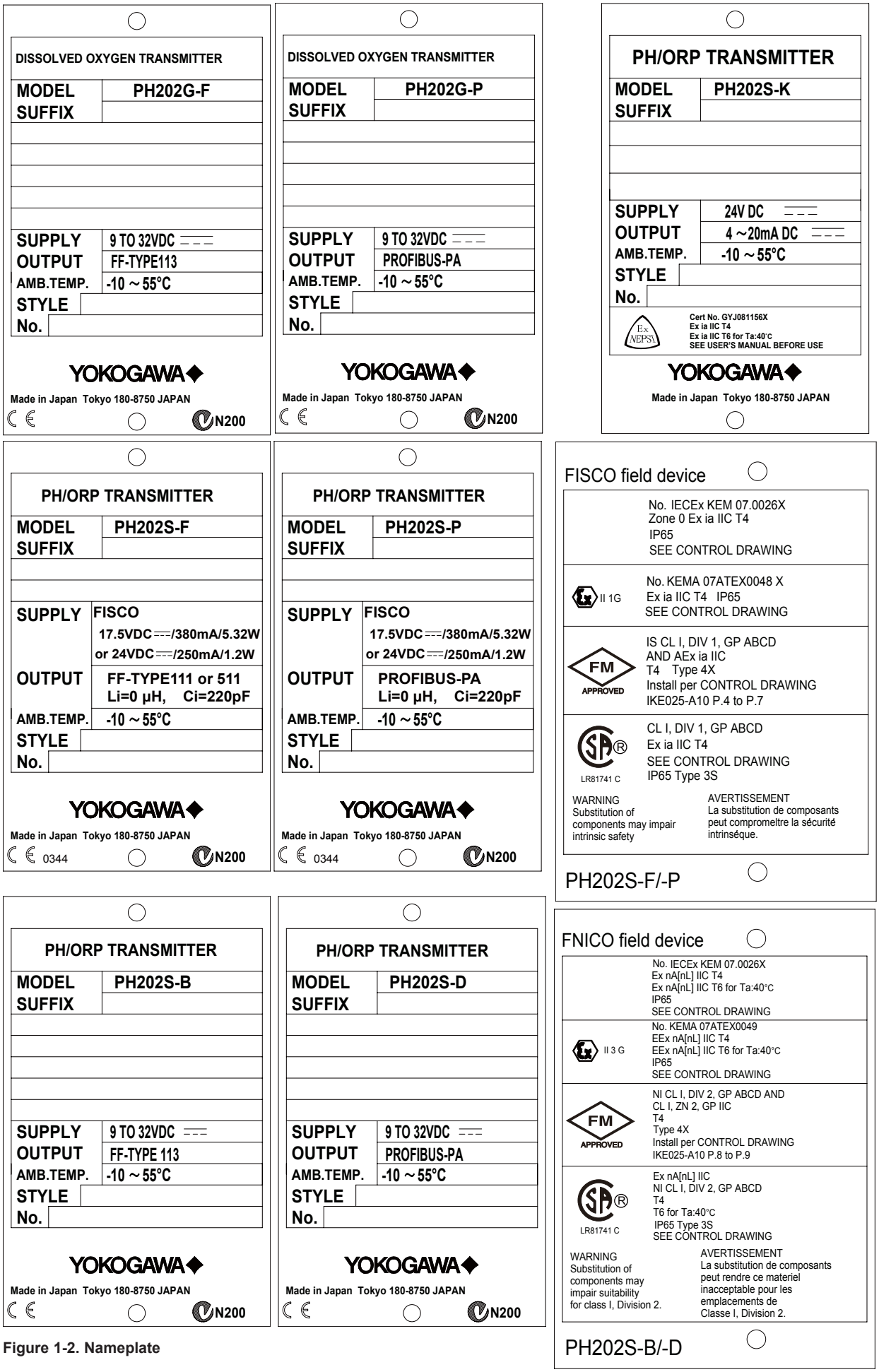


Figure 1-2. Nameplate

NOTE: Check that all the parts are present, including mounting hardware, as specified in the option codes at the end of the model number.
For a description of the model codes, refer to Chapter 2 of this manual under General Specifications.

Basic Parts List: Transmitter PH202
User's Manual English
Optional mounting hardware when specified (See model code)

NOTE: mounting screws and special grommet are packed in the terminal compartment, together with a second link for impedance selection.

1-2. Application

The EXA converter is intended to be used for continuous on-line measurement in industrial installations. The unit combines simple operation and microprocessor-based performance with advanced self-diagnostics and enhanced communications capability to meet the most advanced requirements. The measurement can be used as part of an automated process control system. It can also be used to indicate dangerous limits of a process, to monitor product quality, or to function as a simple controller for a dosing/neutralization system.

Yokogawa designed the EXA analyzer to withstand harsh environments. The converter may be installed either indoors or outside because the IP65 (NEMA 4X) housing and cabling glands ensure the unit is adequately protected. The flexible polycarbonate window on the front door of the EXA allows pushbutton access to the keypad, thus preserving the water and dust protection of the unit even during routine maintenance operations.
A variety of EXA hardware is optionally available to allow wall, pipe, or panel mounting. Selecting a proper installation site will permit ease of operation. Sensors should normally be mounted close to the converter in order to ensure easy calibration and peak performance. If the unit must be mounted remotely from the sensors, WF10 extension cable can be used up to a maximum of 50 metres (150 feet) with a BA10 junction box. Except installations with dual high impedance sensors, where the maximum cable length is 20 metres using integral cable only (no junction box).

The EXA is delivered with a general purpose default setting for programmable items. (Default settings are listed in Chapter 5 and again in Chapter 10). While this initial configuration allows easy start-up, the configuration should be adjusted to suit each particular application. An example of an adjustable item is the type of temperature sensor used. The EXA can be adjusted for any one of eight different types of temperature sensors.

To record such configuration adjustments, write changes in the space provided in Chapter 10 of this manual. Because the EXA is suitable for use as a monitor, a controller or an alarm instrument, program configuration possibilities are numerous.

Details provided in this user's manual are sufficient to operate the EXA with all Yokogawa sensor systems and a wide range of third-party commercially available probes. For best results, read this manual in conjunction with the corresponding sensor user's manual.

2. PH202 SPECIFICATIONS

2-1. General

A. Input specifications
: Dual high impedance inputs (2 x $10^{12}\Omega$) with provision for liquid earth connection. Suitable for inputs from glass or enamel pH & reference sensors and ORP metal electrodes.

B. Input ranges
- pH : -2 to 16 pH
- ORP : -1500 to 1500 mV
- rH : 0 to 55 rH
- Temperature : -30ºC to 140ºC (-20 to 300ºF)
- 8k55Ω NTC sensor: -10ºC to 120ºC (10 to 250 ºF)
- 10kΩ PTC : -20ºC to 140ºC (0 to 300ºF)

C. Output ranges
- pH : min 1 max 20 pH
- ORP : min 100 max 3000 mV
- rH : min 2 max 55 rH
- Temperature : min. 25 ºC max. 200 ºC

(for 8.55kΩ NTC sensor max. 120 ºC)

mA D. Output signal
: 4-20 mA loop powered, isolated from input, maximum load 425 Ω at 24 V DC. With the possibility of 21 mA “FAIL” signal (burn up) and 3.6 mA (burn down when HART® or distributor comm. is non-used), 3.9 mA (burn down when HART® or distributor comm. is used).

E. Temperature compensation
- Range :–30 ºC to 140 ºC

(for 8.55kΩ sensor –10 ºC to 120 ºC)
Sensor types: Pt100, Pt1000, 3kΩ PTC, 5.1kΩ PTC, 8.55kΩ NTC, 350Ω PTC, 6.8kΩ PTC, 10kΩ PTC
Automatic or manual compensation to Nernst equation. Process compensation by configurable coefficient. Adjustable ITP (Iso-thermal point of intersection).

F. Calibration
: Semi-automatic, using tables in transmitter for pH 4, 7 & 9 buffer solutions, or using user-defined tables, with automatic check of measurement stability.
Manual, using standard sample, by correcting reading to value of standard.
Calibration by slope and asymmetry potential setting. (IEC746-2)

G. Logbook
: Software record of important events and diagnostic data. Available through HART® link, with key diagnostic information available in the display.

H. Serial communication
: Bi-directional HART® digital communication superimposed on the 4-20 mA signal.

I. Display
: Custom liquid crystal display, with a main display of 3 1/2 digits 12.5 mm high.
Message display of 6 alphanumeric characters, 7 mm high.
Warning flags and units (pH and mV).

J. Power supply
: Nominal 24 volt DC loop powered system.
- PH202G : 17 to 40 volts, see Fig. 2-1.
- PH202S : 17 to 31.5 volts, see Fig. 2-2.

K. Maximum load resistance:
For the PH202G, see Fig. 2-1.
For the PH202S, see Fig. 2-2.

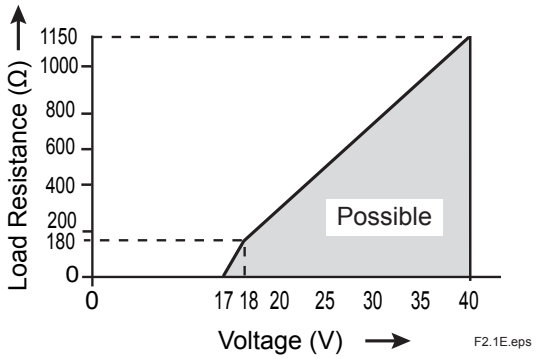


Fig. 2-1. Supply voltage/ load diagram for the PH202G

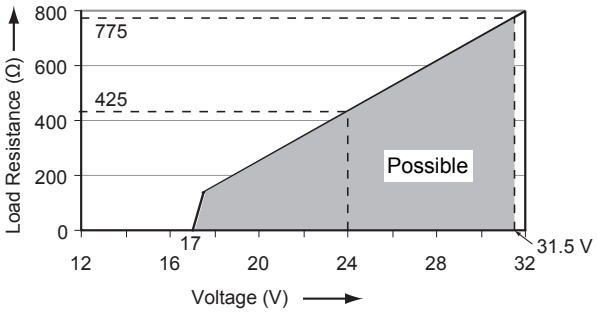


Fig. 2-2. Minimum terminal voltage for the PH202S

(Note) In this manual a **mA** sign appears if it concerns the PH202G (S)-E, -C, -U, -N, -K.

2-2. Operating specifications

A. Performance : pH
- Linearity : ±0.01 pH
- Repeatability: ±0.01 pH
- Accuracy : ±0.01 pH

Performance : ORP
- Linearity : ±1 mV
- Repeatability : ±1 mV
- Accuracy : ±1 mV

Performance : Temperature with Pt1000 Ω, 3kΩ Balco, 5k1Ω, 350Ω, 6k8Ω, PTC10kΩ & 8k55Ω
- Linearity : ±0.3 ˚C
- Repeatability: ±0.1 ˚C
- Accuracy : ±0.3 ˚C

Performance : Temperature with Pt100 Ω
- Linearity : ±0.4 ˚C
- Repeatability: ±0.1 ˚C
- Accuracy : ±0.4 ˚C

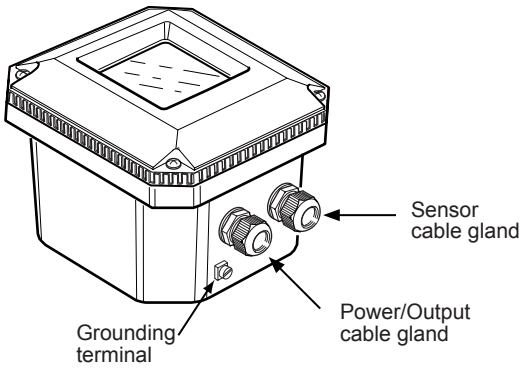
Note on performance specifications:
The following tolerance is added to above performance.
mA output tolerance : ± 0.02 mA of "4 - 20 mA"

B. Ambient operating temperature
: -10 to + 55 ˚C (10 to 131 ˚F)

C. Storage temperature
: -30 to +70 ˚C (-20 to 160 ˚F)

D. Humidity
: 10 to 90% RH (Non-condensing)

F. Housing:
Case: Cast aluminum case with chemically resistant coating
Cover: Polycarbonate window.
Case color: Off-white (Equivalent to Munsell 2.5Y8.4/1.2)
Cover color: Deep sea Moss green (Equivalent to Munsell 0.6GY3.1/2.0)



Cable and terminals :
The PH202 is equipped with terminals suitable for the connection of finished cables in the size: 0.13 to 2.5 mm (26 to 14 AWG)
Cable entry: 2 cable glands 1/2NPT. The cable glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).
Construction : Weather resistant to IP65 and NEMA 4X standards
Mounting : Pipe, wall or panel mounting, using optional hardware
Weight : Approx. 1.6 kg

G. Shipping details
: Package size w x h x d
290 x 300 x 290 mm.
11.5 x 11.8 x 11.5 in.
Packed weight approx. 2.5 kg (5lb)

H. Data protection
: EEPROM for configuration and logbook, and lithium cell for clock.

I. Watchdog timer
: Checks microprocessor

J. Automatic safeguard
: Return to measuring mode when no keystroke is made for 10 min.

K. Operation protection
: 3-digit programmable password.

L. Sensor impedance checking
: Independent impedance check on measuring and reference sensor elements, with temperature compensation. Display of sensor impedance on message line of display. FAIL flag in event of “out of limits” impedance, and the possibility of 21 mA or (3.6 mA or 3.9 mA) error signal.

M. Signal processing (pH/ORP)
: The PH202 can measure pH or ORP. Using the FU20 allows simultaneous measurement and display of pH and ORP. It also allows display and out put of pH.

N. EMC Conformity standards CE , N200
EN 61326-1 Class A, Table 2
(For use in industrial locations)
EN 61326-2-3
EN 61326-2-5 (pending)

CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

O. Intrinsically safe

Refer to conrol drawings.

mA

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Vmax=31.5 V, Imax=100 mA, Pmax=1.2 W, Ci=22 nF, Li=35 µH	-U
IECEx	**IECEx Intrinsically safe (see Note)**	
CENELEC ATEX	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020, EN60079-26 Certificate: KEMA 06ATEX0218 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	-E
IECEx	**IECEx Intrinsically safe (see Note)**	
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.61010-1 Ex ia Class I, Division 1, Groups ABCD, Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH	-C
IECEx	**IECEx Intrinsically safe (see Note)**	
(Note) IECEx Scheme	**IECEx Intrinsically safe** Applicable standard: IEC60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 06.0052X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	

T1E.EPS

Item	Description	Code
CENELEC ATEX Entity	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 07ATEX0048 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
CENELEC ATEX FISCO	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27 Certificate: KEMA 07ATEX0048 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 07ATEX0049 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

ATEX.EPS

Item	Description	Code
IECEx Scheme Entity	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 07.0026X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	-P or
IECEx Scheme FISCO	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27 Certificate: IECEx KEM 07.0026X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	-F
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 07.0026X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	-B or -D

IEC.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Non-incendive safe Approval** Applicable standard: FM3600, FM3611, FM3810 Non-incendive for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Vmax=31.5 V, Ci=22 nF, Li=35 µH	-N
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 06ATEX0219 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	
Canadian Standards Association (CSA)	**CSA Non-incendive safe Approval or type of protection "n"** Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH	
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 06.0052X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	

T2.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220pF, Li=0 µH	-P or -F
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH	-B or -D

FM.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH	-P or -F
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No. 61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH	-B or -D

CSA.EPS

mA

NEPSI Certification (PH202S-K)

NEPSI Intrinsically Safe Type

Cert No. GYJ081156X

- Applicable Standard:
  GB3836.1-2000, GB3836.4-2000
- Type of Protection and Marking Code:
  Ex ia IIC T4/T6
- Ambient Temperature :
  T6; –10 to 40°C, T4; –10 to 55°C

Note 1 Entity Parameters

- Intrinsically safe input parameters
  (terminal + and -):
  Maximum Input Voltage (Ui) = 31.5 V
  Maximum Input Current (Ii) = 100 mA
  Maximum Input Power (Pi) = 1.2 W
  Maximum Internal Capacitance (Ci) = 22 nF
  Maximum Internal Inductance (Li) = 35 µH
- Intrinsically safe output parameters and maximum external parameters
  (terminal 11 and 17):
  Uo=14.4 V, Io=32.3 mA, Po=0.12 W, Co=600 nF, Lo=34 mH

Note 2 Installation

- Electrostatic charges on the display window shall be avoided.
- The external earth connection facility shall be connected reliably.
- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation and will void NEPSI Intrinsically safe certification.
- The user shall not change the configuration in order to maintain/ensure the explosion protection performance of the equipment. Any change may impair safety.
- For installation, use and maintenance of the product, the end user shall observe the instruction manual and the following standards:
  GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".
  GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres".
  GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres- Part 15: Electrical installations in hazardous area (other than mines)" .
  GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres- Part 16: Inspection and maintenance of electrical installation (other than mines)".

mA **mA-HART® communication**

A. Input : Two wire system 4-20 mA

B. Power supply :

PH202G : up to 40 volts
PH202S : up to 31.5 volts

Note: The transmitter contains a switched power supply, drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem. (see figure 2-2)

C. Transmission: Isolated output of 4 to 20 mA DC.

D. Signal : Maximum load 425Ω. (see figure 2-1)
Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)

E. Operating range : 3.9 to 21mA

F. Communication
: HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal

G. Configuration : Local with 6 keys

H. Software : Firmware based on Yokogawa stack.

I. Hardware : Yokogawa HART® Modem F9197UB

J. Other Control systems
: Yokogawa PRM, Rosemount AMS, Siemens PDM

K. Hand Terminal : Rosemount HHT 275/375

L. Other control systems: Yokogawa PRM, Rosemount AMS, Siemens PDM

M. Output span :
- pH : min 1 pH, max 20 pH. (max 90% zero suppression)
  :The instrument is user programmable for linear or non-linear pH ranges.

N. Cable specification
: 0.5 mm diameter or 24 AWG over maximum length of 1500 m

O. DD specification
: The PH202 Device Description is available enabling communications with the Handheld Communicator and compatible devices.

PROFIBUS-PA communications

A. Input signal: Digital
B. Supply voltage: 9 to 32 V DC
C. Operating current: 26.0 mA
D. Operating values: According to IEC 1158-2
E. Bus connection
: Fieldbus interface base on IEC1158-2 according to FISCO-Model
F. Power supply: Power supply is achieved dependant on the application by means of segment coupler
G. Data transfer: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
H. GSD file: The actual file can be downloaded from www.profibus.com Configuration: Local with 6 keys
I. Software: Firmware based on Siemens DPC31 stack.
J. Hardware:
PC- or PCMCIA-interfaces from Siemens
K. Other control: Siemens PDM systems
L Electrical connection:
Terminals acc. to IEC 1158-2
M. Fieldbus-cable-types:
Twisted and shielded two wire cable according to recommendation based on IEC 1158-2 Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

FOUNDATION FIELDBUS H1 communications

A. Input signal: Digital
B. Supply voltage: 9 to 32 V DC
C. Operating current: 26.0 mA (base current)
D. Operating values: According to IEC 1158-2
E. Bus connection
: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
F. Power supply:
Power supply is achieved dependant on application by means of segment coupler
G. Data transfer:
FF specification Rev. 1.4 Basic device
H. Function blocks:
3 x AI, Transducer, Resource
I. Files: Actual file can be downloaded from our homepage
J. Configuration: locally with 6 keys
K. Software: National Instruments: NI-FBUS configurator
L. Hardware: F-BUS interfaces from National Instruments (AT-FBUS, PCMIA-FBUS)
M. Other control systems:
YOKOGAWA PRM, DTM

2-3. Model and suffix codes

1. 2-Wire pH/ORP Transmitter (Non-explosionproof type)

[Style : S3]

Model	Suffix Code	Option Code	Description
PH202G	·····	·····	2-Wire pH/ORP Transmitter (*1)
Type	**-E**	·····	mA with HART (Europe type)
	-C	·····	mA with HART (Canada type)
	-U	·····	mA with HART (North America type)
	-P	·····	Profibus
	-F	·····	FF
Language	**-J**	·····	Japanese
	-E	·····	English
Option	Mounting Hardware	**/U**	Pipe, wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
	Hood	**/H**	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
	Tag Plate	**/SCT**	Stainless steel tag plate
	Conduit Adapter	**/AFTG**	G 1/2
		/ANSI	1/2 NPT
		/TB	Screw terminal (*2)
		/X1	Epoxy baked finish (*3)

(*1) The PH202G can be also used as ORP transmitter. (Setting can be made in the field.)
(*2) It can be specified when the suffix code -A is selected.
(*3) The housing is coated with epoxy resin.

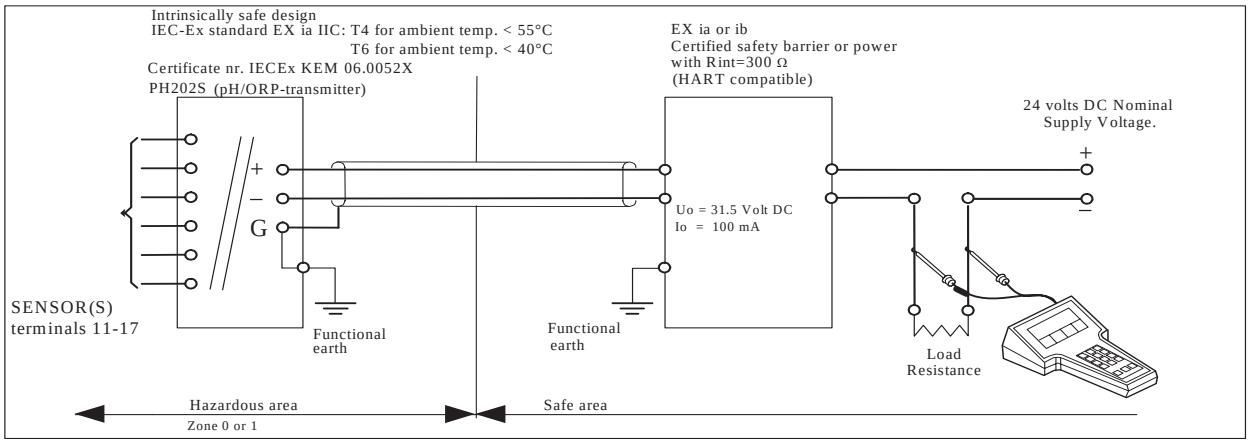
2. 2-Wire pH/ORP Transmitter (Explosionproof type)

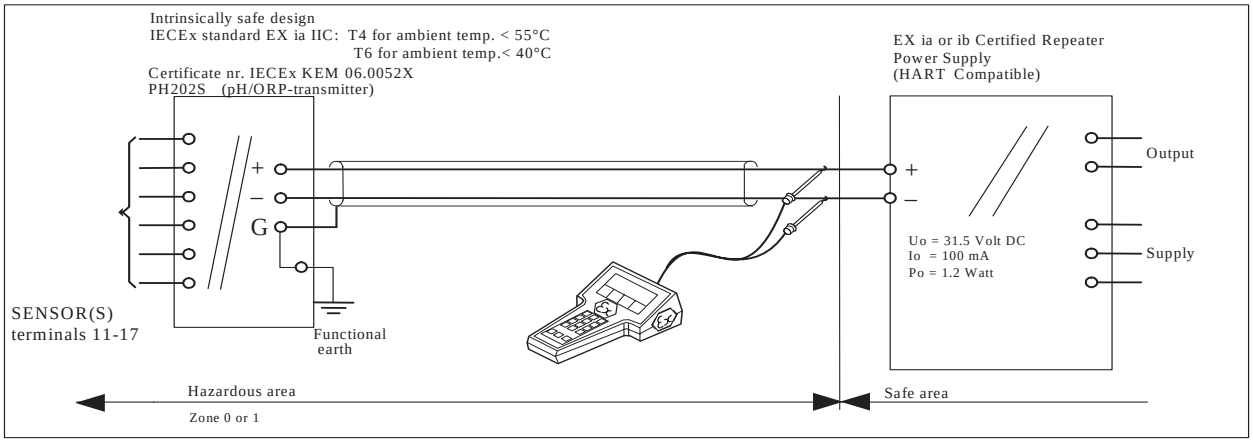
[Style : S3]

Model	Suffix Code	Option Code	Description
PH202S	·····	·····	2-Wire pH/ORP Transmitter (*1)
Type	**-E**	·····	Intrinsic safe mA with HART (ATEX)
	-C	·····	Intrinsic safe mA with HART (CSA)
	-U	·····	Intrinsic safe mA with HART (FM)
	-K	·····	Intrinsic safe mA with HART (NEPSI)
	-P	·····	Intrinsic safe Profibus (ATEX, CSA, FM)
	-F	·····	Intrinsic safe FF (ATEX, CSA, FM)
	-B	·····	Non-incendive FF (ATEX, CSA, FM) (*3)
	-N	·····	Non-incendive mA with HART (ATEX, CSA, FM) (*3)
	-D	·····	Non-incendive Profibus (ATEX, CSA, FM) (*3)
Language	**-J**	·····	Japanese
	-E	·····	English
Option	Mounting Hardware	**/U**	Pipe, wall mounting bracket (Stainless steel)
		/PM	Panel mounting bracket (Stainless steel)
	Hood	**/H**	Hood for sun protection (Carbon steel)
		/H2	Hood for sun protection (Stainless steel)
	Tag Plate	**/SCT**	Stainless steel tag plate
	Conduit Adapter	**/AFTG**	G 1/2
		/ANSI	1/2 NPT
		/X1	Epoxy baked finish (*2)

(*1) The PH202S can be also used as ORP transmitter. (Setting can be made in the field.)
(*2) The housing is coated with epoxy resin.
(*3) When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight.

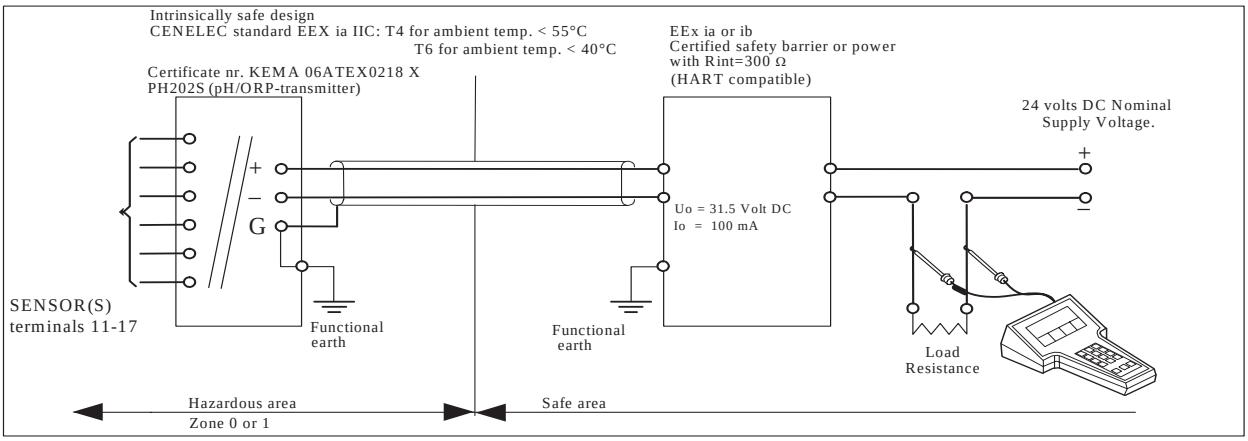
2-4. Control Drawing of PH202S mA HART® Specification (IECEx).

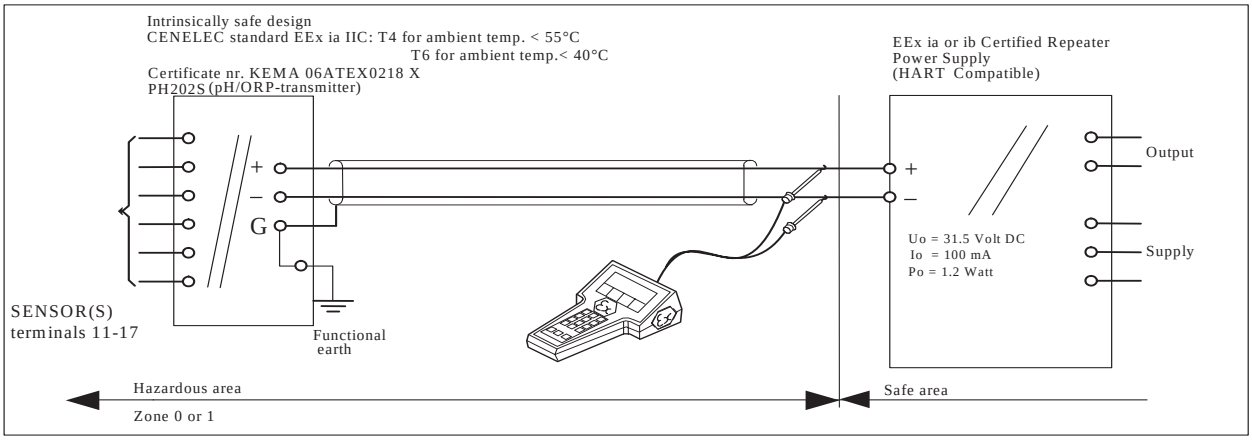




- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.
- Electrical data of the PH202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage U_i = 31.5 V. Maximum input current I_i = 100 mA.
    Maximum input power P_i = 1.2 W.
    Effective internal capacitance C_i = 22 nF.
    Effective internal inductance L_i = 35 μH.
  - Sensor input circuit (terminals 11 through 17):
    Maximum output voltage U_o = 14.4 V. Maximum output current I_o = 32.3 mA.
    Maximum allowed external capacitance Co = 600 nF. (for PH202S-E,-C,-U),
    Co = 3.5 μF (for PH202S-N).
    Maximum allowed external inductance Lo = 34 mH (for PH202S-E,-C,-U),
    Lo = 76 mH (for PH202S-N).
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The Hand Held Communicator must be of a IECEx certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a IECEx certified nonincendive type in case it is used in the nonincendive circuit in the hazardous area.

2-5. Control Drawing of PH202S mA HART® Specification (ATEX)





- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.
- Electrical data of the PH202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage U_i = 31.5 V. Maximum input current I_i = 100 mA.
    Maximum input power P_i = 1.2 W.
    Effective internal capacitance C_i = 22 nF.
    Effective internal inductance L_i = 35 µH.
  - Sensor input circuit (terminals 11 through 17):
    Maximum output voltage U_o = 14.4 V. Maximum output current I_o = 32.3 mA.
    Maximum allowed external capacitance Co = 600 nF. (for PH202S-E,-C,-U),
    Co = 3.5 µF (for PH202S-N).
    Maximum allowed external inductance Lo = 34 mH (for PH202S-E,-C,-U),
    Lo = 76 mH (for PH202S-N).
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The safety barrier shall be certified by notify body.
- Installation should be in accordance with local installation requirements.
- If use ordinary wirings, the general purpose equipment must have Nonincendive Field Wiring terminal approved.
- The Hand Held Communicator must be of a ATEX certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a ATEX certified non-incendive type in case it is used in the non-incendive circuit in the hazardous area.

2-6. Control Drawing of PH202S mA HART® Specification (FM Intrinsically safe design)

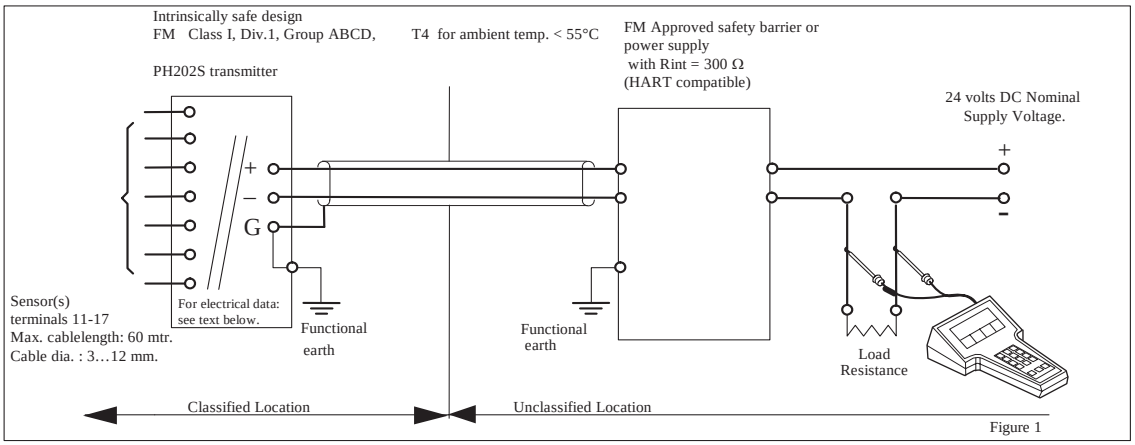


Figure 1

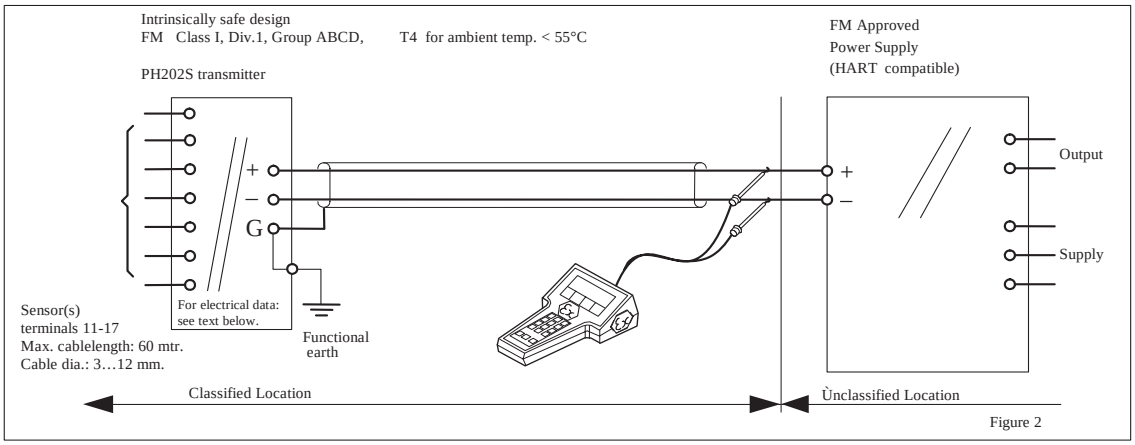


Figure 2

・Electrical data of the PH202S.

-Supply circuit (terminals + and -):

Maximum input voltage Vmax = 31.5 V. Maximum input current Imax = 100 mA.

Maximum input power Pmax = 1.2 W.

Effective internal capacitance Ci = 22 nF. Effective internal inductance Li = 35 μH.

- Sensor input circuit (terminals 11 through 17):

Maximum output voltage Vt = 14.4 V. Maximum output current It = 32.3 mA.

Maximum allowed external capacitance Ca = 600 nF.

Maximum allowed external inductance La = 34 mH

・If Hand Held Terminal (HHT) is not connected to the power supply lines of the PH202S (see figure 1):

Any FM Approved barrier or power supply may be used that meets the following requirements.

Voc or Vt ≤ 31.5 V ; Isc or It ≤ 100 mA; Ca ≥ 22nF + Ccable ; La ≥ 35μH + Lcable

If HHT is connected to the power supply lines of the PH202S (see figure 2):

The Hand Held Terminal must be FM Approved. Refer to the manufacturers control drawing of the HHT and the barrier/power supply to determine the cable parameters.

(Voc or Vt) + VHHT ≤ 31.5 V; (Isc or It) + IHHT ≤ 100 mA;

Ca ≥ 22nF + Ccable+ CHHT ; La ≥ 35μH + Lcable+ LHHT

When installing this equipment, follow the manufacturer's installation drawing.

Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).

Control equipment connected to the barrier/power supply must not use or generate more than 250 Vrms or Vdc.

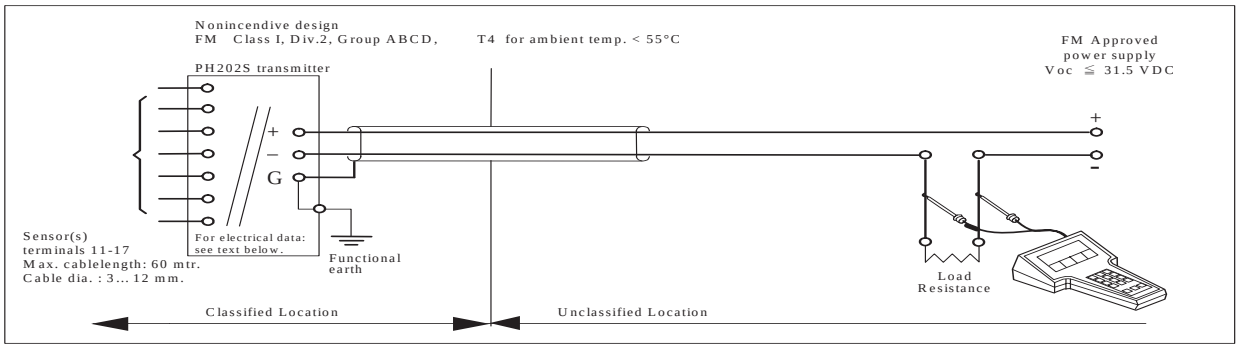
・Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.

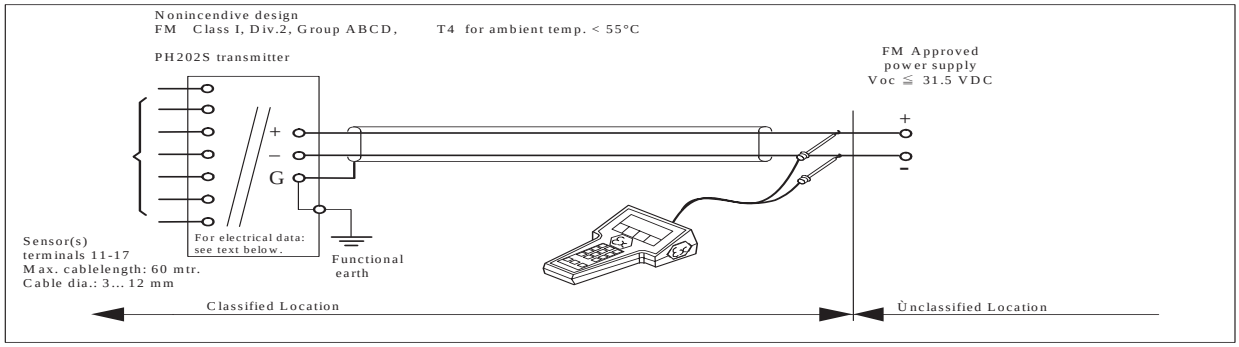
・In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING

- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's'live maintenance procedures.

2-7. Control Drawing of PH202S mA HART® Specification (FM Non-incendive design).





・Electrical data of the PH202S.

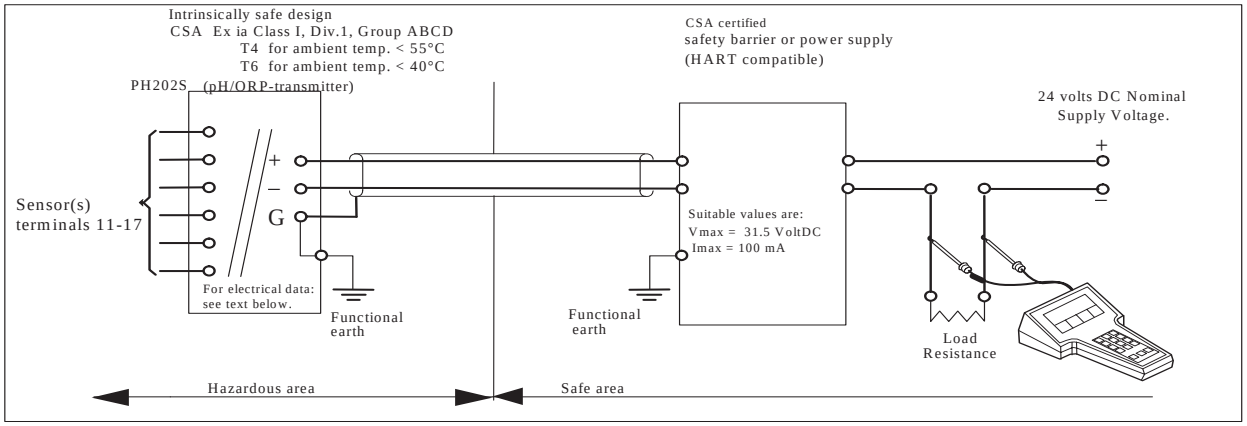
- Supply circuit (terminals + and -):
  Maximum input voltage V_{max} = 31.5 V. Maximum input power Pmax = 1.2 W
  Effective internal capacitance Ci = 22 nF Effective internal inductance Li = 35 μH
- Sensor input circuit (terminals 11 through 17):
  Maximum output voltage V_t = 14.4 V. Maximum output current I_t = 32.3 mA.
  Maximum allowed external capacitance C_a = 2.29μF.
  Maximum allowed external inductance L_a = 64.96mH.

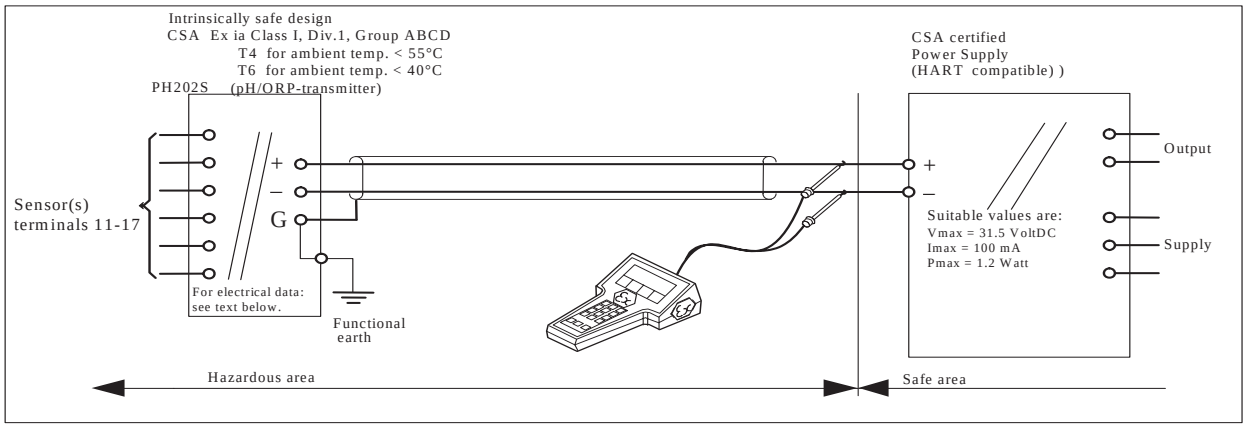
・The Hand Held Terminal must be FM Approved in case it is used in the classified location.
When installing this equipment, follow the manufacturers installation drawing. Installation shall be in accordance with Article 501.4(B) of the National Electrical Code.
Non-incendive field wiring may be installed in accordance with Article 501 of the National Electrical Code.

・ Grounding shall be in accordance with Article 250 of the National Electrical code.
・ In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

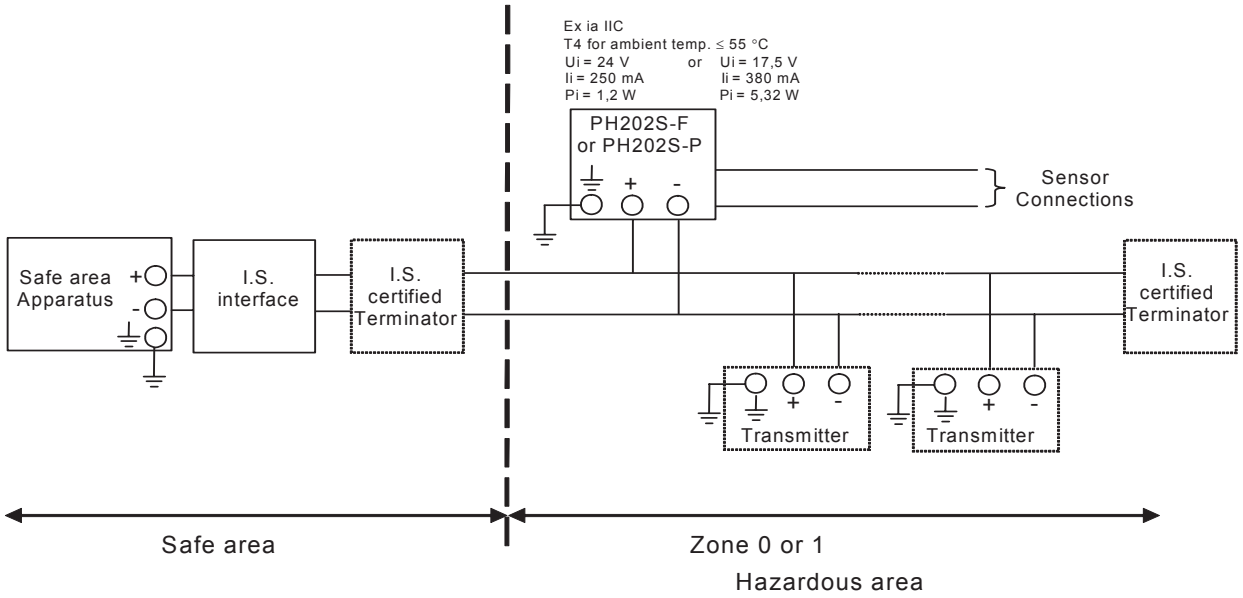
2-8. Control Drawing of PH202S mA HART® Specification (CSA).





- Sensor(s) are thermocouples, RTD's, passive resistive switch devices, or are CSA entity approved and meet connection requirements.
- Electrical data of the PH202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage Vmax = 31.5 V. Maximum input current Imax = 100 mA.
    Maximum input power Pmax = 1.2 W.
    Effective internal capacitance Ci = 22 nF. Effective internal inductance Li = 35 μH.
  - Sensor input circuit (terminals 11 through 17):
    Maximum output voltage Voc = 14.4 V. Maximum output current Isc = 32.3 mA.
    Maximum allowed external capacitance Ca = 600 nF
    Maximum allowed external inductance La = 34 mH.
- Barriers and power supply should be CSA certified. The specifications must not exceed the maximum values as shown in the diagram above.
  Installation should be in accordance with Canadian Electrical Code, Part I.
  Maximum safe area voltage should not exceed 250 VRMS.
  For Class I, Div. 2, Group ABCD the CSA certified barrier is not required, and the Sensor input circuit (terminals 11 through 17) is non-incendive having the parameters :
    Maximum output voltage Voc = 14.4 V. Maximum output current Isc = 32.3 mA.
    Maximum allowed external capacitance Ca = 3.5 μF.
    Maximum allowed external inductance La = 76 mH.
- The Hand Held Communicator must be of a CSA certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area, or of a CSA certified
  non-incendive type in case it is used on the non-incendive circuit in the hazardous area.

2-9. Control Drawing of PH202S FF/PB Specification (IECEx)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.

- Electrical data of the PH202S-F & PH202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui=24 V
    Maximum input current Ii=250 mA
    Maximum input power Pi=1.2 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  or

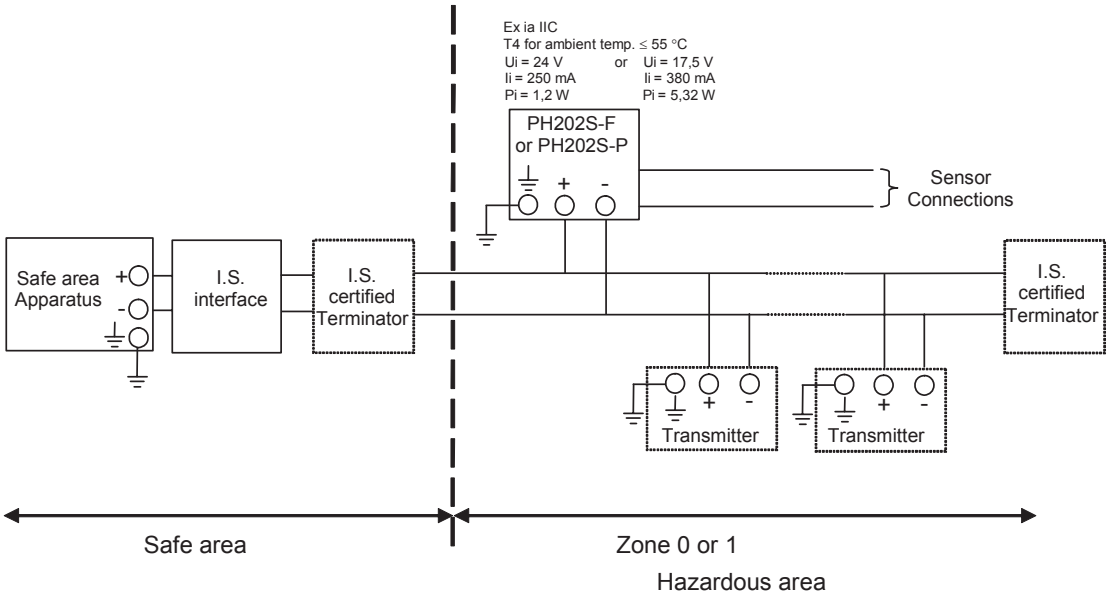
    FISCO field device
    Maximum input voltage Ui=17.5 V
    Maximum input current Ii=380 mA
    Maximum input power Pi=5.32 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  - Sensor input circuit:
    Maximum output voltage Uo=14.4 V; Maximum output current Io=32.3 mA
    Maximum allowed external capacitance Co=600 nF
    Maximum allowed external inductance Lo=34 mH

- Any I.S. interface may be used that meets the following requirements:
    FISCO power supply
    Uo ≤ 24 V or Uo ≤ 17.5 V
    Io ≤ 250 mA Io ≤ 380 mA
    Po ≤ 1.2 W Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

- Electrical data of the PH202S-B & PH202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo=14.4 V; Maximum output current Io=32.3 mA
    Maximum allowed external capacitance Co = 3.5µF
    Maximum allowed external inductance Lo = 76 mH

2-10. Control Drawing of PH202S FF/PB Specification (ATEX)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.
  Electrical data of the PH202S-F & PH202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui=24 V
    Maximum input current Ii=250 mA
    Maximum input power Pi=1.2 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui=17.5 V
    Maximum input current Ii=380 mA
    Maximum input power Pi=5.32 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  - Sensor input circuit:
    Maximum output voltage Uo=14.4V; Maximum output current Io=32.3 mA
    Maximum allowed external capacitance Co=600 nF
    Maximum allowed external inductance Lo=34 mH

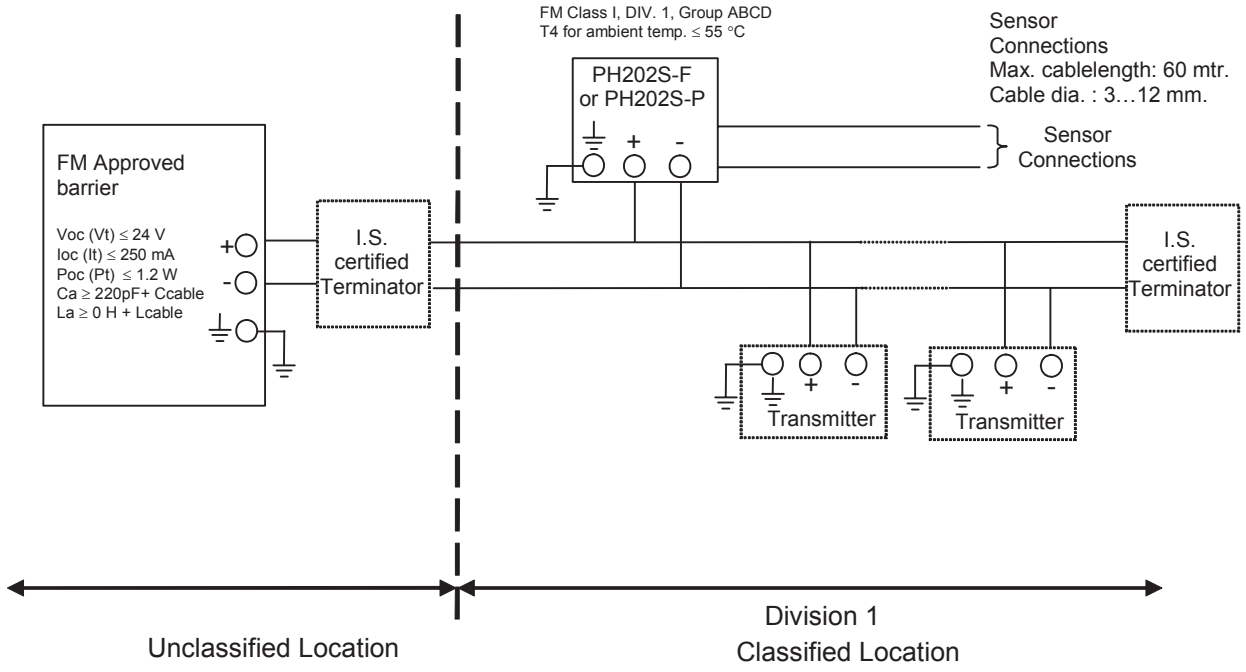
- Any I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    FISCO power supply
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

- Electrical data of the PH202S-B & PH202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci= 220pF; Effective internal inductance Li= 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo=14.4 V; Maximum output current Io=32.3 mA
    Maximum allowed external capacitance Co = 3.5 µF
    Maximum allowed external inductance Lo = 76 mH

2-11. Control Drawing of PH202S FF/PB Specification (FM Intrinsically safe Entity).



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.
- Electrical data of the PH202S-F & PH202S-P:
  - Supply circuit:
    Maximum input voltage Vmax = 24 V
    Maximum input current Imax = 250 mA
    Maximum input power Pi=1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 μH.
  - Sensor input circuit:
    Maximum output voltage Vt = 14.4 V;
    Maximum output current It = 32.3 mA
    Maximum allowed external capacitance Ca = 600 nF
    Maximum allowed external inductance La = 34 mH

- Any FM Approved barrier may be used that meets the following requirements:
  Voc or Vt ≤ 24 V
  Ioc or It ≤ 250 mA
  Poc or Pt ≤ 1.2 W
  Ca ≥ 220 pF + Ccable; La ≥ 0 μH + Lcable

  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the barrier must not use or generate more than 250 Vrms or Vdc.
- Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

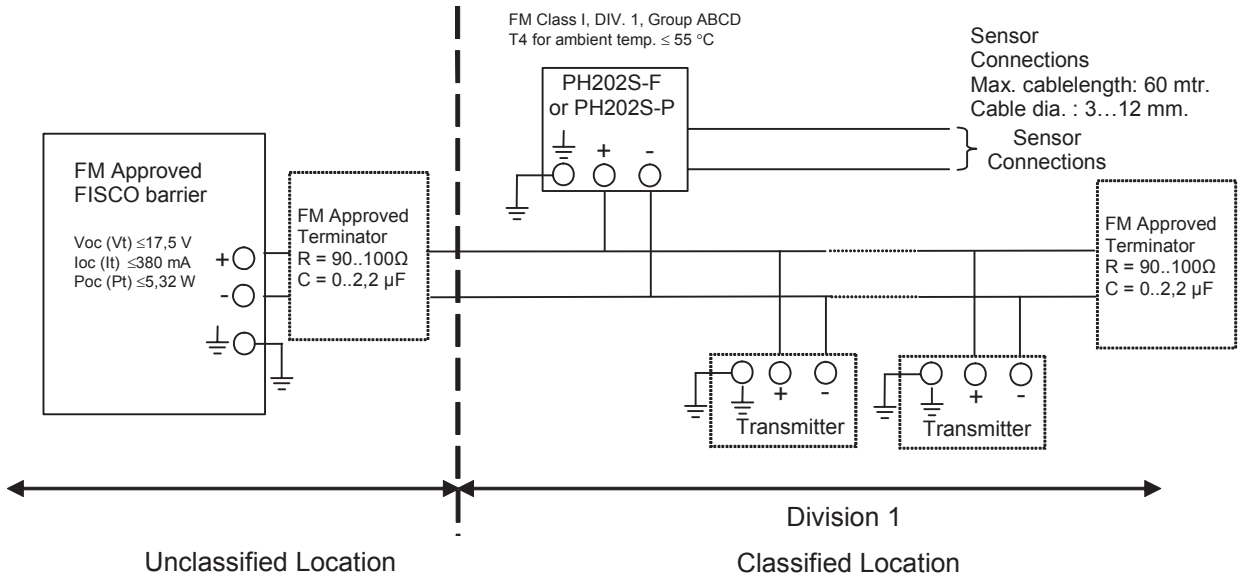
WARNING
- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0,4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

  WARNING
  - Substitution of components may impair Intrinsic Safety
  - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

Application Doc. No.: IKE025-A10 P.4 to P.5

2-12. Control Drawing of PH202S FF/PB Specification (FM Intrinsically safe FISCO)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the PH202S-F & PH202S-P:
  - Supply circuit: Ui = 17.5 V; Ii = 380 mA; Pi = 5.32 W; Ci = 220 pF; Li = 0 µH.
  - Sensor input circuit: Vt = 14.4 V; It = 32.3 mA; Ca =600 nF; La = 34 mH

- Any FM Approved FISCO barrier may be used that meets the following requirements:
  Voc or Vt ≤ 17.5 V; Ioc or It ≤ 380 mA; Poc or Pt ≤ 5.32 W
  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the FISCO barrier must not use or generate more than 250 Vrms or Vdc.

- Resistance between FISCO Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

- The FISCO concept allows the interconnection of several I.S. apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (Vmax), the current (Imax) and the power (Pi) which I.S. apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater that the voltage (Voc, Vt), the current (Ioc, It) and the power (Poc, Pt) which can be providede by the FM approved FISCO barrier. In addition, the maximum unprotected residual capacitance (Ci) and inductance (Li) of each apparatus (other than the terminator) connected to the Fieldbus must be less than or equal to 5 nF and 10 µH respectively.

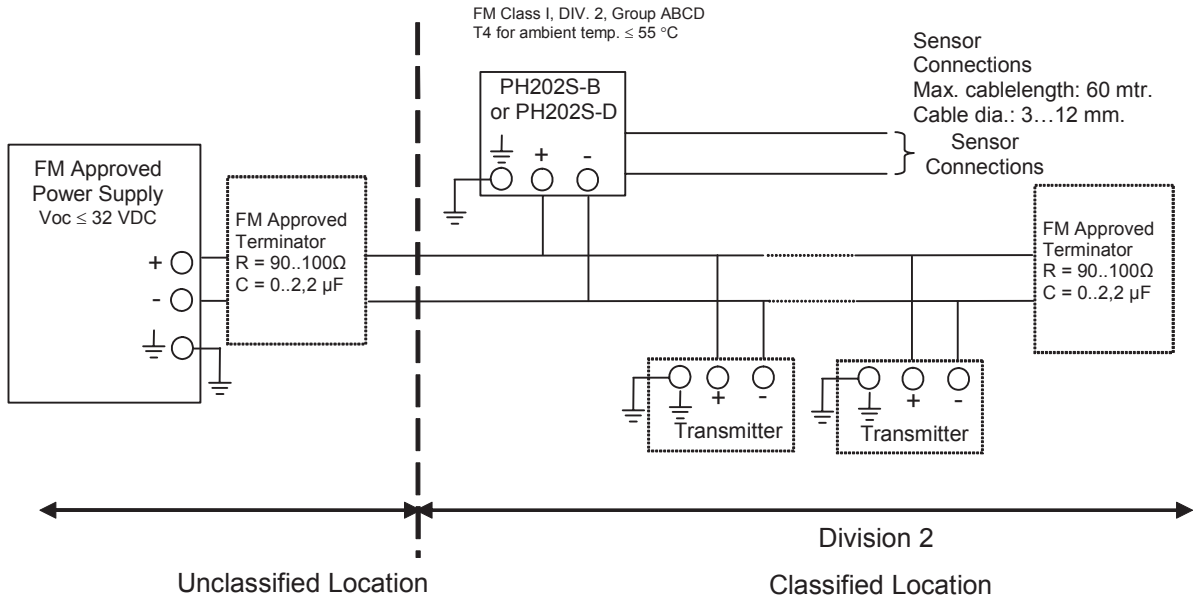
- In each I.S. Fieldbus segment only one active source, normally the FM Approved FISCO barrier, is allowed to provide the necessary power for the Fieldbus system. All other equipment connected to the bus cable has to be passive (not providing energy to the system), except to a leakage current of 50μA for each connected device. Seperately powered equipment needs a galvanic isolation to insure that the I.S. Fieldbus circuit remains passive.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0,4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

WARNING
- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

Application Doc. No.: IKE025-A10 P.6 to P.7

2-13. Control Drawing of PH202S FF/PB Specification (FM Non-incendive Entity).



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the PH202S-B & PH202S-D:
  - Supply circuit: Vmax=32 V; Pi=1.2 W; Ci= 220 pF; Li= 0 µH
  - Sensor input circuit: Vt=14.4 V; It=32.3 mA; Ca=2.29µF; La=64.96 mH

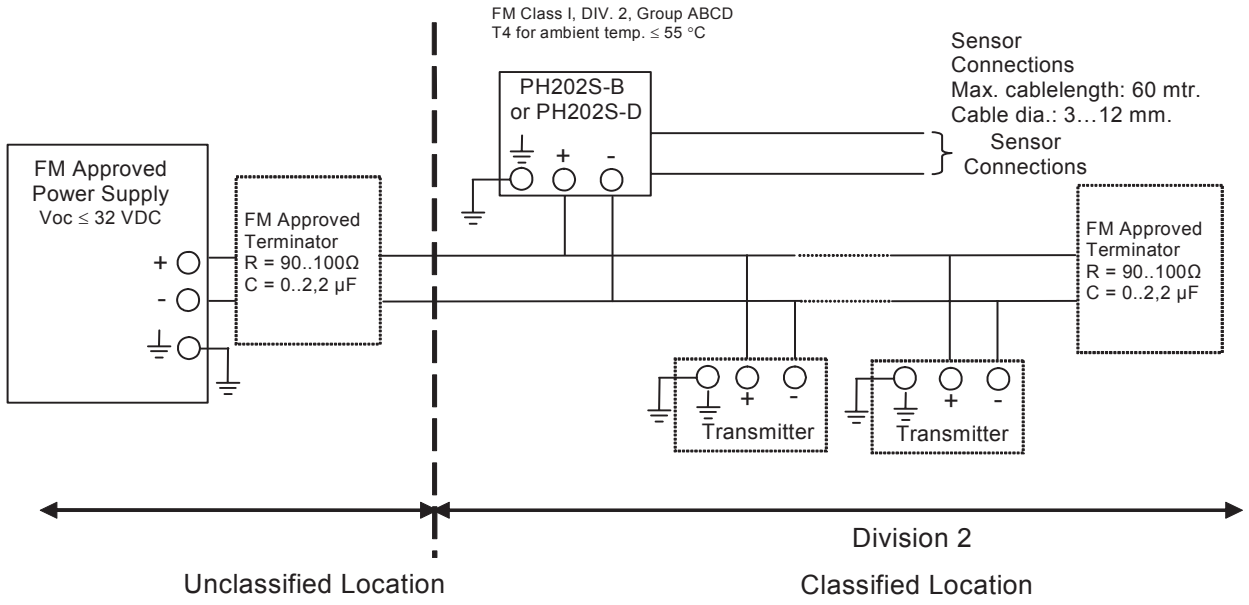
  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79). Nonincendive field wiring may be installed in accordance with Article 501.4(B)(3)

- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

Application Doc. No.: IKE025-A10 P.8

2-14. Control Drawing of PH202S FF/PB Specification (FM Non-incendive FNICO)



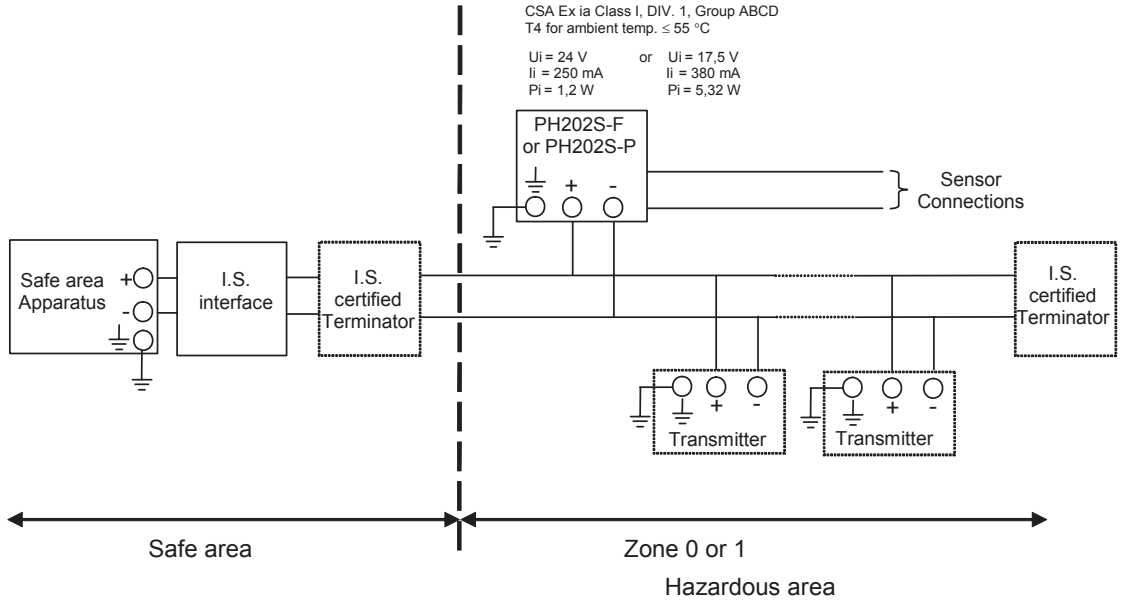
- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.
- Electrical data of the PH202S-B & PH202S-D:
  - Supply circuit: Vmax=32 V; Pi=5.32 W; Ci= 220 pF; Li= 0 µH
  - Sensor input circuit: Vt=14.4 V; It=32.3 mA; Ca = 2.29 µF; La = 64.96 mH

  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79).
  Non-incendive field wiring may be installed in accordance with Article 501.4(B)(3)
- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

Application Doc. No.: IKE025-A10 P.9

2-15. Control Drawing of PH202S FF/PB Specification (CSA).



- Sensor(s) are a thermocouple, RTD's, passive resistive switch devices, or is CSA entity approved and meet connection requirements.
- Electrical data of the PH202S-F & PH202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui =24 V
    Maximum input current Ii =250 mA
    Maximum input power Pi =1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

  or

    Maximum input voltage Ui =17.5 V
    Maximum input current Ii =380 mA
    Maximum input power Pi =5.32 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 32.3 mA
    Maximum allowed external capacitance Co = 600 nF
    Maximum allowed external inductance Lo = 34 mH

- Any CSA approved I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    Uo ≤ 17.5 V
    Io x ≤ 380 mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  Installation should be in accordance with Canadian Electrical Code, Part I or CEC, Part I. Maximum safe area voltage should not exceed 250 Vrms.

- Electrical data of the PH202S-B & PH202S-D (non-incendive):
  For Class I, Div.2, Group ABCD the CSA approved I.S. interface is not required, and the sensor input circuit is non-incendive having the parameters:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 32.3 mA
    Maximum allowed external capacitance Co = 3.5 µF
    Maximum allowed external inductance Lo = 76 mH

3. INSTALLATION AND WIRING

3-1. Installation and dimensions

3-1-1. Installation site

The EXA transmitter is weatherproof and can be installed inside or outside. It should, however, be installed as close as possible to the sensor to avoid long cable runs between sensor and transmitter. In any case, the cable length should not exceed 50 meters (162 feet). Select an installation site where:

- Mechanical vibrations and shocks are negligible
- No relay/power switches are in the direct environment
- Access is possible to the cable glands (see figure 3-1)
- The transmitter is not mounted in direct sunlight or severe weather conditions
  When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight
- Maintenance procedures are possible (avoiding corrosive environments)

The ambient temperature and humidity of the installation environment must be within the limits of the instrument specifications. (See chapter 2).

3-1-2. Mounting methods

Refer to figures 3-2 and 3-3. Note that the EXA transmitter has universal mounting capabilities:

- Panel mounting using optinal bracket, refer to Fig. 3-2a.
- Panel mounting using two (2) self-tapping screws, refer to Fig. 3-2b.
- Surface mounting on a plate (using bolts from the back)
- Wall mounting on a bracket (for example, on a solid wall)
- Pipe mounting using a bracket on a horizontal or vertical pipe (nominal pipe diameter JIS 50A)

Unit: mm (inch)

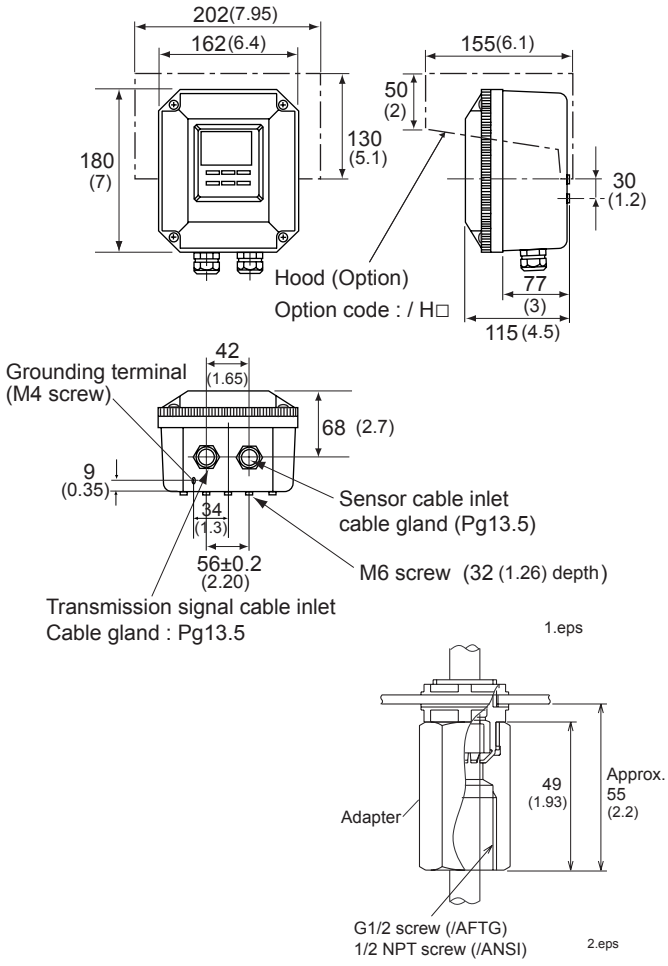


Fig. 3-1. Housing dimensions and layout of glands

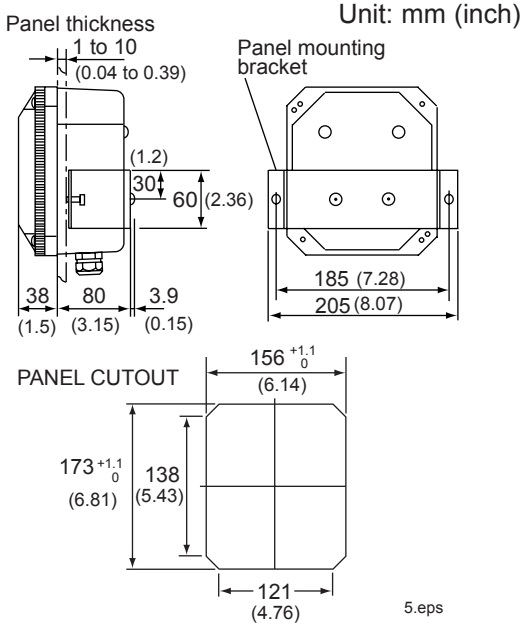


Fig. 3-2a. Panel mounting diagram

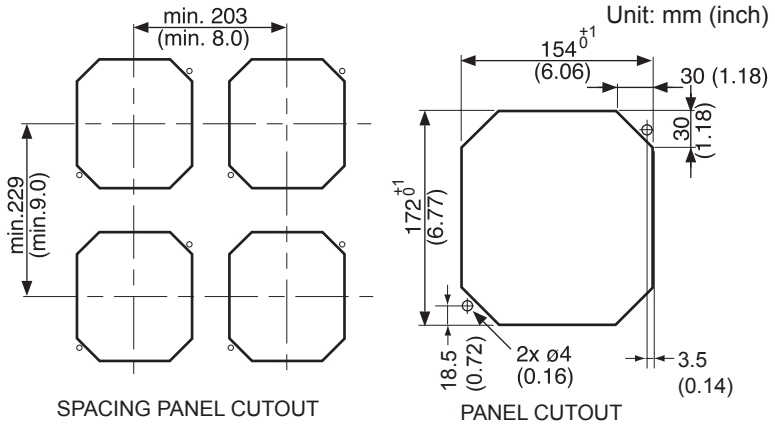


Fig. 3-2b. Panel mounting using two (2) self-tapping screws

Unit: mm (inch)

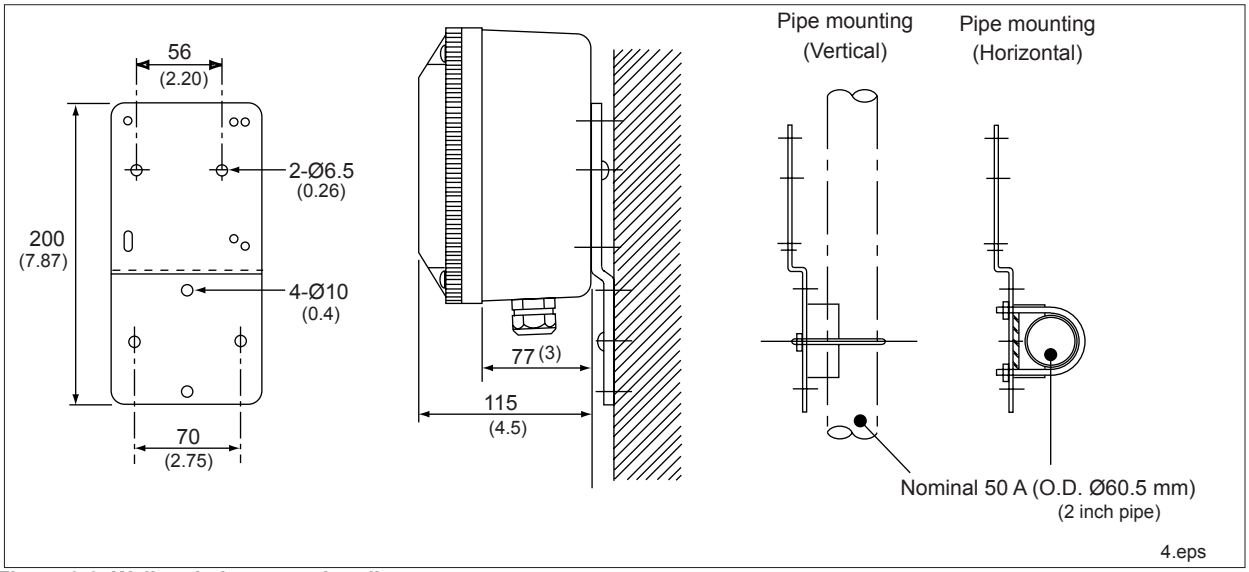


Figure 3-3. Wall and pipe mounting diagram

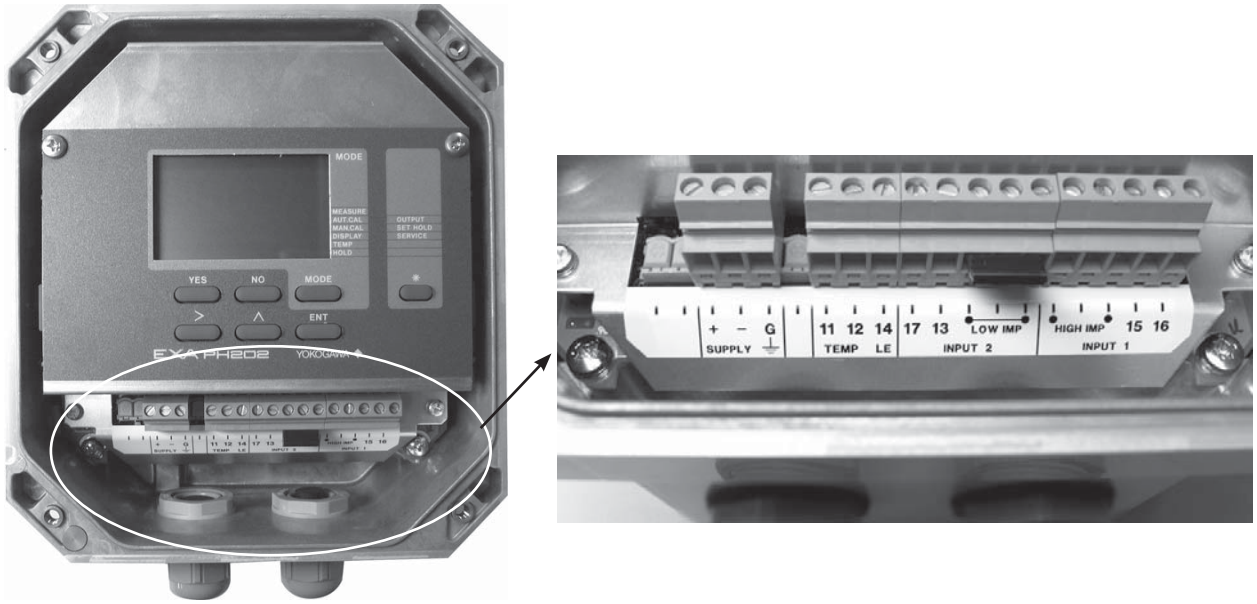


Figure 3-4. Internal view of EXA wiring compartment

3-2. Preparation

Refer to figure 3-4. The power/output connections and the sensor connections should be made in accordance with the diagram on page 3-6. The terminals are of a plug in style for ease of mounting.

To open the EXA 202 for wiring:

1. Loosen the four frontplate screws and remove the cover.
2. The terminal strip is now visible.
3. Connect the power supply. Use the gland on the left for this cable.
4. Connect the sensor input, using the gland on the right (see fig. 3-5). Switch on the power. Commission the instrument as required or use the default settings.
5. Replace the cover and secure frontplate with the four screws.
6. Connect the grounding terminals tp protective earth.
7. The optional hose connection is used to guide the cables coming from an immersion fitting through a protective plastic tubing to the transmitter.

3-2-1. Cables, terminals and glands

The PH202 is equipped with terminals suitable for the connection of finished cables in the size range: 0.13 to 2.5 mm (26 to 14 AWG). The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).

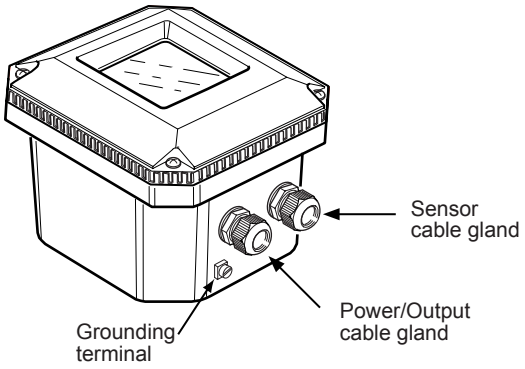


Figure 3-5. Glands to be used for cabling

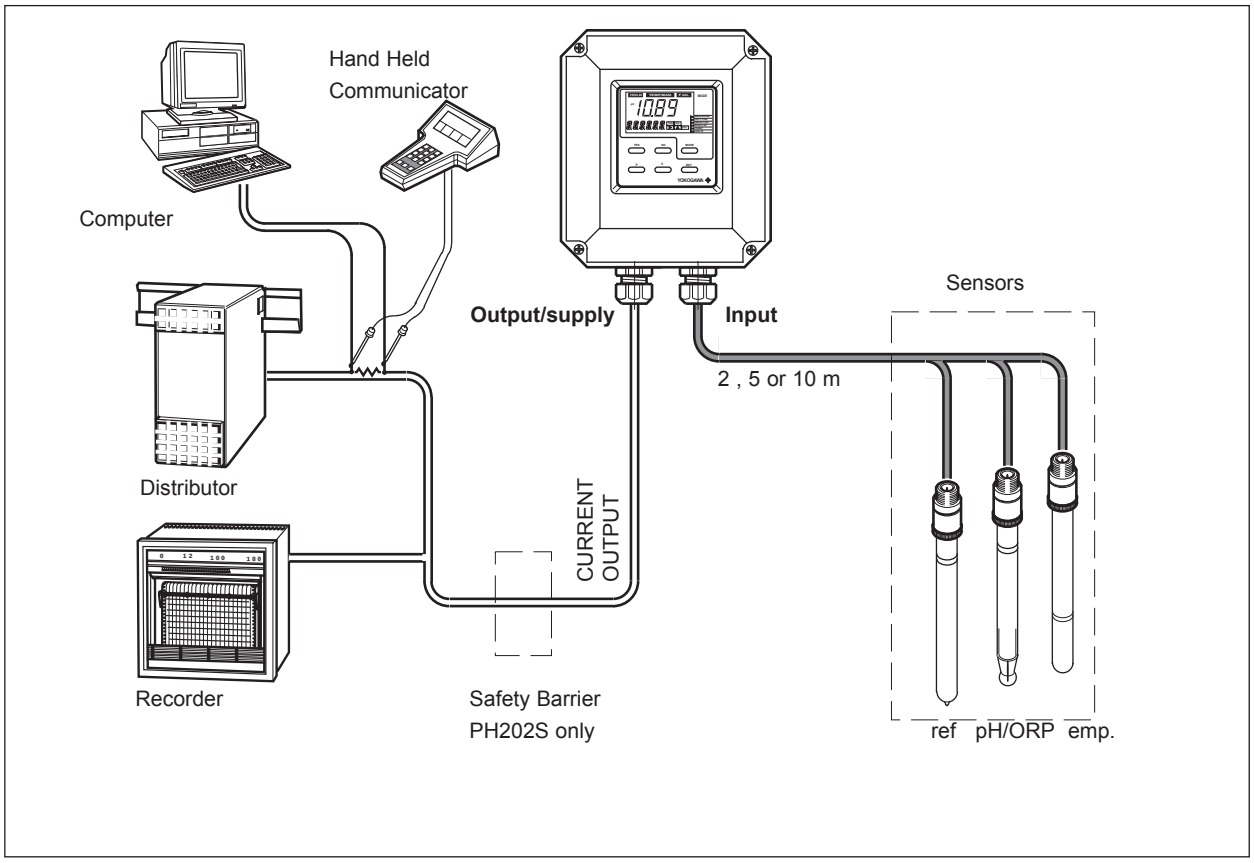


Figure 3-6. System configuration

3-3. Wiring of sensors

3-3-1. General precautions

Generally, transmission of signals from pH sensors is at a very low voltage and high impedance level. Thus a lot of care must be taken to avoid interference. Before connecting sensor cables to the transmitter make sure that next conditions are met:

- the sensor cables are not mounted in tracks together with high voltage and or power switching cables
- only standard coaxial electrode cables or extension cable are used
- the transmitter is mounted within the distance of the sensor cables (max. 10 m)
- the setup is kept flexible for easy insertion and retraction of the sensors in the fitting.

3-3-2. Additional precautions for installations in hazardous areas

Make sure that the total of capacitance and inductances connected to the input terminals of the EXA PH202S do not exceed the limits given in the certificate.
This sets a limit to the cable and extensions used.

- The intrinsic safe version of the PH202S instrument can be mounted in Zone 0 or 1 (PH202S-B, -N, -D).
- The sensors can be installed in Zone 0 or Zone 1 if a safety barrier according to the limits given in the system certificate is used.
- Ensure that the total of capacitance and inductances connected to the terminals of the EXA PH202S do not exceed the limits given in the certificate of the safety barrier or distributor.
- The cable used should preferably have a BLUE colour or marking on the outside.
- Installation for (sensors in Zone 0 or 1):
  Generally, the distributor with input/output isolation has no external earth connection. If there is an earth connection on the distributor and the external connection of the transmitter is connected to “protective” earth, the shield of the 2-wire cable may NOT be connected to “protective” earth at the distributor too.

3-3-3. Installation in: Hazardous Area-Non-Incendive

The EXA PH202S-N may be installed in a Category 3/ Zone 2/ Div.2 area without the use of safety barriers. Maximum permissible supply voltage 31.5V

3-3-4. Liquid earth

In all circumstances, the sensor side of the measuring loop must be grounded to the measuring liquid. The EXA PH202S uses advanced differential high impedance input circuits. This technique calls for a grounding to the liquid. In addition to that the sensor checking circuits also use the liquid earth for measurement of impedance of the sensors. All Yokogawa fittings have provisions for this connection. It is usually called liquid earth in all our manuals.
A separate connection should be made to the terminal numbered 14 in all cases to get a proper and stable measuring loop.

3-3-5. Access to terminal and cable entry

1. To access terminals remove the front cover of the EXA PH202S by releasing the 4 captive screws.
2. Thread the sensor cables into the connection space and connect the cables to the terminals as indicated in the wiring diagram. Make sure all connections are firm and do not touch each other.
3. Screw the gland securely and tighten it to keep out moisture. DO NOT use a wrench to tighten the nut.
4. The optional hose connection is used to guide the cables coming from an immersion fitting through a protective plastic tubing to the transmitter.

3-4. Wiring of power supply

3-4-1. General precautions

⚠ WARNING

Do not activate the power supply yet. First make sure that the DC-power supply is according to the specifications given.

DO NOT USE ALTERNATING CURRENT OR MAINS POWER SUPPLY! !

The cable leading to the distributor (power supply) or safety barrier transports power to and output signal from the transmitter. Use a two conductor shielded cable with a size of at least 1.25 mm and an outside diameter of 6 to 12 mm. The cable gland supplied with the instrument accepts these diameters. The maximum length of the cable is 2000 metre, or 1500 metres when using the communications. This ensures the minimum operating voltage for the instrument.

Grounding:

- If the transmitter is mounted on a grounded surface (e.g. a metal frame fixed in the soil) the shield of the 2-wire cable may NOT be connected to ground at the distributor.
- If the transmitter is mounted on a non-conducting surface (e.g. a brick wall) it is recommended to ground the shield of the 2-wire cable at the distributor end.

3-4-2. Connection of the power supply

The terminal strip is accessed as was described in §3-2-1. Use the left-hand gland to insert the supply/ output cable to the transmitter. Connect the supply to the terminals marked +, - and G as is indicated in figures 3-8 and 3-9.

3-4-3. Switching the instrument on

After all connections are made and checked, the power can be switched on from the distributor. Observe the correct activation of the instrument at the display. If for any reason the display does not indicate a value, consult the trouble shooting section.

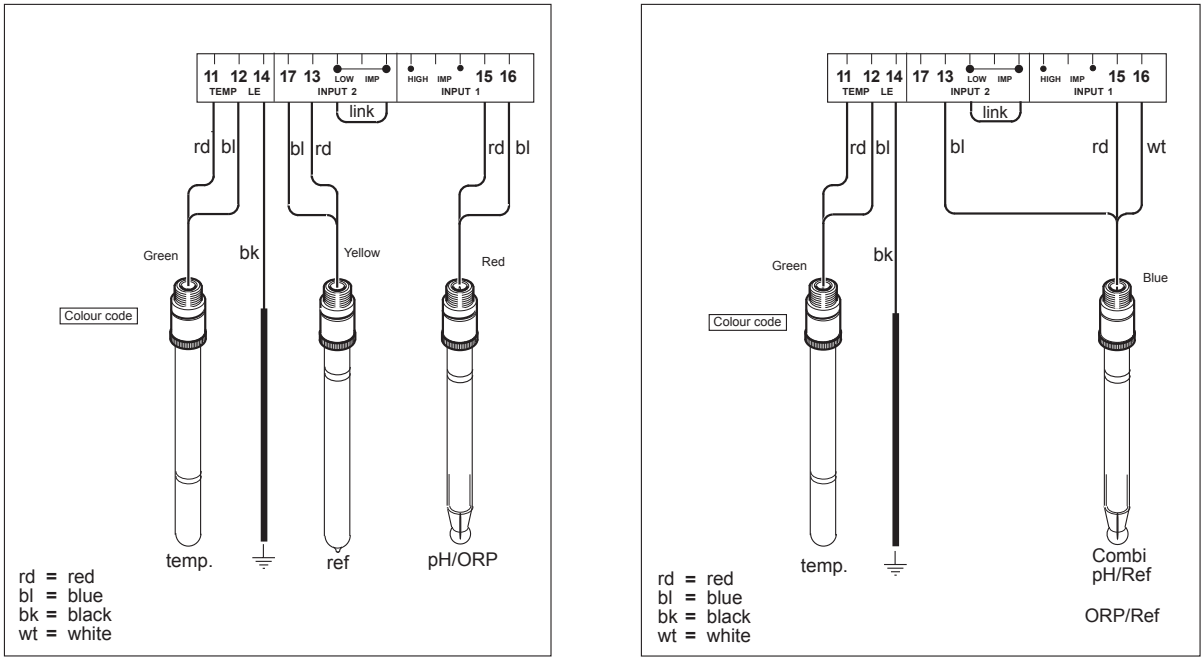


Fig. 3-7. Connection diagrams

3-5. Wiring the sensor system

3-5-1. Impedance measurement jumper settings

NOTE:

It is important to decide first which application and which settings are appropriate for the installation. This decision is best made before the jumpers are installed, because the cables will rest beside the jumpers in their installed positions.

Table 3-1. Impedance measuring jumpers

Figure no.	Jumper Settings Input #1	Jumper Settings Input #2	Application & Sensor Connections
1	High Impedance	Low Impedance	Normal pH sensors Glass sensor on Input #1 Reference sensor on Input #2
2	High Impedance	High Impedance	Special electrodes using 2 glass sensors (e.g. Pfaudler 18)
3	Low Impedance	High Impedance	ORP (pH compensated) and/or rH metal sensor on Input #1 pH glass (as reference) on Input #2
4	Low Impedance	Low Impedance	ORP (Redox measurement) metal sensor on Input #1 Normal reference on Input #2

For convenience insulated jumper links are provided. Ordinary wire links can also be used, and are just as effective.

The following four jumper figure illustrations (figure 3-8) show the jumper positions related to the figure numbers in the above table.

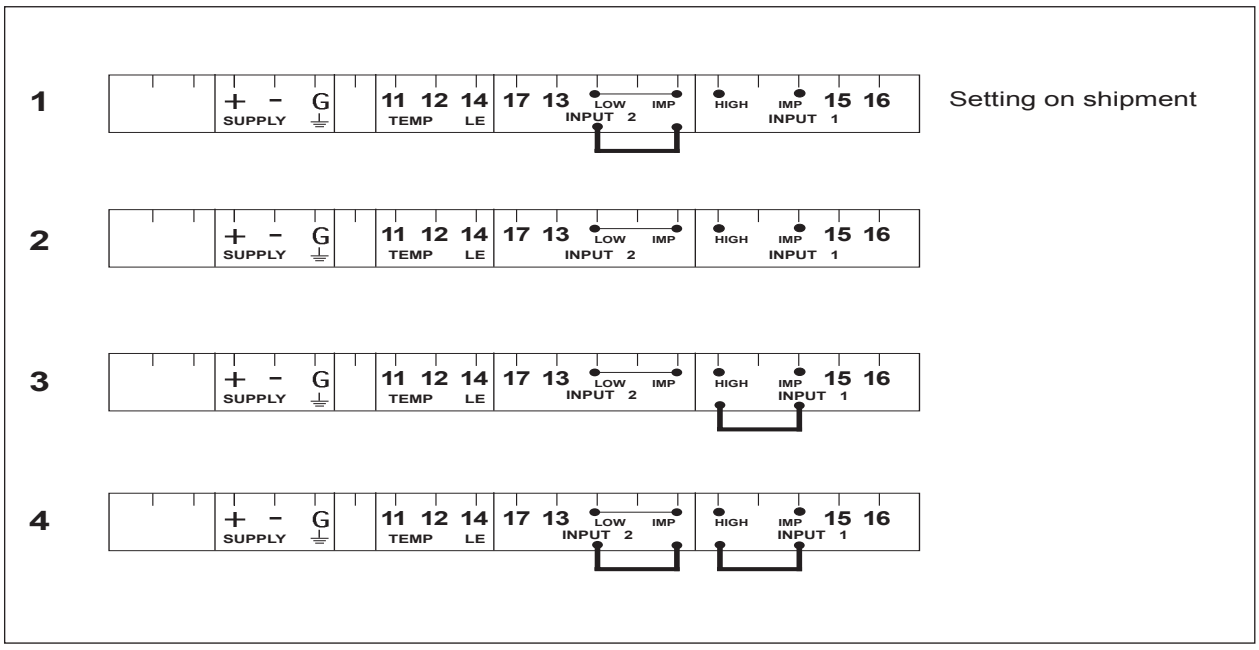


Fig. 3-8. Jumper positions

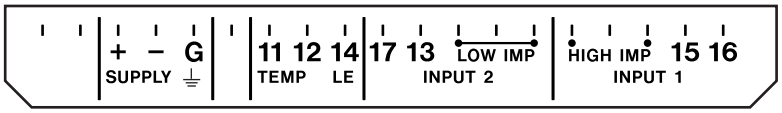


Figure 3-9. Terminal identification labels

3-6. Sensor wiring

Refer to figure 3-10, which includes drawings that outline sensor wiring.
For sensor wiring of PH8EFP, PH8ERP, PH8EHP, OR8EFG, OR8ERG, HA405, HA406, HA485, DPA405, DPA406, DPA485, HF405, DPAS405, DPAS485 and FU20, see APPENDIX 2 (Chapter 11).

The EXA analyzers can be used with a wide range of commercially available sensor types, both from Yokogawa and other manufacturers. The sensor systems from Yokogawa fall into two categories; the ones that use a fixed cable and the ones with separate cables.

To connect sensors with fixed cables, simply match the terminal numbers in the instrument with the identification numbers in the instrument on the cable ends.

The separate sensors and cables are not numbered, but instead use a color-coding system. The electrodes have a colored band incorporated in the label on the connection cap:

- Red for measuring electrodes (both pH and ORP)
- Yellow for reference electrodes
- Blue for combined sensors with both measuring and reference elements in the same body
- Green for temperature sensors

The recommended procedure is to color-code each end of the cables to match the sensors with the color strips provided with each cable. This provides a quick way to identify the ends of the cables belonging to a particular sensor when they are installed. (The procedure for fixing the identification labels is described in detail in the instruction sheet provided with the cable.)

3-6-1. Connection cable

There are two types of connection cable, one for single sensors and one for combined sensors. The former is a coaxial cable and has only two connections.

- Red to measuring element
- Blue to screen (shield)

The latter is a triaxial cable with three connections, (it has an extra white wire termination) these wires are connected:

- Red to measuring element
- Blue to reference
- White to screen (shield)

To connect the other sensor systems, follow the general pattern of the terminal connections as listed below:

11 & 12	Temperature compensation resistor input
13	Input no. 2 (normally the reference element)
17	Screen (shield) for input no. 2
14	Liquid earth (solution ground) connection
15	Input no. 1 (normally the measuring element)
16	Screen (shield) for input no. 1

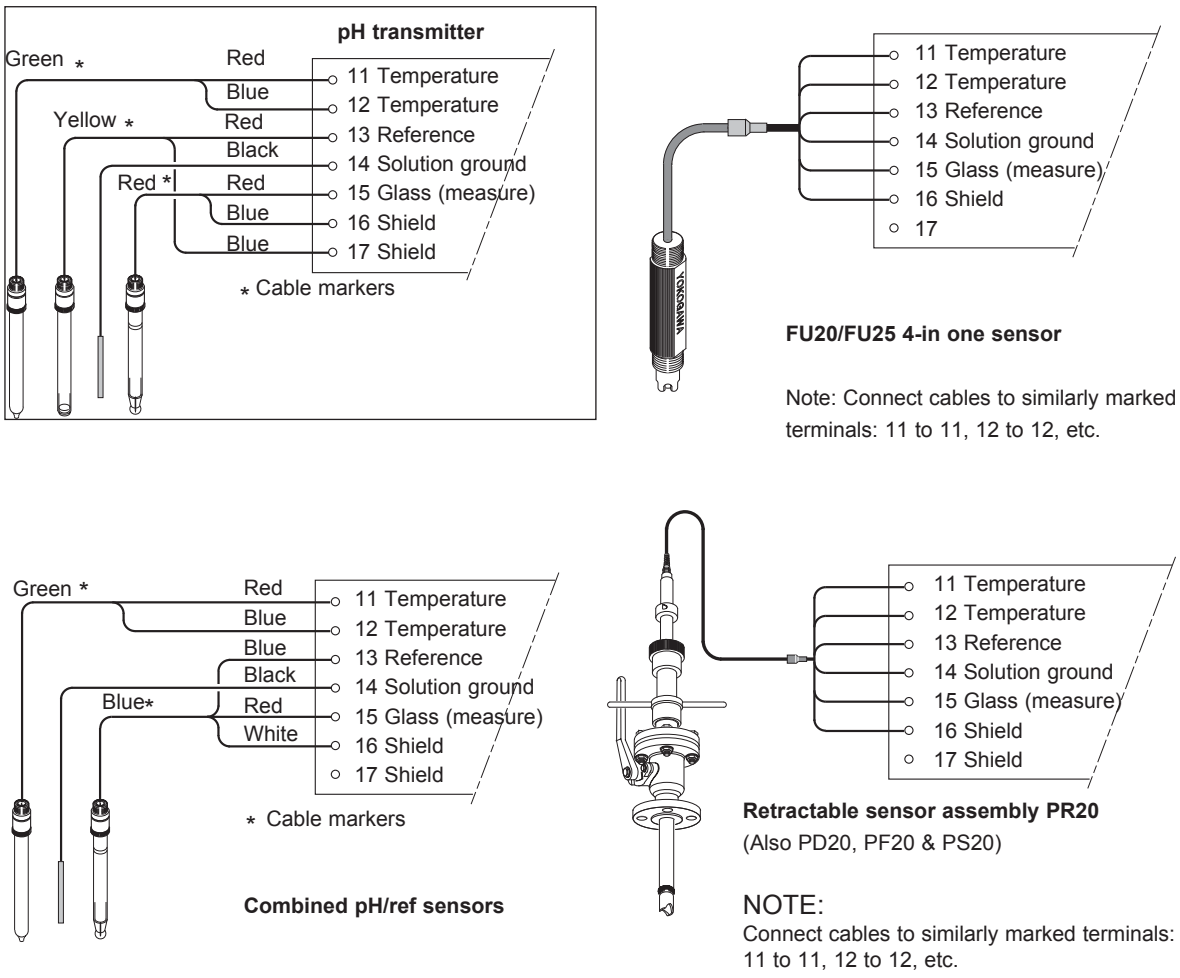


Figure 3-10a. Sensor wiring

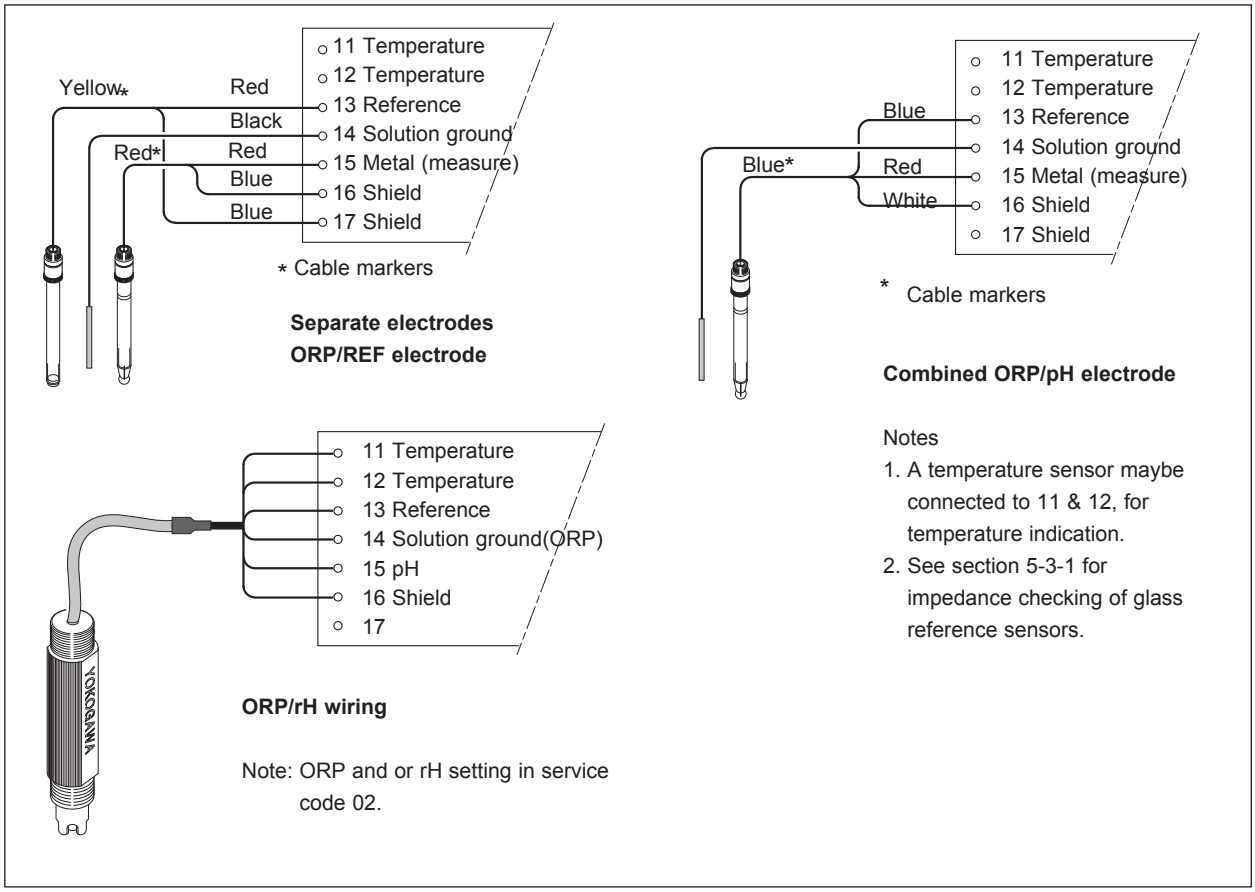


Figure 3-10b. Sensor wiring

3-6-2. Sensor cable connection with special grommet

In order to seal multiple sensor cables into EXA, a special grommet is provided that is designed to accommodate one, two or three sensor cables (5 mm dia.) plus a liquid earth cable (2.5 mm dia.). In the pack with the grommet are blanking pieces to close any unused holes. When correctly assembled, the grommet maintains the IP65, NEMA 4X rating of the EXA PH202 housing.

Refer to figure 3-5 to assemble the grommet connections:

1. First remove the nut and standard rubber seal from the selected gland
2. Discard the seal. This will be replaced later by the special grommet
3. Thread the cables through the nut and the gland
4. Connect the cables to their designated terminals
5. Arrange the cables to avoid tangles and insert the grommet between the gland and the nut
6. The grommet is split to permit the cables to be mounted after connection. (This also ensures even length adjustment.)
7. Ensure that any unused holes are filled with the blanking pieces
8. Tighten the nut to form a firm seal. (Hand-tight is sufficient.)

NOTE:

The special gland is intended to be used to seal the multiple cables from the Yokogawa flow fittings such as FF20 and FP20. The designated cables are WU20 sensor cables, which are approximately 5 mm (0.2") in diameter, and 82895002 liquid earth cables, which are approximately 2.5 mm (0.1") in diameter.

For sensor systems using a single cable, like the FU20 (FU25) and the PR20, PD20, PF20 and PS20, the standard gland will accommodate the cable adequately. Single cables between approximately 6 mm and 12 mm (0.28" and 0.47") can be sealed properly with these glands.

3-6-3. Sensor cable connections using junction box (BA10) and extension cable (WF10)

For the WTB10 terminal box, see APPENDIX.

Where a convenient installation is not possible using the standard cables between sensors and transmitter, a junction box and extension cable may be used. The Yokogawa BA10 junction box and the WF10 extension cable should be used. These items are manufactured to a very high standard and are necessary to ensure that the specifications of the system are not compromised. The total cable length should not exceed 50 metres (e.g. 5 m fixed cable and 45 m extension cable). In the case of systems using dual high impedance sensors (e.g. Pfaudler 18), then the cable length is restricted to 20 metres (fixed cable only, no extension with WF10).

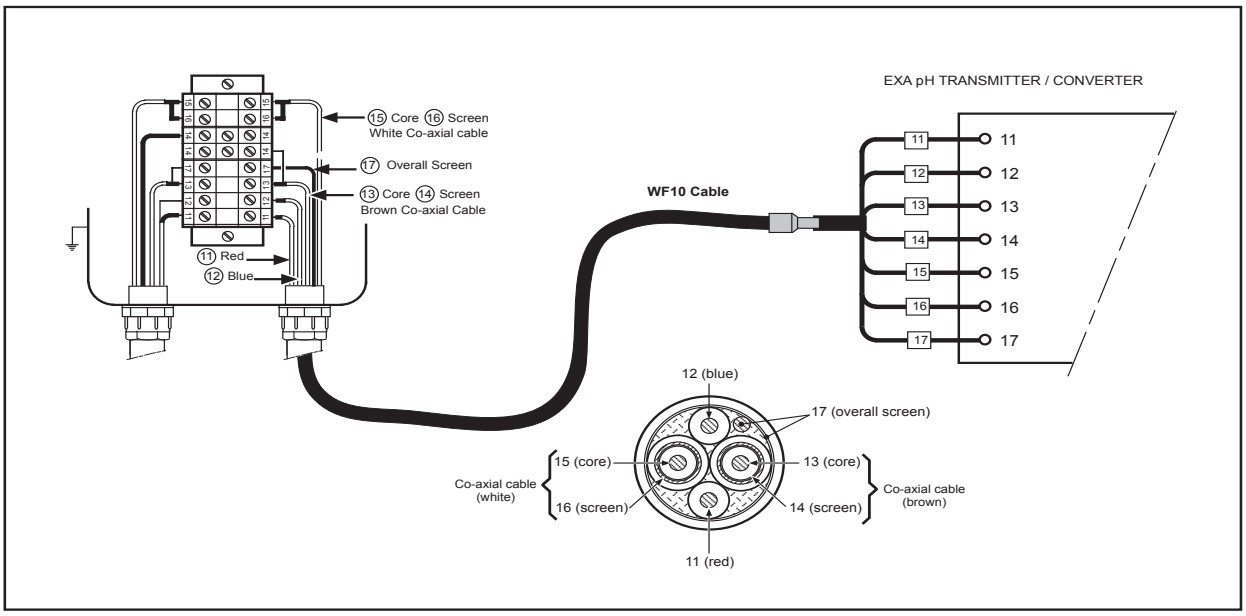
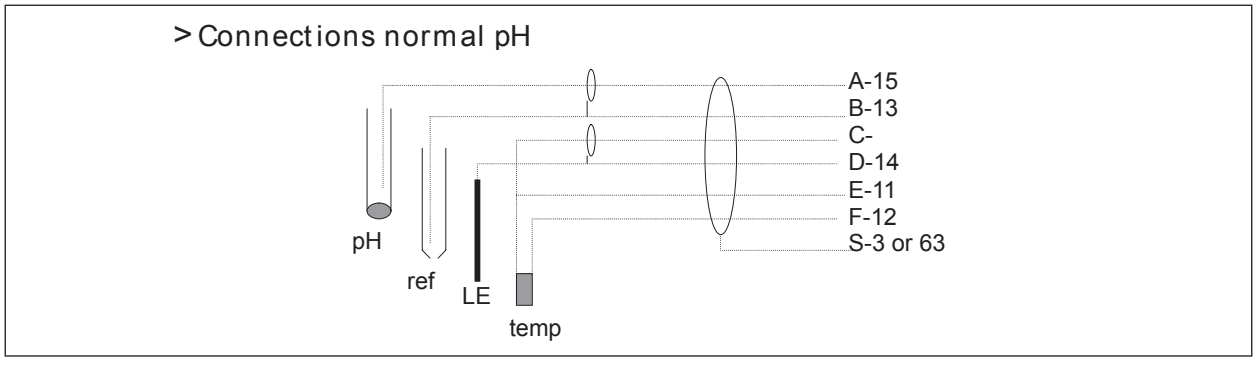
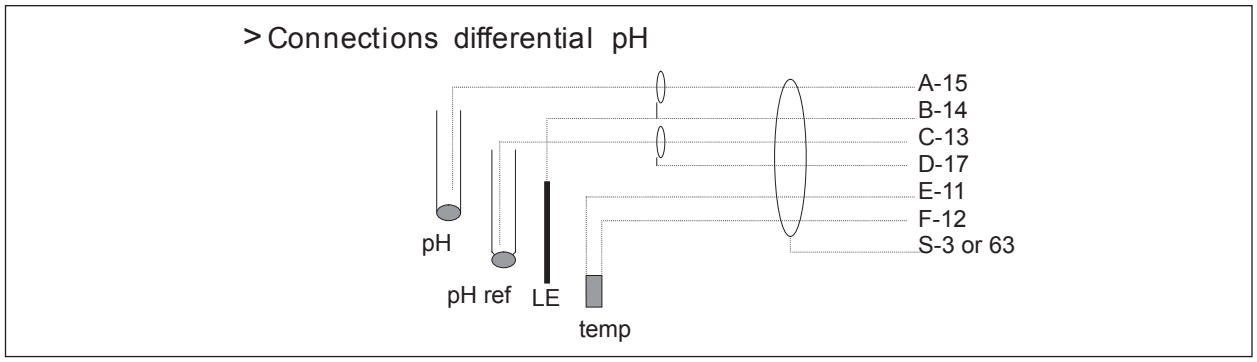


Fig. 3-11. Connection of WF10 extension cable and BA10/BP10 junction box

NOTE: See page 3-12 for termination for WF10 cable in combination with EXA pH.

3-6-4. Connection VP type sensor





Extension cable may be purchased in bulk quantities, cut to length. Then it is necessary to terminate the cable as shown below.
Termination procedure for WF10 cable.
1. Slide 3 cm of heat shrink tube (9 x 1.5) over the cable end to be terminated.
2. Strip 9 cm of the outer (black) insulating material, taking care not to cut or damage internal cores.

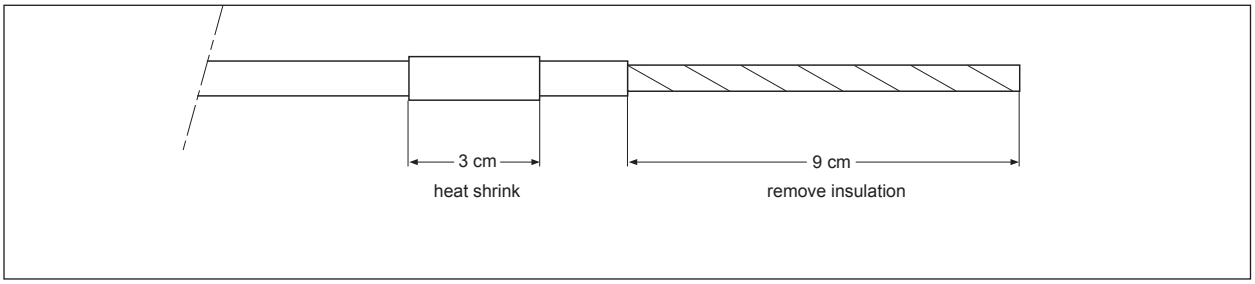


Fig. 3-12a.

3. Remove loose copper screening, and cut off the cotton packing threads as short as possible.
4. Strip insulation from the last 3 cm of the brown, and the white coaxial cores.

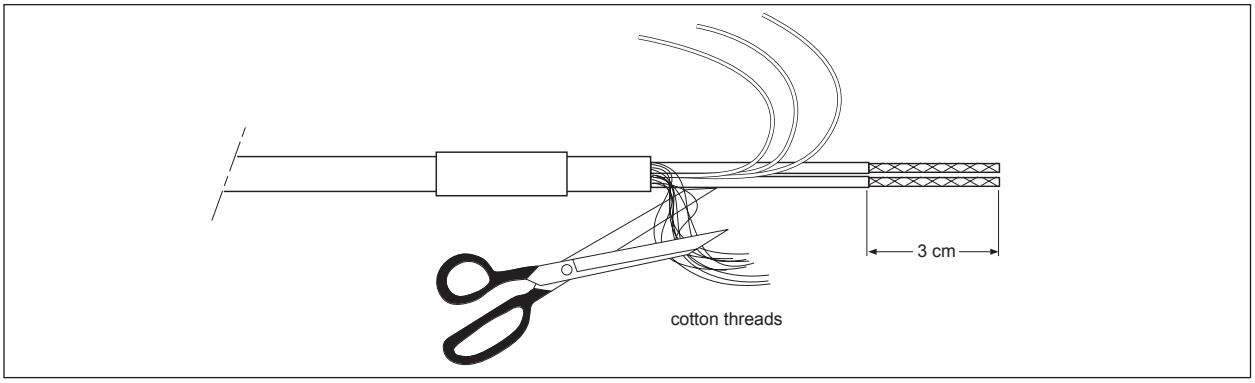


Fig. 3-12b.

5. Extract the coaxial cores from the braid, and trim off the black (low-noise) screening material as short as possible.
6. Insulate the overall screen and the 2 coaxial screens with suitable plastic tubing.
7. Strip and terminate all ends with suitable (crimp) terminals and identify with numbers as shown.

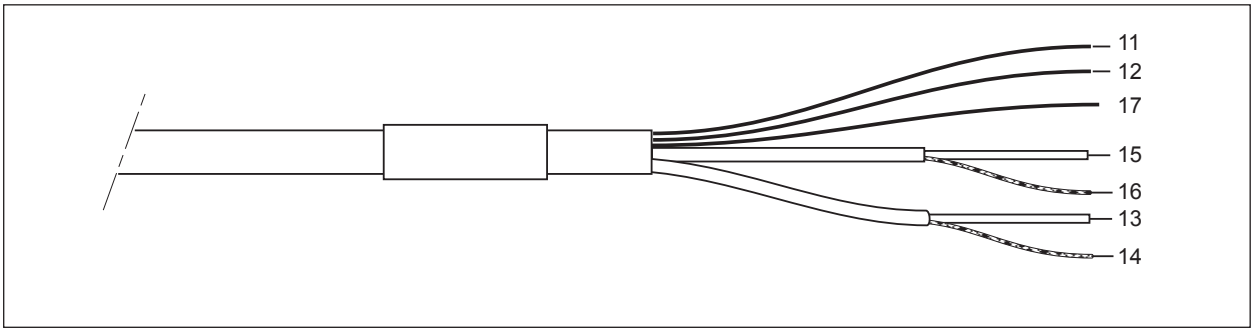


Fig. 3-12c.

8. Finally shrink the overall heat shrink tube into position.

4. OPERATION; DISPLAY FUNCTIONS AND SETTING

4-1. Operator interface

This section provides an overview of the operation of the EXA operator interface. The basic procedures for obtaining access to the three levels of operation are described briefly. For a step-by-step guide to data entry, refer to the relevant section of this user's manual. Figure 4-1 shows the EXA operator interface.

LEVEL 1: Maintenance

These functions are accessible by pushbutton through a flexible front cover window. The functions make up the normal day-to-day operations that an operator may be required to complete. Adjustment of the display and routine calibration are among the features accessible in this way. (See table 4-1).

LEVEL 2: Commissioning

A second menu is exposed when the EXA front cover is removed and the display board is revealed. Users gain access to this menu by pressing the button marked ∗ in the lower right of the display board. This menu is used to set such values as the output ranges and hold features. It also gives access to the service menu. (See table 4-1).

LEVEL 3: Service

For more advanced configuration selections, press the button marked ∗ , then press "NO" repeatedly until you reach *SERV. Now push the "YES" button. Selecting and entering "Service Code" numbers in the commissioning menu provide access to the more advanced functions. An explanation of the Service Codes is listed in chapter 5 and an overview table is shown in chapter 10.

Table 4-1. Operations overview

	Routine	Function	Chapter
Maintenance	AUT.CAL	Calibration with programmed buffer solutions	6
	MAN.CAL	Calibration with other buffer solutions	6
	SAMPLE	Grab sample calibration	6
	DISP	Read auxiliary data or set message display	4
	MAN.IMP	Manual start of impedance check	5
	TEMP	Select automatic or manual compensation	5
	HOLD	Switch hold on/off (when activated)	5
Commissioning	*OUTP	Adjust the output range	5
	*HOLD	Activate the hold function	5
Service (Access to coded entries from the commissioning level)	*SERV	Fine tune the specialized functions of the transmitter	5

NOTE:

All three levels may be separately protected by a password. See Service Code 52 in chapter 5 Service Code table for details on setting passwords.

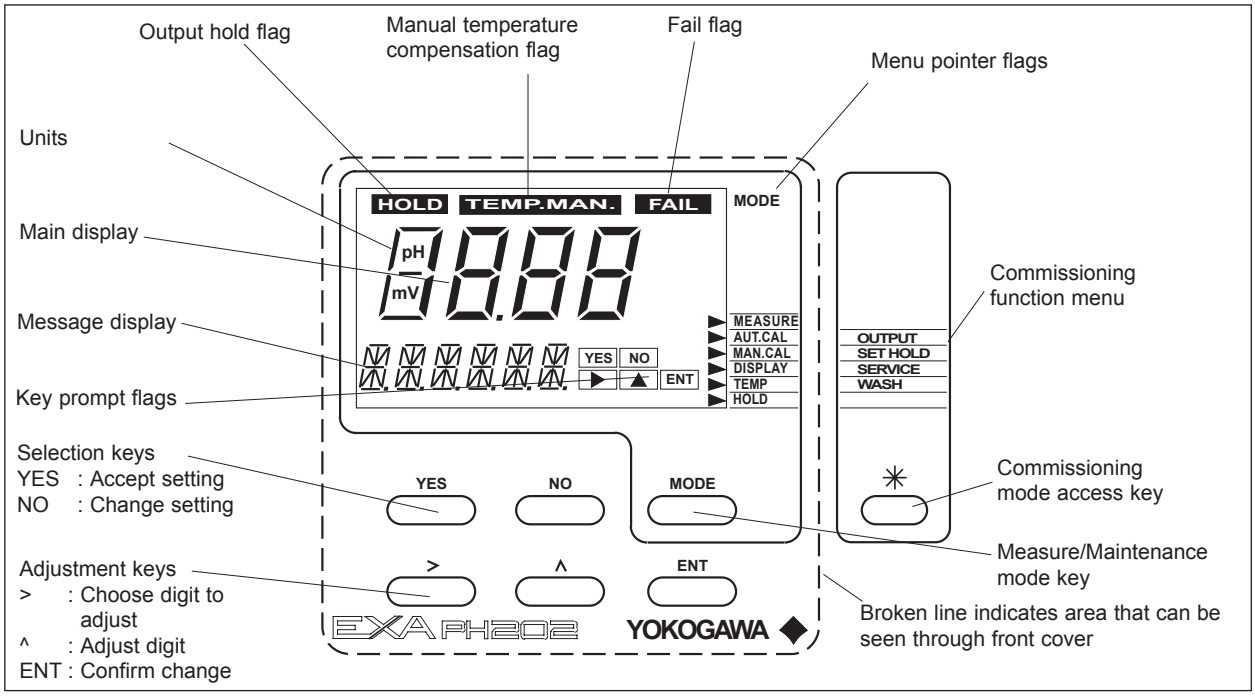


Figure 4-1. PH202 operator interface

4-2. Explanation of operating keys

MODE key — This key toggles between the measuring and maintenance modes. Press once to obtain access to the maintenance function menu.

AUT.CAL
MAN.CAL
DISP
SETPOINT
WASH
MAN.IMP
TEMP
HOLD

Press again to return to the measuring mode (press twice when hold is activated)

YES/NO keys — These are used to select choices from the menu.
YES is used to accept a menu selection.
NO is used to reject a selection, or to move ahead to the next option.

DATA ENTRY keys (▶ ▲ ENT)

▶ is used as a "cursor" key. Each press on this key moves the cursor or flashing digit one place to the right. This is used to select the digit to be changed when entering numerical data.

▲ is used to change the value of a selected digit. Each press on this key increases the value by one unit. The value can not be decreased, so in order to obtain a lower value, increase past nine to zero, then increase to the required number.

ENT When the required value has been set using the > & ^ keys, press ENT to confirm the data entry. Please note that the EXA does not register any change of data until the ENT key is pressed.

* key — This is the commissioning mode key. It is used to obtain access to the commissioning menu. This can only be done with the cover removed or opened. Once this button has been used to initiate the commissioning menu, follow the prompts and use the other keys as described above.

4-3. Setting passcodes

4-3-1. Passcode protection

In Service Code 52, EXA users can set passcode protection for each one of the three operating levels, or for any one or two of the three levels. This procedure should be completed after the initial commissioning (setup) of the instrument. The passcodes should then be recorded safely for future reference.

When passcodes have been set, the following additional steps are introduced to the configuration and programming operations:

Maintenance
Press MODE key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Maintenance Mode

Commissioning
Press * key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Commissioning Mode.

Service
From the commissioning menu, select *SERV by pressing YES key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Service Mode.

NOTE:
See Service Code 52 for the setting of passcodes.

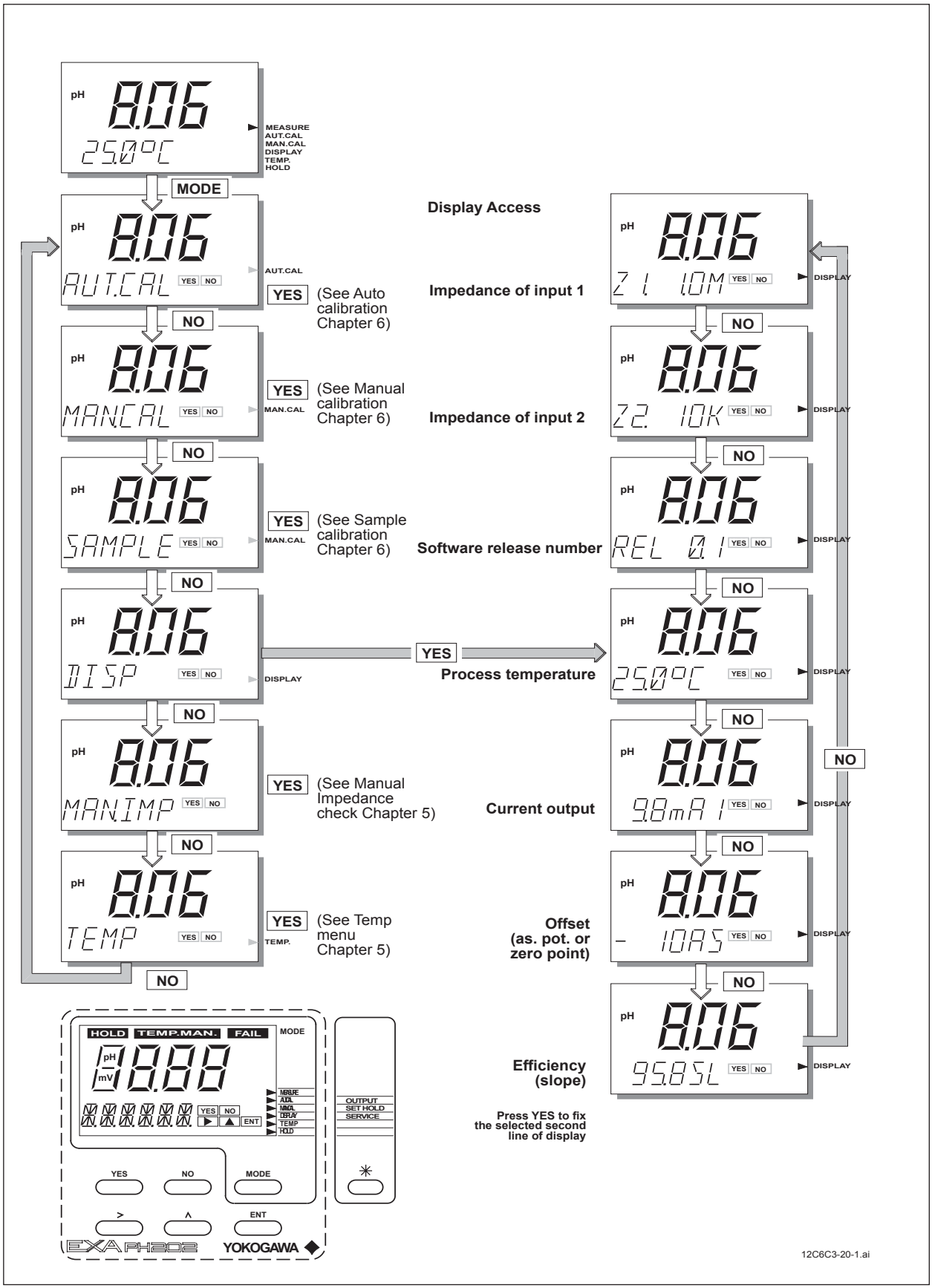
4-4. Display examples

The following pages show the sequence of button presses and screens displayed when working in some standard configurations.

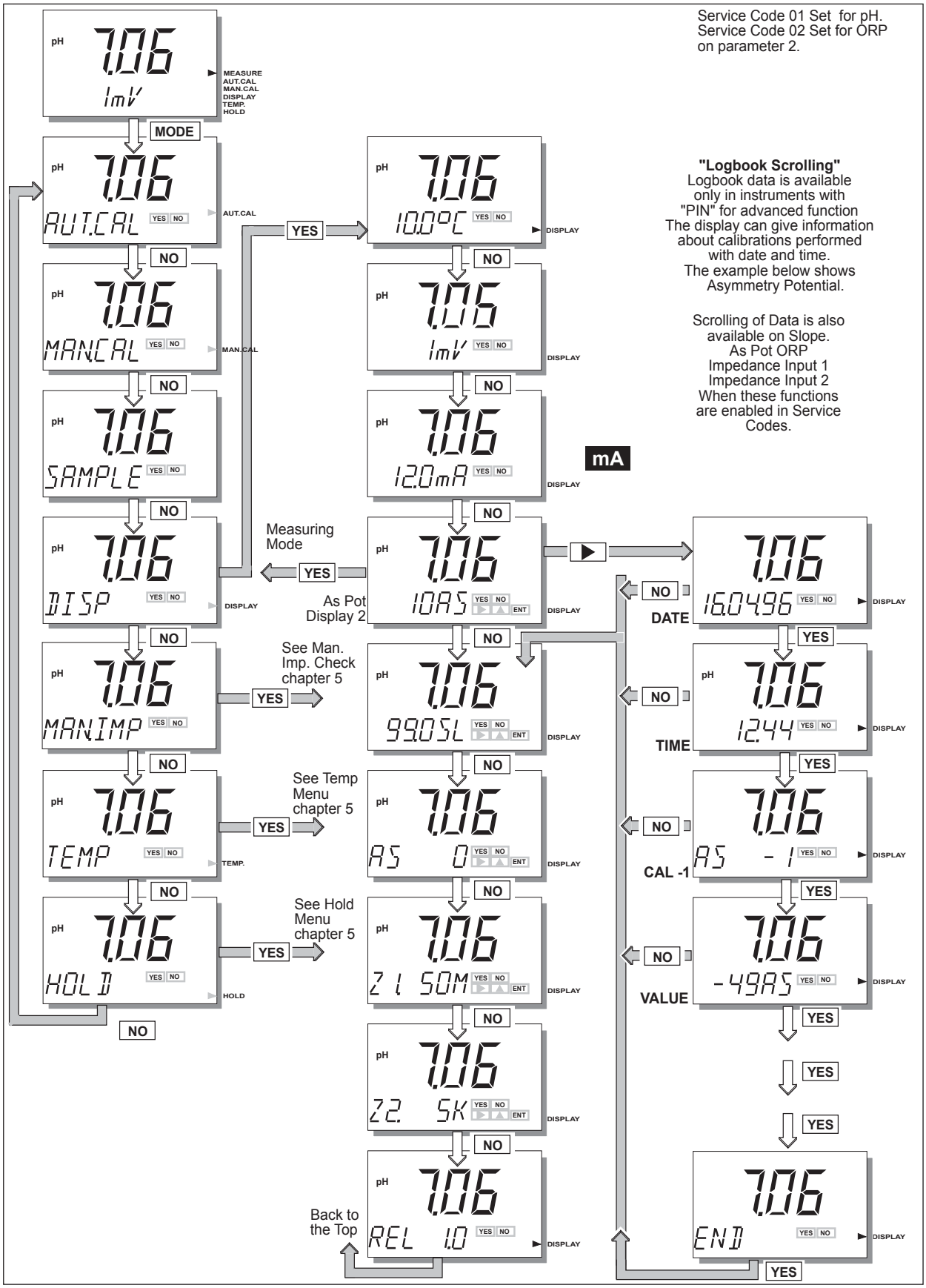
More or less options will be made available by the configuration of some service codes. For instance the impedance measurement screens do not appear when impedance checking is switched off in service codes 03 and 04.

4-5. Display functions

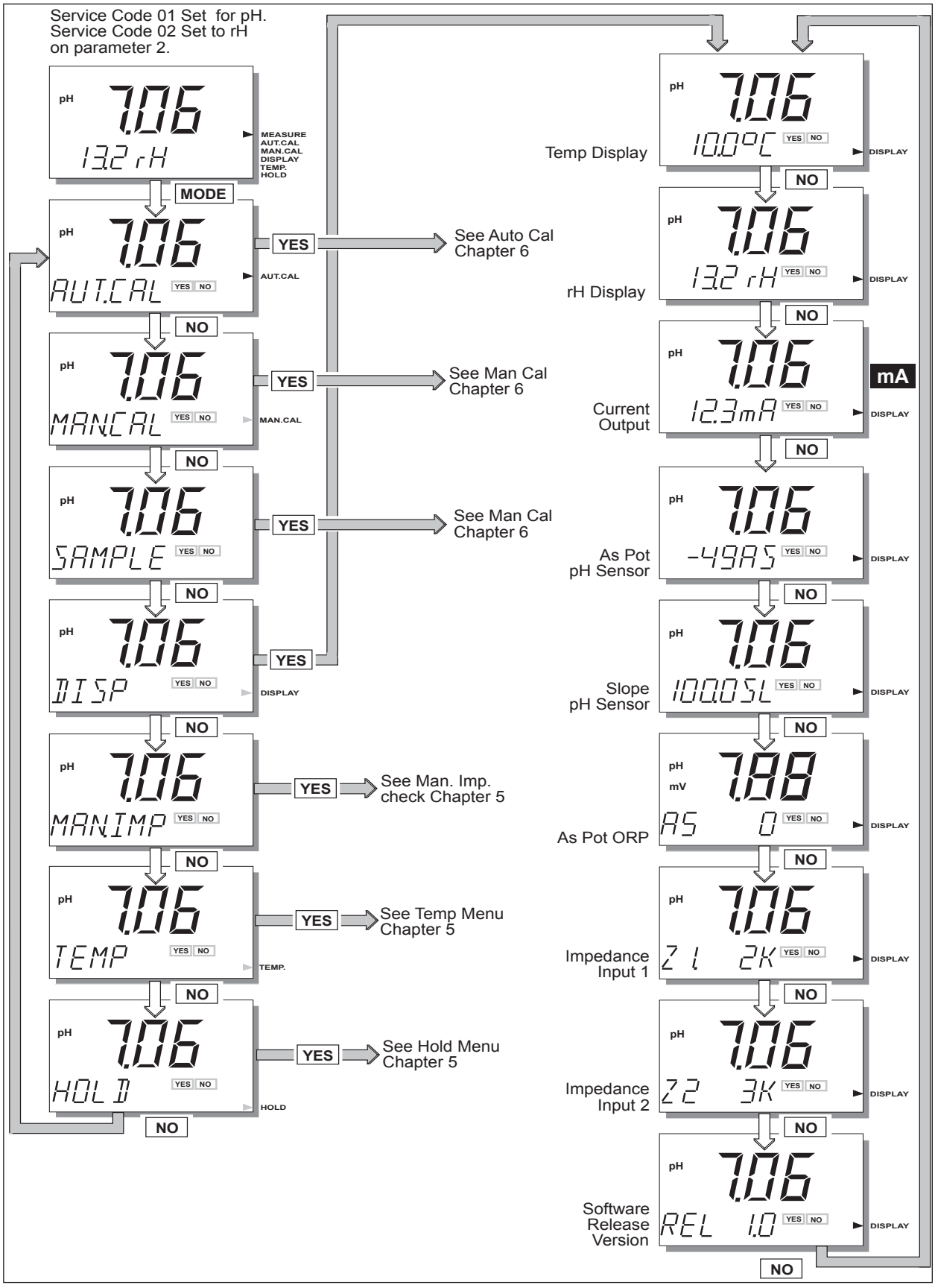
4-5-1. Display functions pH (default)



4-5-2. Display functions pH (ORP)



4-5-3. Display functions pH (rH)



5. PARAMETER SETTING

5-1. Maintenance mode

Standard operation of the EXA instrument involves use of the maintenance (or operating) mode to set up some of the parameters.

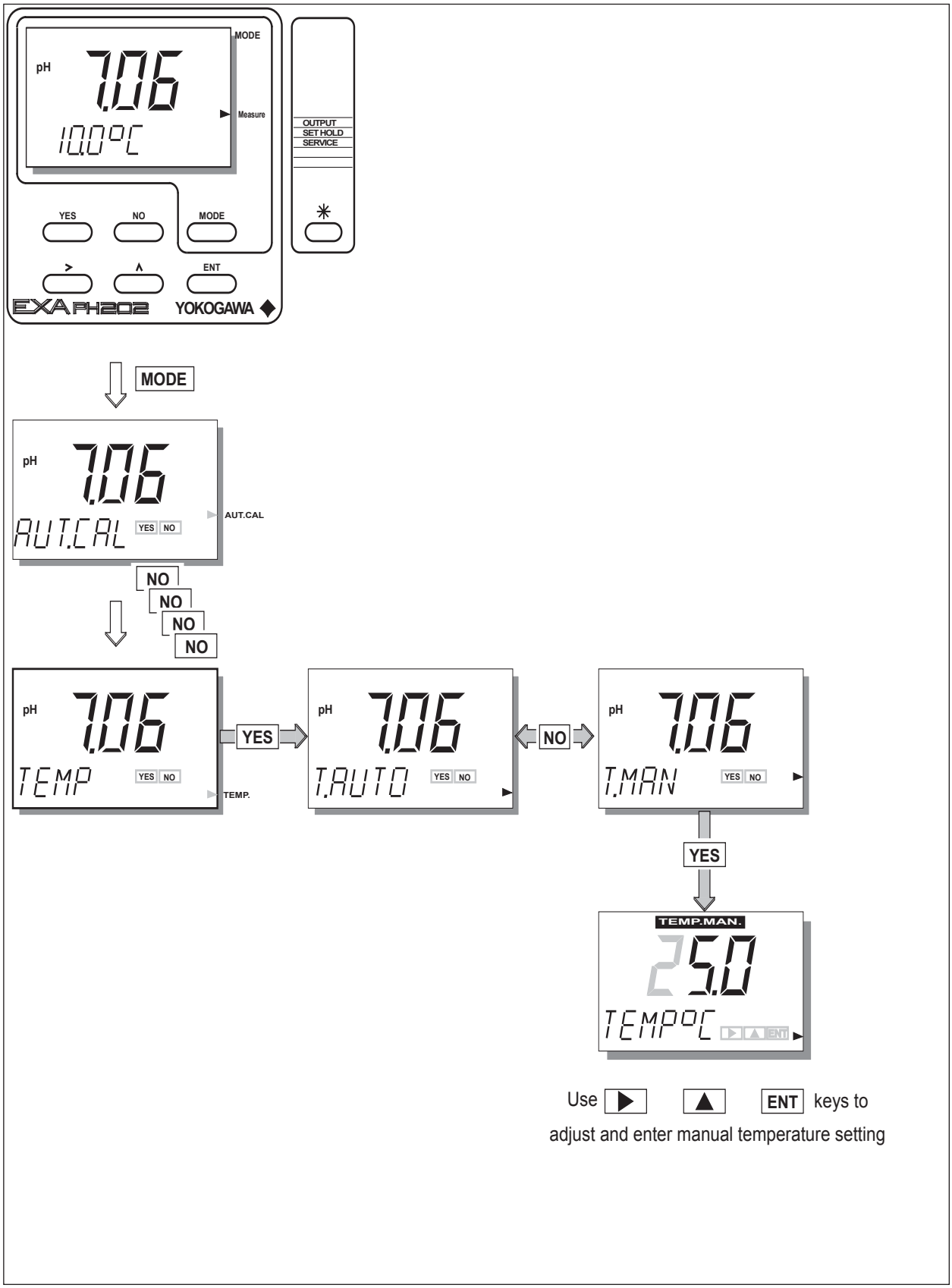
Access to the maintenance mode is available via the six keys that can be pressed through the flexible window in the instrument cover. Press the MODE-key once to enter this dialog mode.

Note:

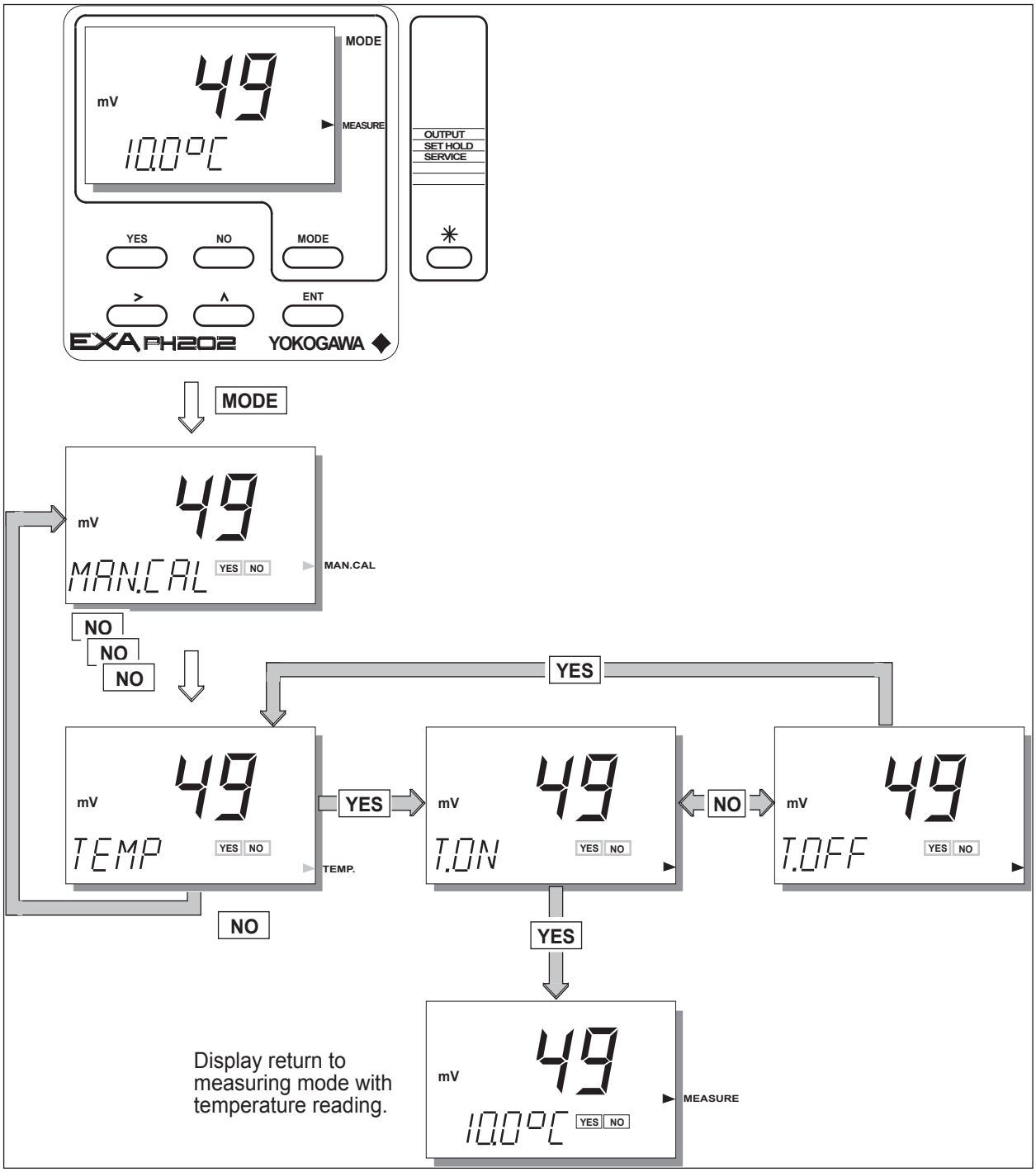
At this stage the user will be prompted for pass code where this has been previously set up in service code 52 in chapter 5.

Automatic calibration (AUT.CAL)	See “calibration” section 6.
Manual calibration (MAN.CAL)	See “calibration” section 6.
Sample calibration (SAMPLE)	See “calibration” section 6.
Display setting (DISP)	See “operation” section 4.
Manual impedance check (MAN.IMP)	See “parameter setting” §5-1-4 and §5-3-5 code 51.
Temperature (TEMP)	Set automatic or manual compensation and adjust manual reading (when pH is set in section 5 service code 01). See adjustment procedure in §5-1-1. Set automatic reading (when ORP is set in Section 5, service code 01). See adjustment procedure §5-1-2.
mA Hold (HOLD)	Manually switch on/off HOLD (when enabled in commissioning menu section). See adjustment procedure in §5-1-3.

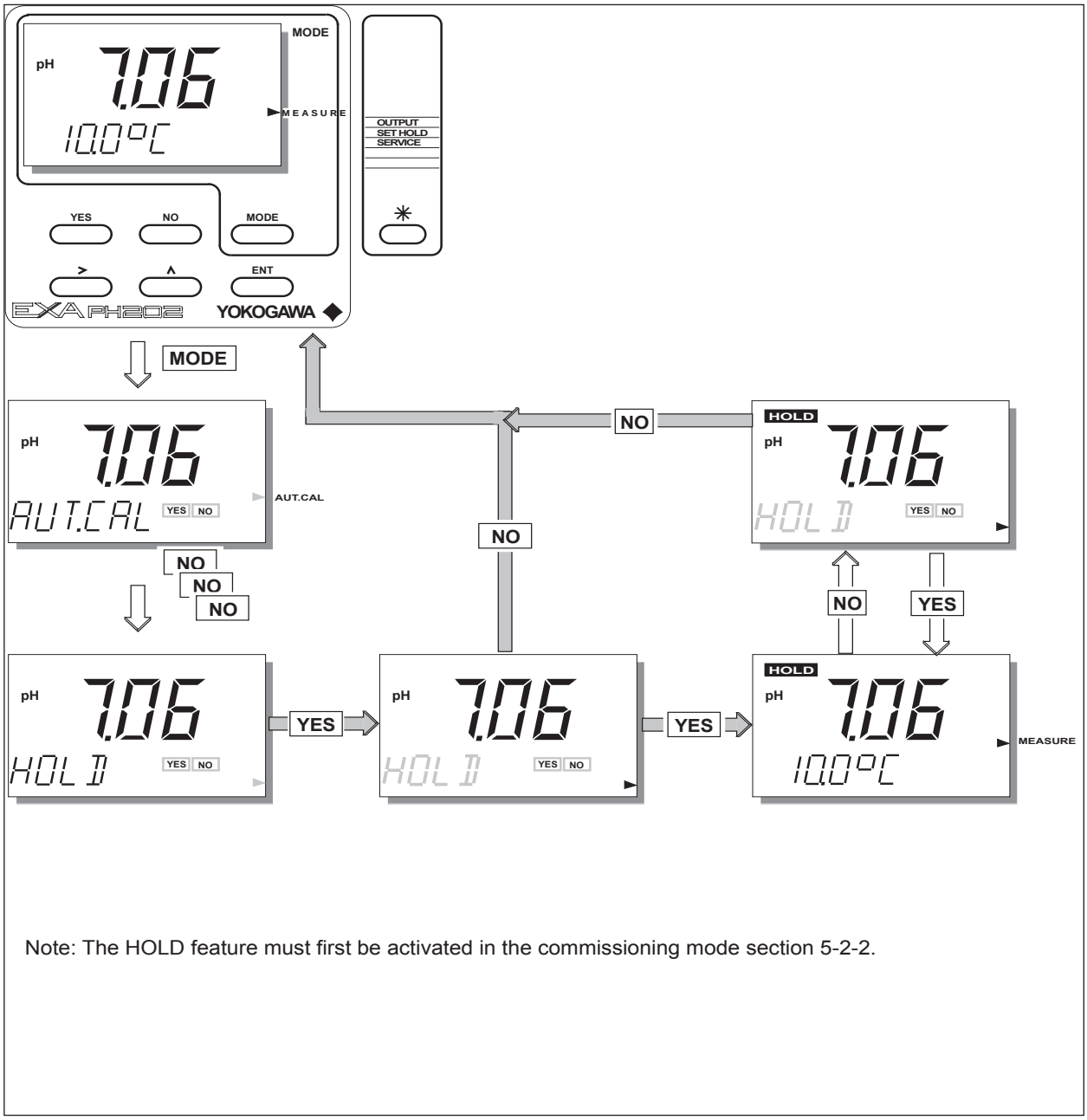
5-1-1. Manual temperature selection and adjustment
pH selected in service code 01.



5-1-2. Process temperature measuring in ORP mode
ORP selected in service code 01.

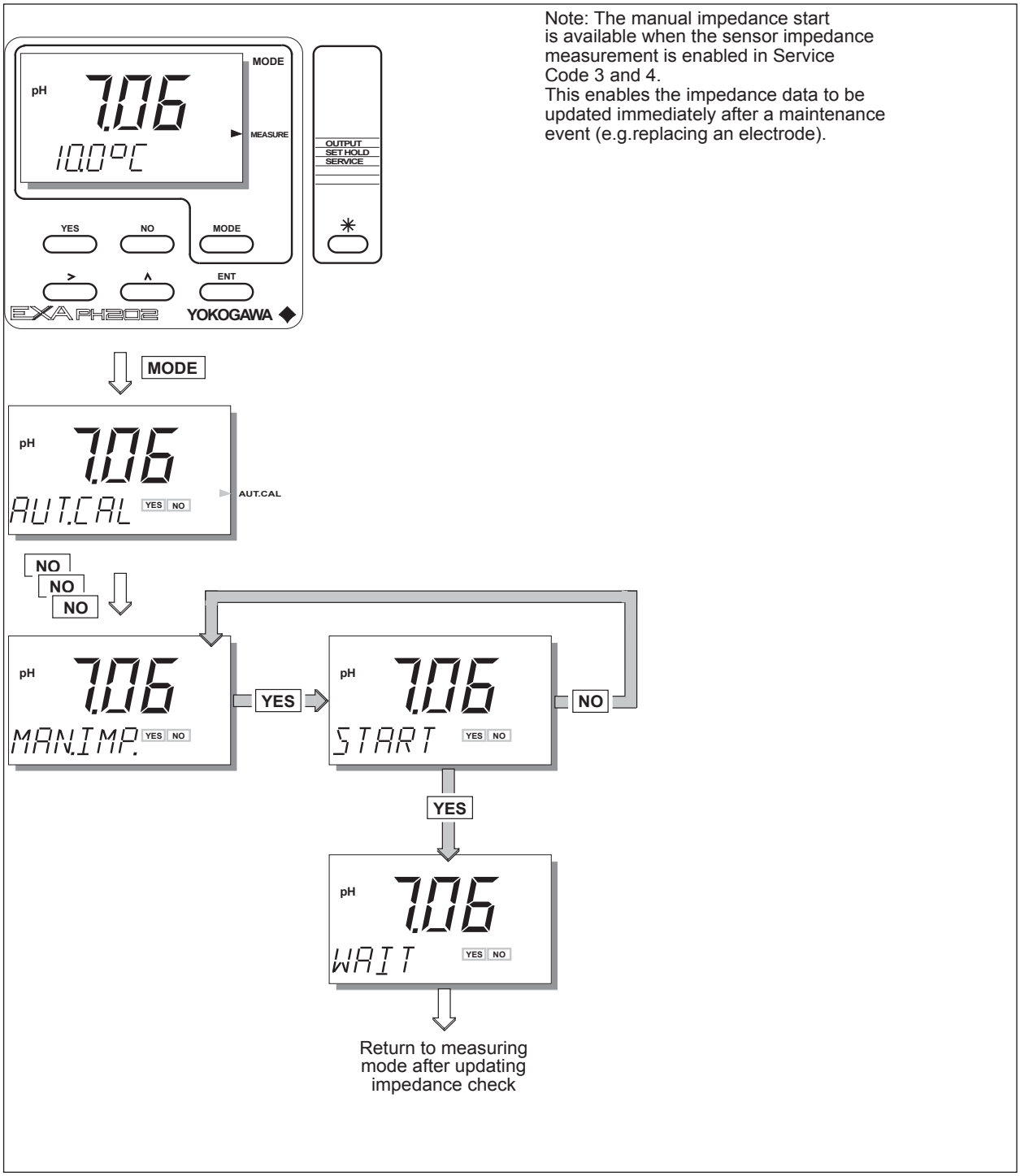


mA 5-1-3. Manual activation of HOLD



Note: The HOLD feature must first be activated in the commissioning mode section 5-2-2.

5-1-4. Manual impedance check



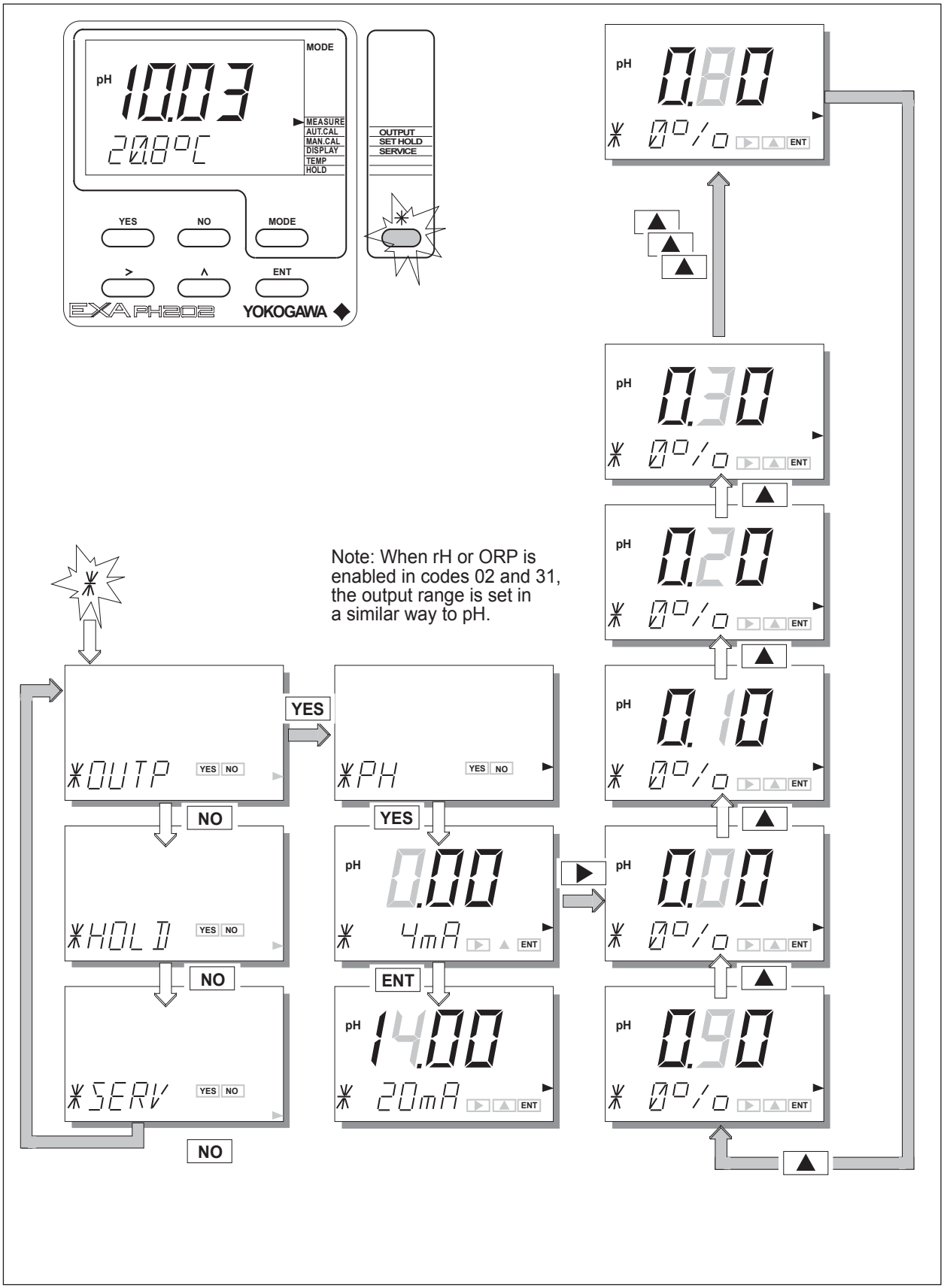
5-2. Commissioning mode

In order to obtain peak performance from the EXA, you must set it up for each custom application.

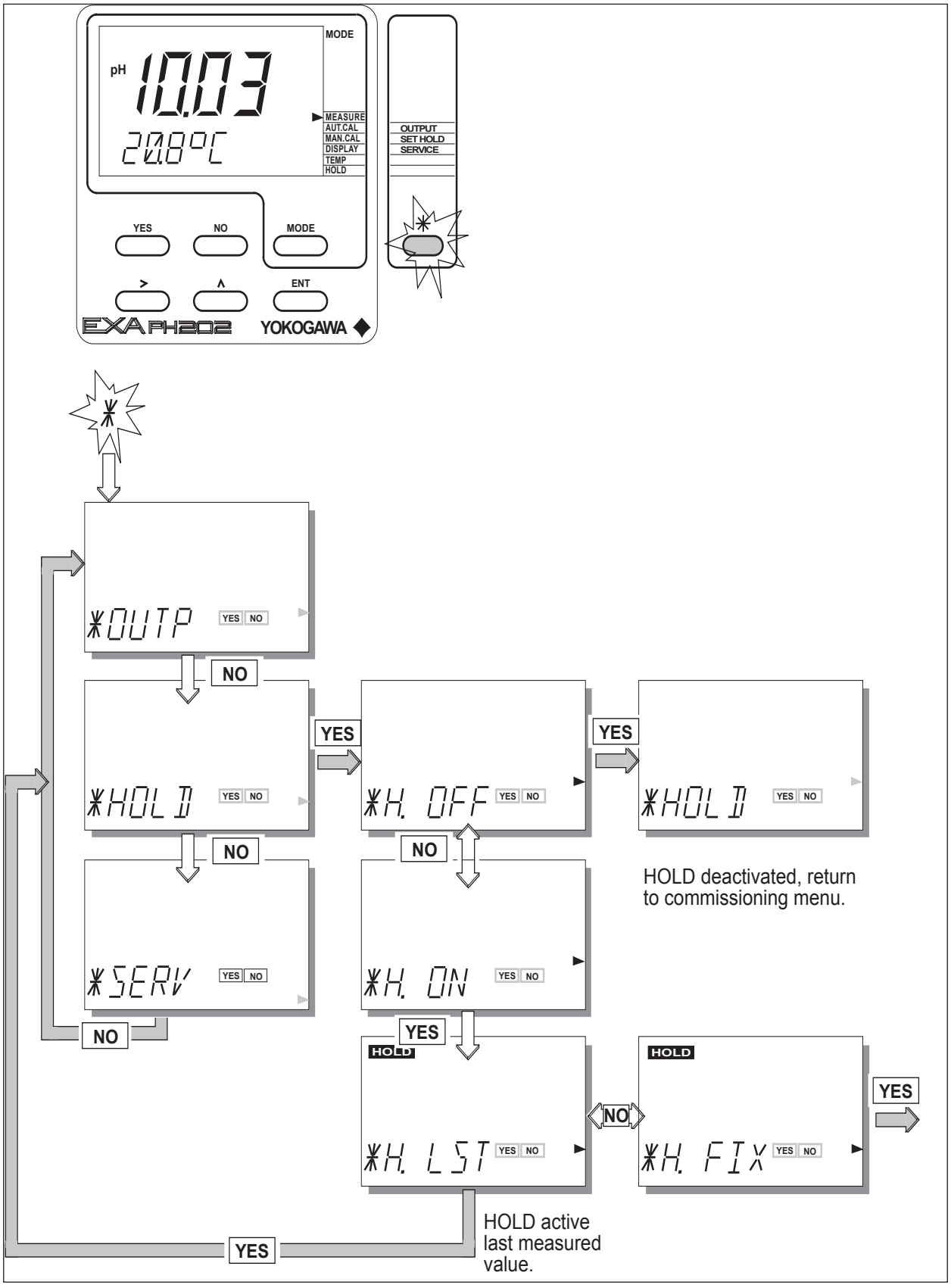
mA Output range (*OUTP)	mA output is set as default to 0 - 14 pH. For enhanced resolution in more stable measuring processes, it may be desirable to select 5 - 10 pH range, for example. Service codes 31 and 35 can be used to choose output function on mA output.
mA Hold (*HOLD)	The EXA transmitter has the ability to “hold” the output during maintenance periods. This parameter should be set up to hold the last measured value, or a fixed value to suit the process.
Service (*SERV)	This selection provides access to the service menu.

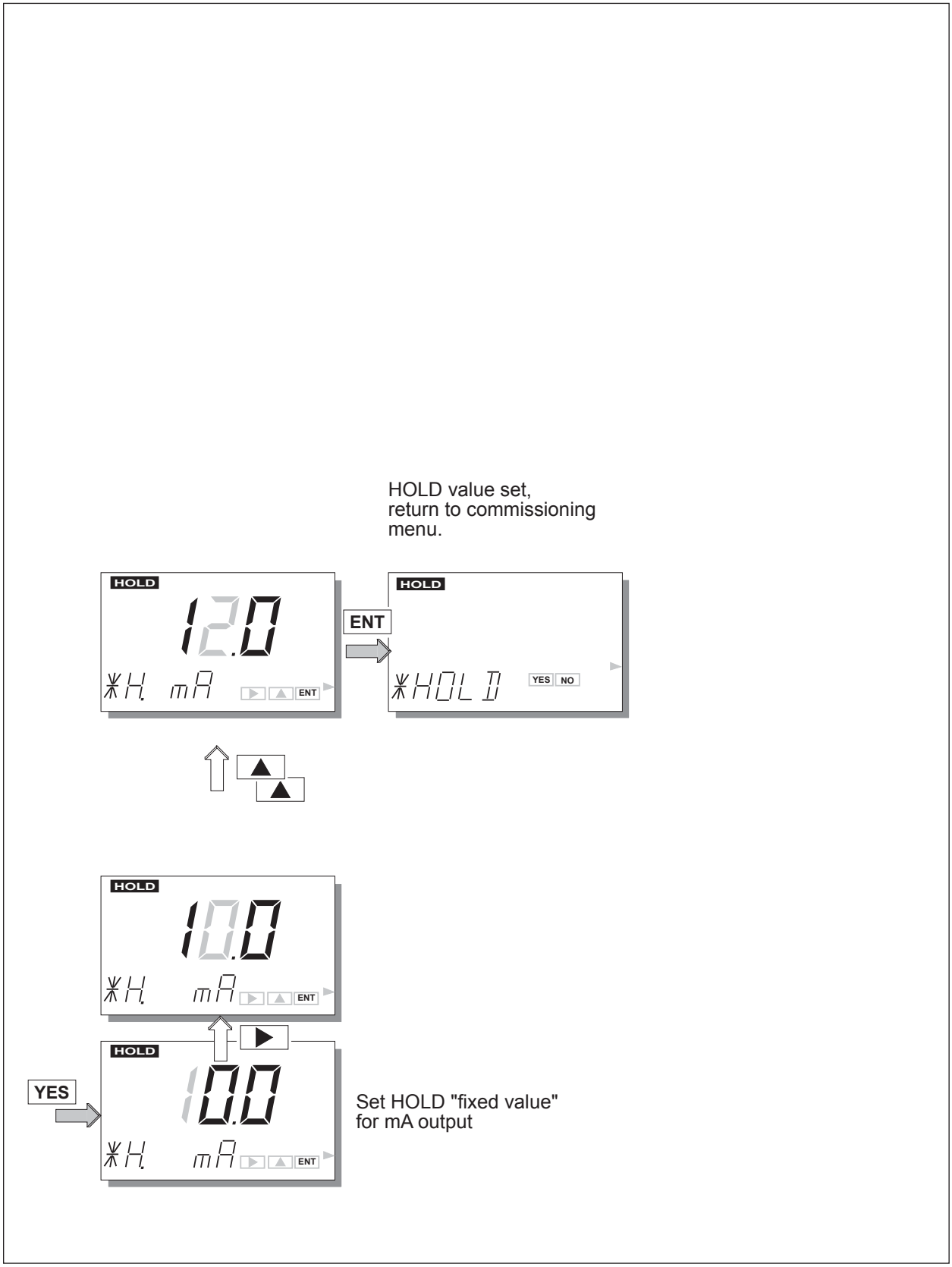
What follows are pictorial descriptions of typical frontplate pushbutton sequences for each parameter setting function. By following the simple YES/NO prompts and arrow keys, users can navigate through the process of setting range, hold and service functions.

mA 5-2-1. Output range

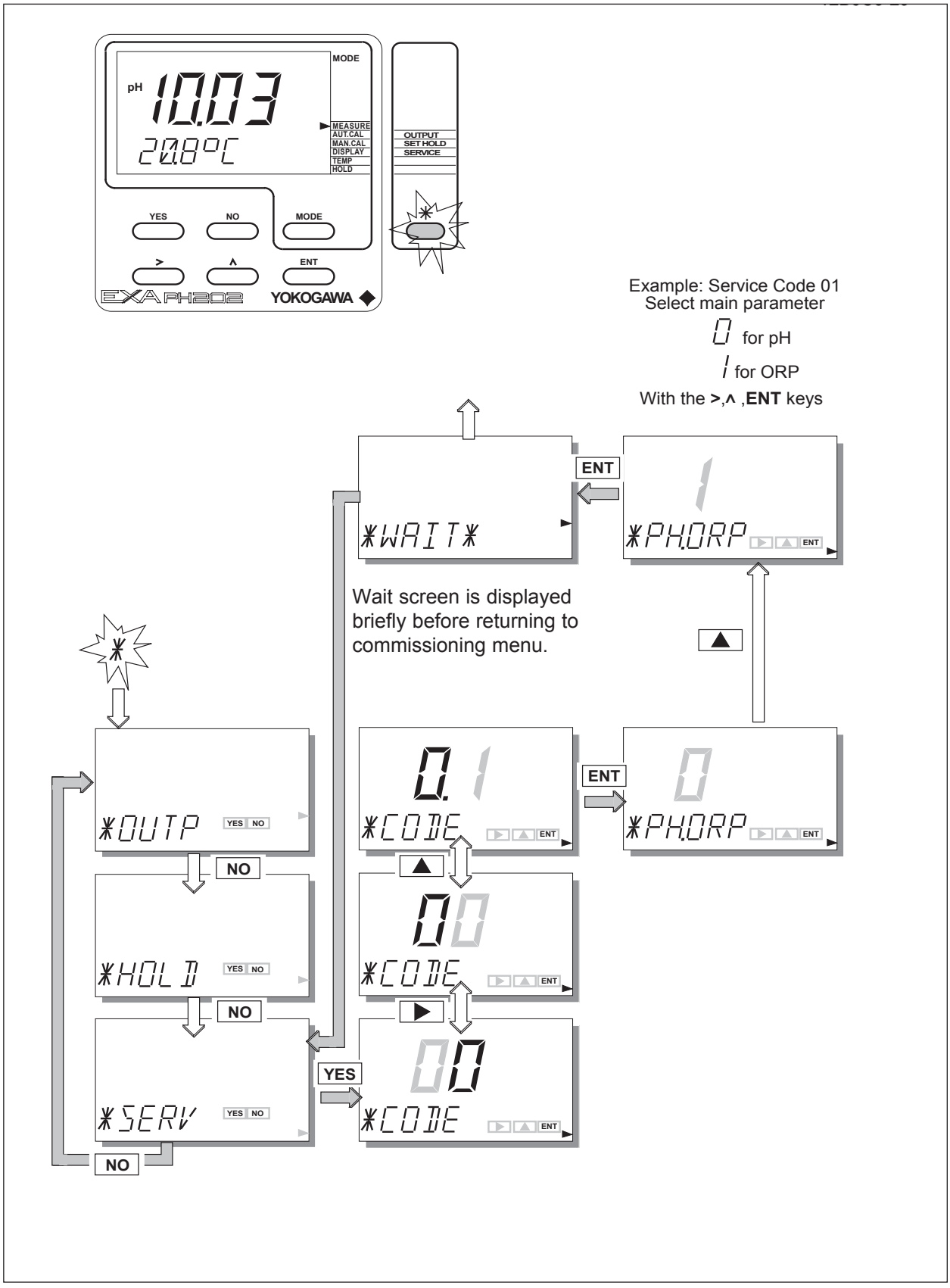


mA 5-2-2. Hold


MODE
pH
10.03
20.8°C
MEASURE
AUT.CAL
MAN.CAL
DISPLAY
TEMP
HOLD
OUTPUT
SET HOLD
SERVICE
YES
NO
MODE
>
^
ENT
EXA PH202
YOKOGAWA
OUTP
HOLD
H. OFF
H. ON
H. LST
H. FIX
SERV
HOLD
HOLD
NO
YES
HOLD deactivated, return to commissioning menu.
HOLD active last measured value.


HOLD value set,
return to commissioning
menu.
HOLD
12.0
ENT
HOLD
YES
NO
HOLD
10.0
HOLD
10.0
YES
Set HOLD "fixed value"
for mA output

5-2-3. Service


MODE
pH
10.03
20.8°C
MEASURE
AUT.CAL
MAN.CAL
DISPLAY
TEMP
HOLD
OUTPUT
SET HOLD
SERVICE
YES
NO
MODE
>
^
ENT
EXA PH202
YOKOGAWA
Example: Service Code 01
Select main parameter
0 for pH
1 for ORP
With the >,^ ,ENT keys
WAIT
ENT
*PH.ORP
Wait screen is displayed
briefly before returning to
commissioning menu.
*OUTP
YES NO
NO
*HOLD
YES NO
NO
*SERV
YES NO
NO
YES
*CODE
ENT
01
00
10
mA
mA

5-3. Notes for guidance in the use of service coded settings

Don't set or input service code numbers other than the code numbers defined in this manual. Setting an undefined service code may make the transmitter malfunction.
When an undefined service code is input by some accident, push the MODE key and escape from the service level.

5-3-1. Parameter specific functions

Code 01 *pH/ORP Choose the main measuring parameter. The option of the ORP input is used with an inert metal electrode as measuring sensor which gives a reading directly in millivolts. This signal can then be interpreted to give information about the oxidation state of the process solution, and derived information like the absence of a compound (like Cyanide for example which is destroyed in oxidizing solutions).

Code 02 *PRM.2 Enable the use of a second measuring parameter simultaneously with pH (the main parameter).
With the correct sensor (e.g FU20), ORP measurement is possible as parameter 2 With the same sensor, rH measurement is possible as parameter 2, this is calculated from pH and ORP and is a value which gives the oxidizing power of the solution while compensating for the effect of pH.
This function is particularly useful for applications where both the pH and oxidation-reduction potential of the process need to be known. The availability of both measurements in a single system is convenient.
Note that in both cases a suitable sensor combination is needed to make this possible. The Yokogawa FU20 (4-in-1) sensor can be used for this purpose, or a combination of individual sensors. Contact your local Yokogawa sales office for advice regarding applications and sensor selection.

Code 03 & 04 *Z1.CHK & *Z2.CHK The EXA PH202 has an impedance check capable of monitoring the impedance of all sorts of sensor systems. In order to “fine tune” this diagnostic tool it is necessary to set it up to match the sensors used. The default settings give a good setup for a conventional system comprising pH glass sensor and a reference electrode, either as individual electrodes or as a combination style sensor. The impedance limits will need to be adjusted to get the best from systems using heavy duty, or fast response electrodes.
The impedance measuring system has a very wide span requirement. As it can measure in kΩ and also in GΩ (10^9) there are hardware switches to set high range (1MΩ to 2 GΩ) or low range (1kΩ to 1MΩ) measuring. As a default the system is set to measure high impedances on input 1 (the one normally used for the pH glass sensor input) and low impedances on input 2 (the one normally used for the reference input). Examples of where these settings need to be changed from the default, are Pfaudler enamel sensors which need two high impedance settings, and Platinum sensors with a standard reference, which need two low impedance settings.
The temperature compensation of the impedance measurement is for conventional pH glass sensors. When other sensors are used, switch this feature off.

Code 05 *CAL.CK The calibration checking feature, when enabled, gives security against entering wrong calibration data. For example when aged sensors are due for replacement, the EXA flags an error message and prevents a calibration being completed where the subsequent measurement can only exhibit errors and drift.
Limits are set for the maximum permissible Asymmetry potential, and Slope.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Parameter specific functions								
01	*PH.ORP	Select main parameter	pH	0			0	pH
			ORP	1				
02	*PRM.2	Enable 2nd parameter	Off	0			0	Off
			ORP	1				
			rH	2				
03	*Z1.CHK	Impedance check 1	Low	0			1.1.1	
			High	1				High
			Temp comp off		0			
			Temp comp on		1			On
			Imp check off			0		
			Imp check on			1		On
	*Z.L.xΩ	Low impedance limit	Press NO to step through choice of units,					1 MΩ
		x = None, K, M or G	press YES to select units, then use the					
			>, ^ ENT keys to set the value					
	*Z.H.xΩ	High impedance limit	Press NO to step through choice of units,					1 GΩ
		x=None, K, M or G	press YES to select units, then use the					
			>, ^ ENT keys to set the value					
04	*Z2.CHK	Impedance check 2	Low	0			0.0.1	Low
			High	1				
			Temp comp off		0			Off
			Temp comp on		1			
			Imp check off			0		
			Imp check on			1		On
	*Z.L.xΩ	Low impedance limit	Press NO to step through choice of units,					100 Ω
		x = None, K, M or G	press YES to select units, then use the					
			>, ^ ENT keys to set the value					
	*Z.H.xΩ	High impedance limit	Press NO to step through choice of units,					200 kΩ
		x = None, K, M or G	press YES to select units, then use the					
			>, ^ ENT keys to set the value					
05	*CAL.CK	Calibration check	Asymmetry check off	0			1.1	
			Asymmetry check on	1				On
			Slope check off		0			
			Slope check on		1			On
06-09			Not used					

5-3-2. Temperature compensation and measuring functions.

Code 10 *T.SENS Selection of the temperature compensation sensor. The default selection is the Pt1000 Ohm sensor, which gives excellent precision with the two wire connections used. The other options give the flexibility to use a very wide range of other pH sensors.

Code 11 *T.UNIT Celsius or Fahrenheit temperature scales can be selected to suit user preference.

Code 12 *T.ADJ With the process temperature sensor at a stable known temperature, the temperature reading is adjusted in the main display to correspond. The calibration is a zero adjustment to allow for the cable resistance, which will obviously vary with length.
The normal method is to immerse the sensor in a vessel with water in it, measure the temperature with an accurate thermometer, and adjust the reading for agreement.

Code 13 *T.COMP Process compensation automatically allows for changes in the pH or ORP of the process with temperature. The characteristic of each process will be different, and the user should determine if this feature is to be activated, and what compensation figure to choose.

The compensation is given in pH per 10 °C or mV per 10 ºC.
The standard temperature is 25°C (fixed value) in setting the temperature compensation.

Example: For pure water with an alkali dose, (e.g. boiler feed water) a coefficient of approx. 0.35pH can be expected. However, applications vary and a simple test will determine what if any coefficient is suitable for the process.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Temperature measuring and compensation functions								
10	*T.SENS	Temperature sensor	Pt1000	0			0	Pt1000
			Pt100	1				
			3kBalco	2				
			5k1	3				
			8k55	4				
			350	5				
			6k8	6				
			PTC10k	7				
11	*T.UNIT	Display in °C or °F	°C	0			0	°C
			°F	1				
12	*T.ADJ	Calibrate temperature	Adjust to allow for cable resistance					None
13	*T.COMP	Set temp comp	Compensation for process changes off	0			0	Off
			Compensation for process changes on	1				
	*T.COEF	Adjust process TC	Set for TC in pH per 10 °C				-0.00	pH per 10 °C
14-19			Not used					

5-3-3. Calibration functions

Code 20 *Δt.SEC & *ΔPH — These functions are used to determine the stability level demanded by the EXA as acceptance criteria for the automatic calibration. for general purpose electrode systems with a fast response. Where heavy duty electrodes are used, or when low temperatures are concerned, these values should be adjusted. When adjusting these settings, the longer the time interval and the smaller the pH change, the more stable will be the reading. However, it is important to bear in mind that the time taken to reach stability is an exponential function, and too ambitious a setting will cause the instrument to wait for a very long time before accepting a calibration.

Code 21 *AS.LOW & *AS.HI — Limit values for the drift of an electrode system before an error is signalled when a calibration is done. These default values should be adjusted to suit the application, this will be especially important with enamel or Antimony probes. In case in service code 27 the Asymmetry Potential is disabled and the Zero Point is used, service code 21 is used for entering the limits of the Zero Point.

*ZP.LOW & *ZP.HI — Limit values for zero point, if enabled in service code 27.

Code 22 *SL.LOW & *SL.HI — Limit values for acceptable slope (sensitivity) calibrations.

Code 23 *ITP, *SLOPE & *ASP — Values can be entered directly in this section. These data can be provided by the manufacturer of the probe, or by the users laboratory etc. They are determined independently of the measuring loop.
Note: it is not necessary to enter this data in most cases as the EXA automatically does this while performing a calibration. The feature is used in the case of special electrode systems and where calibration in the process environment is not possible.

Code 24, 25, & 26 *BUF.ID — The following buffer calibration tables are programmed into the EXA. They are the primary buffer standards according to NIST (formerly NBS) and various other national standards. We strongly recommend the use of these buffer solutions as they give the best buffer capacity, reliability and accuracy when calibrating.

Table 5-1.

	pH 4	pH 7	pH 9		pH 4	pH 7	pH 9
0 °C	4.00	6.98	9.46	**45 °C**	4.05	6.83	9.04
5 °C	4.00	6.95	9.40	**50 °C**	4.06	6.83	9.01
10 °C	4.00	6.92	9.33	**55 °C**	4.08	6.83	8.99
15 °C	4.00	6.90	9.28	**60 °C**	4.09	6.84	8.96
20 °C	4.00	6.88	9.23	**65 °C**	4.11	6.84	8.94
25 °C	4.01	6.87	9.18	**70 °C**	4.13	6.85	8.92
30 °C	4.02	6.85	9.14	**75 °C**	4.15	6.85	8.90
35 °C	4.02	6.84	9.10	**80 °C**	4.16	6.86	8.89
40 °C	4.04	6.84	9.07				

These tables may be adjusted in the case that the user wishes to use other calibration solutions. The “name” of the buffer can be changed at the *BUF.ID prompt. The other values can then be adjusted in sequence.

Code 27 *ZERO.P — As an alternative to Asymmetry Potential, the Zero point can be used to define and calibrate the EXA pH unit.
Note that this method conforms to the DIN standard for instruments No. IEC 60746-2.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Calibration functions								
20	*Δt.SEC	Stability check time						5 sec.
	*ΔPH	Stability check pH						0.02 pH
21	*AS.LOW	As Pot low limit						-120 mV
(As Pot)	*AS.HI	As Pot high limit						120 mV
21	*ZP.LOW	Zero Point low limit						5.00 pH
(Zero)	*ZP.HI	Zero Point high limit						9.00 pH
22	*SL.LOW	Slope low limit						70 %
	*SL.HI	Slope high limit						110 %
23	*ITP	Set ITP	Preset calibration data from manufacturer					7.00 pH
(pH)	*SLOPE	Set slope	or from laboratory determinations.					100 %
	*ASP.1D	Set As Pot	For the main parameter					0.0 mV
		↑	Press YES to confirm 0.1 mV resolution,					
		Select YES/NO	then set value with >, ^, ENT keys.					
		↓	Press NO to change to *ASP.					
	*ASP	Set As Pot	For the main parameter					
			Press YES to confirm 1 mV resolution,					
			then set value with >, ^, ENT keys.					
	*ASPmV	Set As Pot ORP	For parameter 2 (when activated in					
			service code 02)					
23	*ASP.1D	Set As Pot (ORP)	For the main parameter					
(ORP)		↑	Press YES to confirm 0.1 mV resolution,					
		Select YES/NO	then set value with >, ^, ENT keys.					
		↓	Press NO to change to *ASP.					
	*ASP	Set As Pot	For the main parameter					
			Press YES to confirm 1 mV resolution,					
			then set value with >, ^, ENT keys.					
24	*BUF.ID	Buffer table 4	Buffer tables to NIST (formerly NBS)					
25	*BUF.ID	Buffer table 7	(see section 10 for table details)					
26	*BUF.ID	Buffer table 9	User adjustable for special requirements					
27	*ZERO.P	Enable zero point in	Disable zero point (enable As Pot)	0			0	Disabled
		pH units	Enable zero point (disable As Pot)	1				
28-29			Not used					

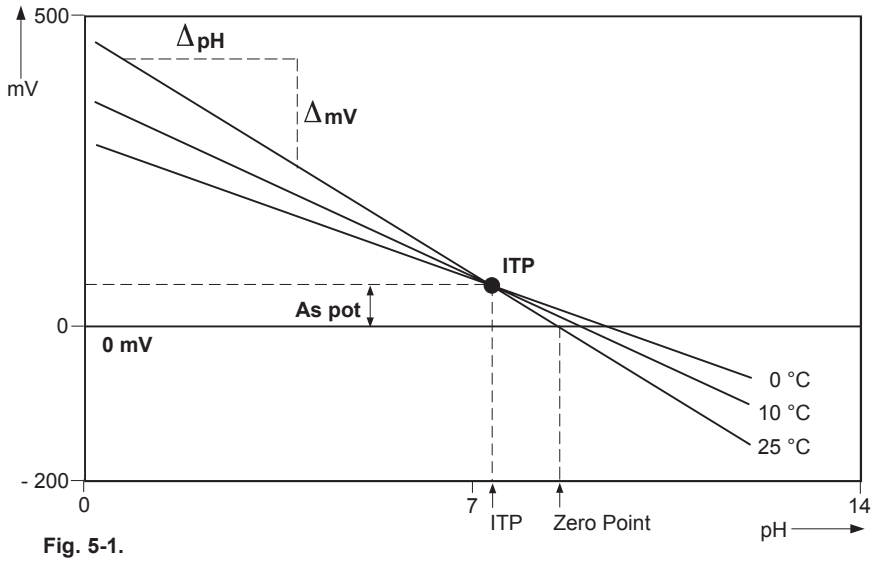


Fig. 5-1.

mA 5-3-4. mA output functions

Code 31 *OUTP.F When pH is set in code 01 as the main parameter, the output functions may be set as follows:-
0: pH
1: pH (table)
2: Parameter 2 (ORP or rH as set in code 02)
When ORP is set in code 01 as the main parameter, the output functions may be set to:
0: ORP
1: ORP (table)

Code 32 *BURN Diagnostic error messages can signal a problem by sending the output signals upscale or downscale (21 mA or 3.6 mA when HART or distributor comm. is non-used, 3.9 mA when HART or distributor comm. is used). This is called upscale or downscale burnout, from the analogy with thermocouple failure signalling of a burned-out or open circuit sensor. The pulse burnout setting gives a 21 mA signal for the first 30 seconds of an alarm condition. After the "pulse" the signal returns to normal. This allows a latching alarm unit to record the error. In the case of the EXA the diagnostics are extensive and cover the whole range of possible sensor faults.

Code 35 *TABLE The table function allows the configuration of an output curve by 21 steps (intervals of 5%).
The following example shows how the table may be configured to linearise the output with a mA curve.

Table 5-2.

	4-20 mA		**4-20 mA**
0%	4.0 mA	**50%**	12.0 mA
5%	4.8 mA	**55%**	12.8 mA
10%	5.6 mA	**60%**	13.6 mA
15%	6.4 mA	**65%**	14.4 mA
20%	7.2 mA	**70%**	15.2 mA
25%	8.0 mA	**75%**	16.0 mA
30%	8.8 mA	**80%**	16.8 mA
35%	9.6 mA	**85%**	17.6 mA
40%	10.4 mA	**90%**	18.4 mA
45%	11.2 mA	**95%**	19.2 mA
		100%	20.0 mA

mA

Code	Display	Function	Function detail	X	Y	Z	Default values	
mA Outputs								
30			Not used					
31	*OUTP.F	mA output functions Code 01 set for pH	pH pH (table) Parameter 2 (with suitable sensor(s), and when enabled in code 02)	0 1 2			0	
32	*BURN	Burn function	No burnout Burnout downscale Burnout upscale Pulse burnout	0 1 2 3			0	No Burn.
33, 34			Not used					
35	*TABLE *0% *5% *10% *90% *100%	Output table for mA	Linearisation table for mA1 in 5% steps. The measured value is set in the main display using the >, ^, ENT keys, for each of the 5% interval steps. Where a value is not known, that value may be skipped, and a linear interpolation will take place.					
36-39			Not used					

5-3-5. User interface

Code 50	*RET.	When Auto return is enabled, the transmitter reverts to the measuring mode from anywhere in the configuration menus, when no button is pressed during the set time interval of 10 minutes.
Code 51	*MODE	The manual impedance check (on demand) can be setup for operation in the maintenance mode. (Through the closed front cover).
Code 52	*PASS	Passcodes can be set on any or all of the access levels, to restrict access to the instrument configuration.
Code 53	*Err.4.1	Error message configuration. Two different types of failure mode can be set. Hard fail gives a steady FAIL flag in the display, A Fail signal is transmitted on the outputs when enabled in code 32. Soft fail gives a flashing FAIL flag in the display. The call for maintenance is a good example of where a SOFT fail is useful. A warning that the regular maintenance is due, should not be used to shut down the whole measurement.
Code 54		Not used
Code 55	*CALL.M	Call for maintenance is a trigger to signal that the system has been in service for longer than the set time without calibration. The user can set up to 250 days as a routine service interval.
Code 56	*DISP	The display resolution can be set to either 0.01pH or 0.1pH. Not applicable to the ORP (mV) display.

Code	Display	Function	Function detail	X	Y	Z	Default values	
User interface								
50	*RET.	Auto return	Auto return to measuring mode Off	0				
			Auto return to measuring mode On	1			1	On
51	*MODE	Mode setup	Manual impedance check Off	0			0	Off
			Manual impedance check On	1				
52	*PASS	Passcode	Maintenance passcode Off	0			0.0.0	Off
		Note # = 0 - 9, where	Maintenance passcode On	#				
		0 = no passcode	Commissioning passcode Off		0			Off
		1=111, 2=333, 3=777	Commissioning passcode On		#			
		4=888, 5=123, 6=957	Service passcode Off			0		Off
		7=331, 8=546, 9=847	Service passcode On			#		
53	*Err.4.1	Error setting	Impedance low (input 1) Soft fail	0				
			Impedance low (input 1) Hard fail	1			1	Hard
	*Err.5.1		Impedance high (input 1) Soft fail	0				
			Impedance high (input 1) Hard fail	1			1	Hard
	*Err.4.2		Impedance low (input 2) Soft fail	0				
			Impedance low (input 2) Hard fail	1			1	Hard
	*Err.5.2		Impedance high (input 2) Soft fail	0				
			Impedance high (input 2) Hard fail	1			1	Hard
	*Err.07		Temperature too high Soft fail	0				
			Temperature too high Hard fail	1			1	Hard
	*Err.08		Temperature too low Soft fail	0				
			Temperature too low Hard fail	1			1	Hard
	*Err.09		pH out of range Soft fail	0				
			pH out of range Hard fail	1			1	Hard
	*Err.11		Wash recovery check Soft fail	0			0	Soft
			Wash recovery check Hard fail	1				
	*Err.16		Call for maintenance Soft fail	0			0	Soft
			Call for maintenance Hard fail	1				
54			Not used					
55	*CALL.M	Call for maintenance	Set time limit for calibration Off	0			0	Off
			Set time limit for calibration On	1				
			Set valid maintenance period if On				250	days
56	*DISP	Display resolution	Set pH decimal display 0.1 pH	0				
			Set pH decimal display 0.01pH	1			1	0.01 pH
57-59			Not used					

5-3-6. Communication setup

mA	Code 60	*COMM.	The settings should be adjusted to suit the communicating device connected to the output. The communication can be set to HART® or to PH201*B distributor (for Japanese market only)
		*ADDR.	Select adress 00 for point to point communication with 4-20 mA transmission. Address 01 to 15 are used in multi-drop configuration (fixed 4 mA output). For the Yokogawa PC202 software package, the default settings match the software as shipped.
mA	Code 61	*HOUR	The clock/calendar for the logbook is set for current date and time as reference.
		*MINUT	
		*SECND	
		*YEAR	
		*MONTH	
		*DAY	
	Code 62	*ERASE	Erase logbook function to clear the recorded data for a fresh start. This may be desirable when re-commissioning an instrument that has been out of service for a while.

5-3-7. General

Code 70	*LOAD	The load defaults code allows the instrument to be returned to the default set up with a single operation. This can be useful when wanting to change from one application to another.
Code 79	*CUST.D	Load customer defaults. This code allows the instrument to be returned to the factory default set, except that buffer tables (code 24,25,26) are unchanged.

5-3-8. Test and setup mode

Code 80	*TEST	Not used

Note: attempting to change data in service code, 80 and above without the proper instructions and equipment, can result in corruption of the instrument setup, and will impair the performance of the unit.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Communication								
60	*COMM.	Communication	Set HART® communication Off	0			1.0	On
			Set HART® communication On	1				
			write enable		0			write
			write protect		1			enable
			Set communication PH201*B	2				
			Without half time check		0			
			With half time check		1			
	*ADDR.	Network address	Set address 00 to 15				00	
61	*HOUR *MINUT *SECND *YEAR *MONTH *DAY	Clock setup	Adjust to current date and time using >, ^ and ENT keys					
62	*ERASE	Erase logbook	Press YES to clear logbook data					
63-69			Not used					

Code	Display	Function	Function detail	X	Y	Z	Default values	
General								
70	*LOAD	Load defaults	Reset configuration to default values					
71-78			Not used					
79	*CUST.D	Load Customer Defaults	Reset configuration to default values except buffer tables					

Code	Display	Function	Function detail	X	Y	Z	Default values	
Test and setup mode								
80	*TEST	Test and setup	Not used					

6. CALIBRATION

The EXA PH202 can be calibrated in three distinct ways.

6-1. Automatic calibration

This method uses internally programmed buffer tables, (from Service Codes 24, 25 and 26), to calculate the buffer value at the actual temperature during the calibration. In addition, the stability of the reading is automatically calculated, and when the reading has stabilized fully automatic adjustments of slope and asymmetry are made. This eliminates the question of how long the operator should allow prior to adjustment. A menu driven prompt system conducts the operator through the simple, foolproof routine.

Default settings for the buffer solutions are the standard NIST (formerly NBS) recognised solutions “4”, “7” and “9”. These are known as primary buffers. They have a much better buffer capacity than the “commercial” or adjusted buffers. Yokogawa strongly recommends the use of these buffers to provide the best pH calibration.

6-2. Manual calibration

In this method, the operator decides on the actual value to enter. Manual calibration is most often used for single-point adjustment of the asymmetry potential, by comparison method.

Manual calibration can also be used to perform a full 2-point calibration with solutions other than the NIST buffers that are listed in the calibration tables. In this case, the solutions are applied sequentially as in the AUT CAL method, but the user determines the adjustment of reading and stability.

NOTE:

During manual calibration the temperature coefficient is still active. This means that the readings are referred to 25 °C. This makes grab sample calibration easy and accurate. However, if the manual calibration technique is used for buffer calibration, the temperature coefficient must be set to zero in maintenance mode in the “TEMP” routine (see chapter 5).

6-3. Sample calibration

The operator activates the “SAMPLE” calibration routine, at the same time as taking a representative process sample. After determining the pH of this sample by independent methods, (in the lab for example) the reading can be adjusted. While the sample is being analyzed, EXA holds the sample data in memory, while continuing to control and read pH normally.

6-4. Data entry

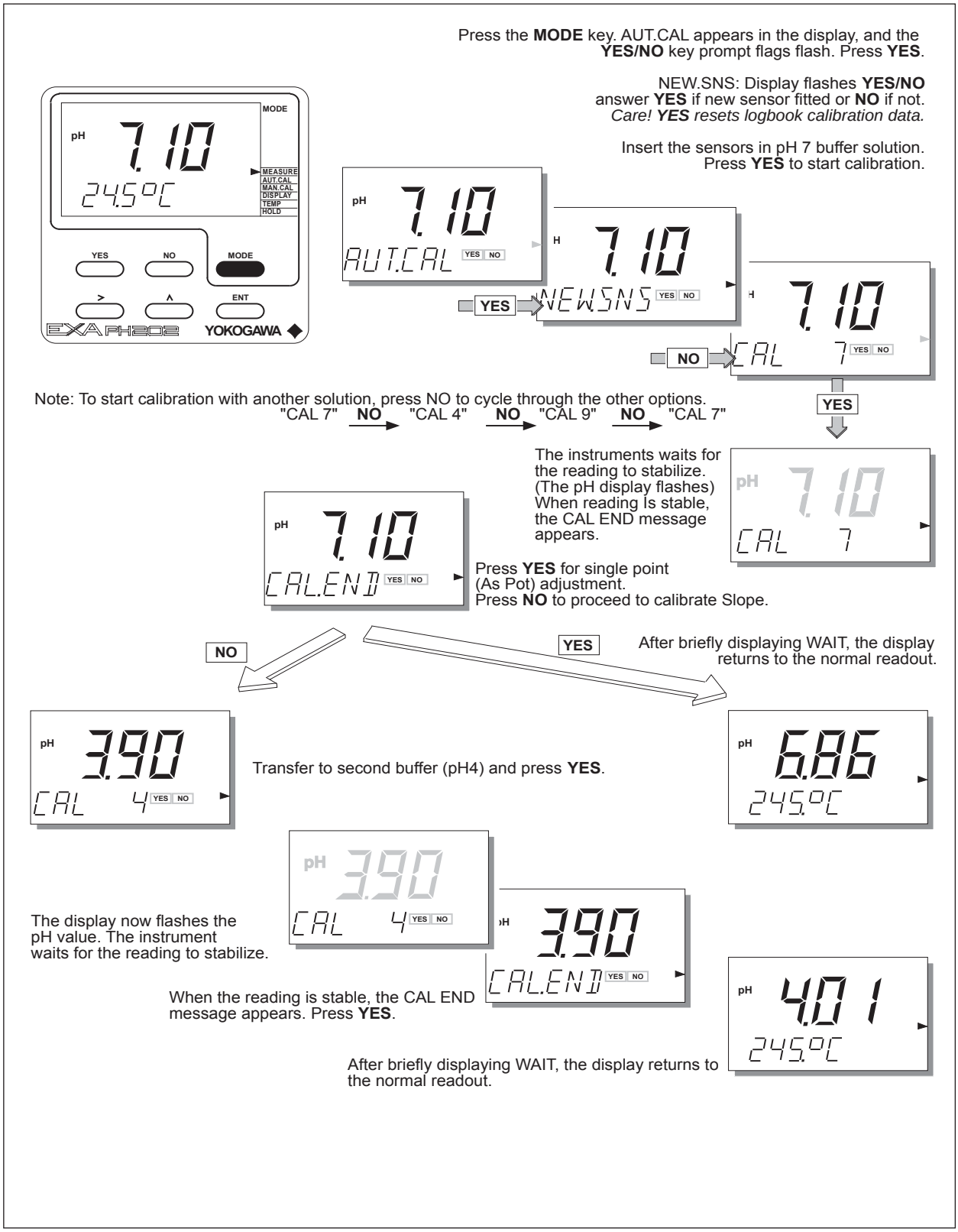
In special circumstances, users can directly enter the calibration data in the service code menu (see chapter 5). This is appropriate where the manufacturer provides calibration data for each probe (as with the Pfaudler sensors) or where electrodes are laboratory calibrated for subsequent installation on the plant.
Service Code 23 allows the values of ITP, asymmetry potential (or zero point) and slope to be entered.

NOTE:

· Be sure to use fresh, pure standard solution to ensure that the calibration is accurate.
· If the temperature of the standard solution changes then its pH will also change.
  Ensure that the temperature of the standard solution is stable at calibration time.
· In using a pH sensor which isn't incorporated with a temperature element for automatic temperature compensation, the temperature of measured solution should be set on the PH202 transmitter.
· When an antimony sensor is applied, measured temperature value also should be set.

6-5. Calibration procedures

6-5-1. Automatic calibration



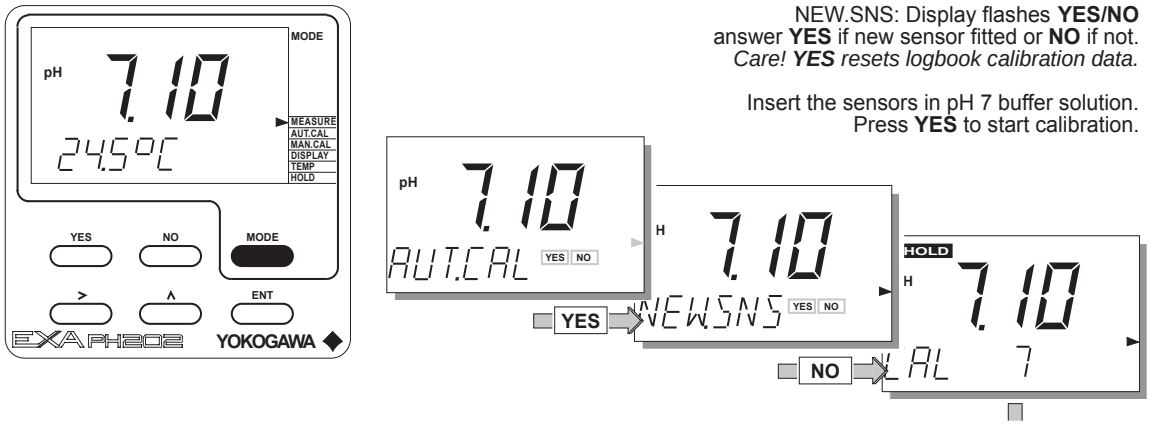
mA 6-5-2. Automatic calibration with HOLD active

12B6C3-31

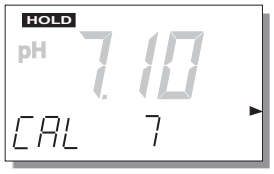
Press the **MODE** key. AUT.CAL appears in the display, and the **YES/NO** key prompt flags flash. Press **YES**.

NEW.SNS: Display flashes **YES/NO** answer **YES** if new sensor fitted or **NO** if not.
*Care! **YES** resets logbook calibration data.*

Insert the sensors in pH 7 buffer solution.
Press **YES** to start calibration.

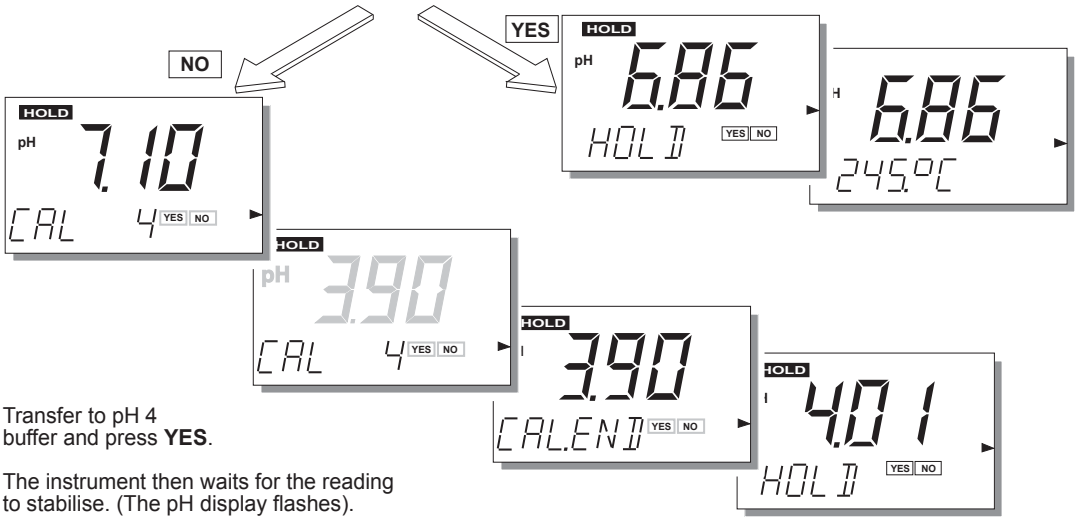


Note: To start calibration with another solution, press NO to cycle through the other options.
"CAL 7" **NO** "CAL 4" **NO** "CAL 9" **NO** "CAL 7"



The instruments waits for the reading to stabilise. (The pH display flashes) When reading Is stable, the CAL END message appears.

Press **YES** for single point (As Pot) adjustment.
Press **NO** to proceed to calibrate Slope.



The single-point calibration is now complete. put sensors back in the process and press **NO** to switch off HOLD and return to measuring mode.

Transfer to pH 4 buffer and press **YES**.

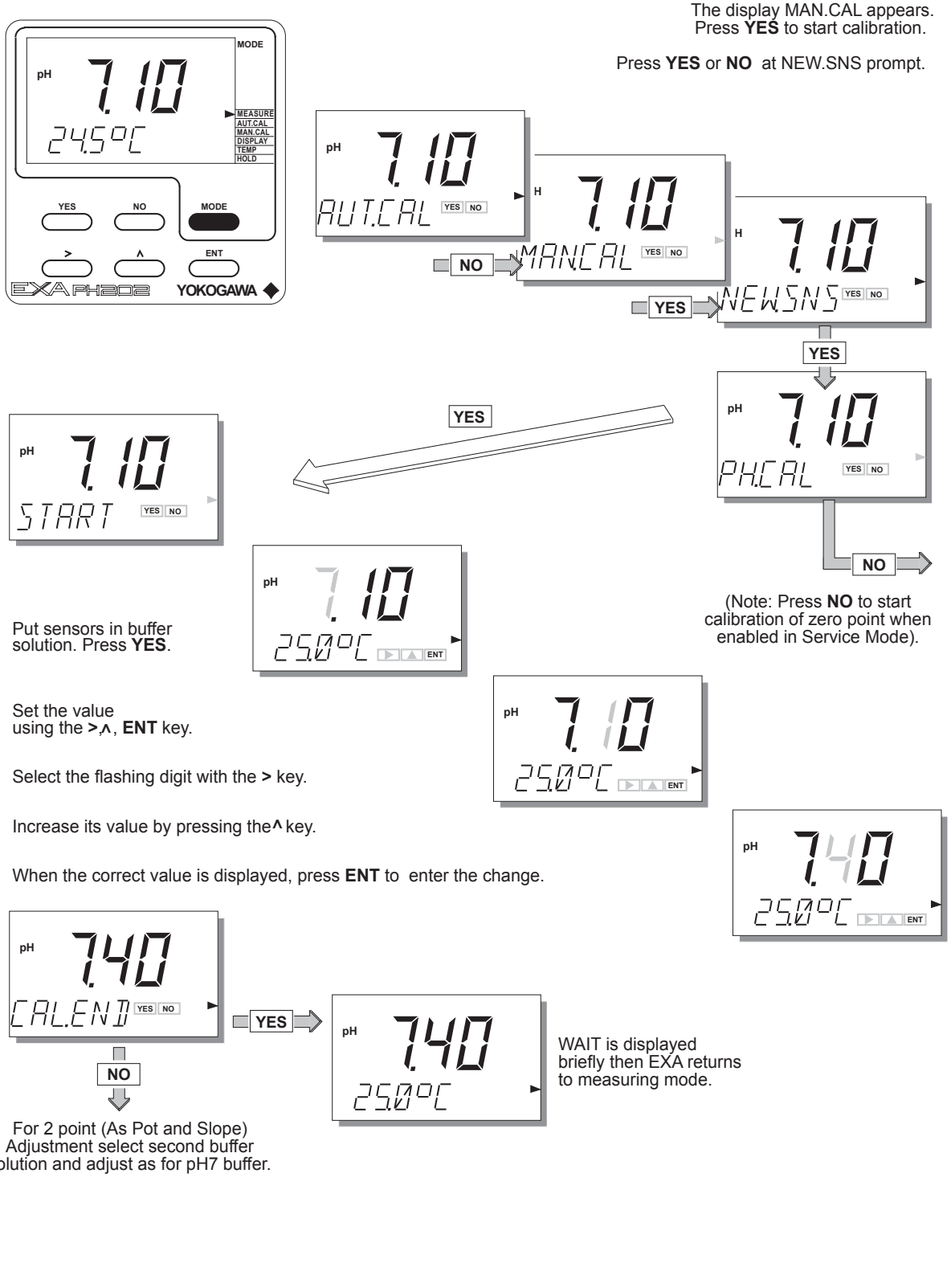
The instrument then waits for the reading to stabilise. (The pH display flashes).

When the reading is stable, the CAL END message appears. Press **YES**.
WAIT flashes briefly then HOLD

The calibration is now complete. Put the sensors back in the process and press **NO** to turn off HOLD and return to the measuring mode.

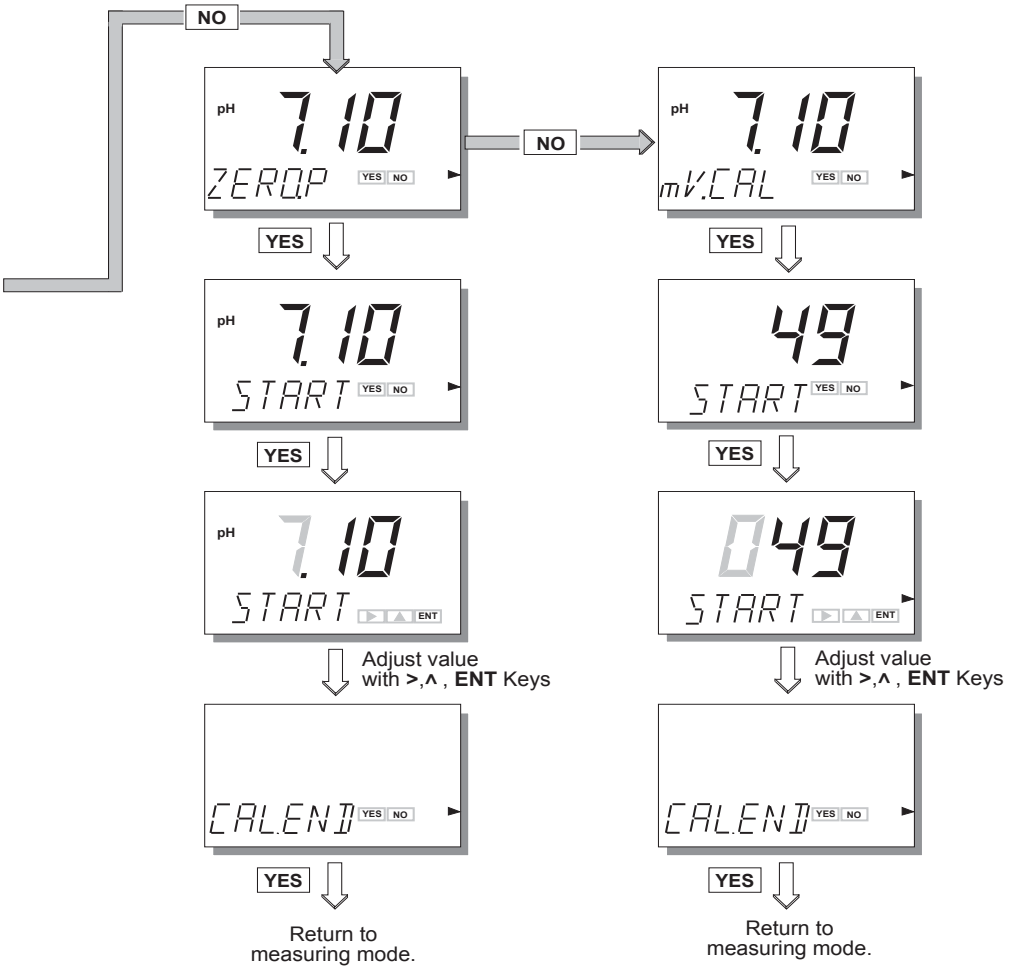
6-5-3. Manual calibration (2nd parameter calibration)

12B6C3-32



Manual Calibration of zero point according to IEC 60746-2. When enabled in service code 27.

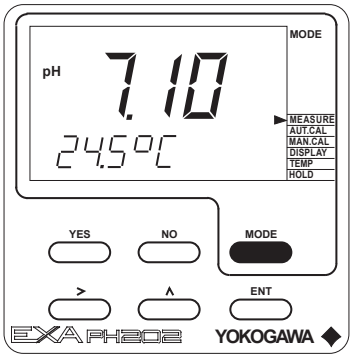
Manual Calibration of mV offset for ORP (2nd parameter). Where both pH and ORP (or rH) are measured, the offset (Asymmetry potential) of the second parameter is calibrated as shown below. When enabled in service code 02.

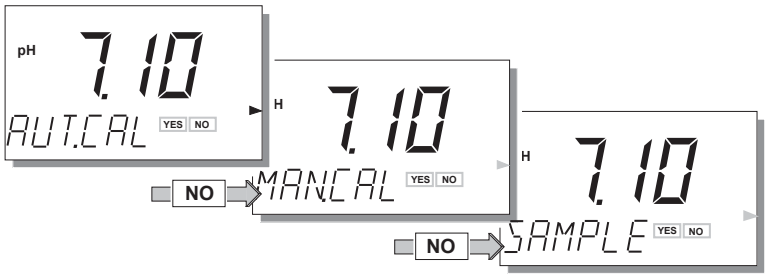


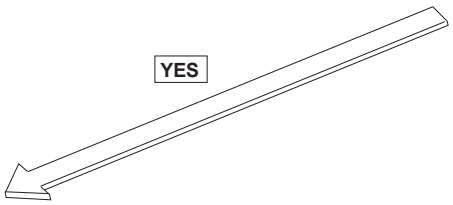
6-5-4. Sample calibration

Press the **MODE** key. The legend AUT.CAL appears, and the YES/NO key prompt flags flash. Press **NO**.

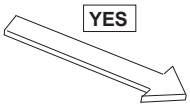
The display MAN.CAL appears. Press **NO**.SAMPLE appears Press **YES** to start calibration.



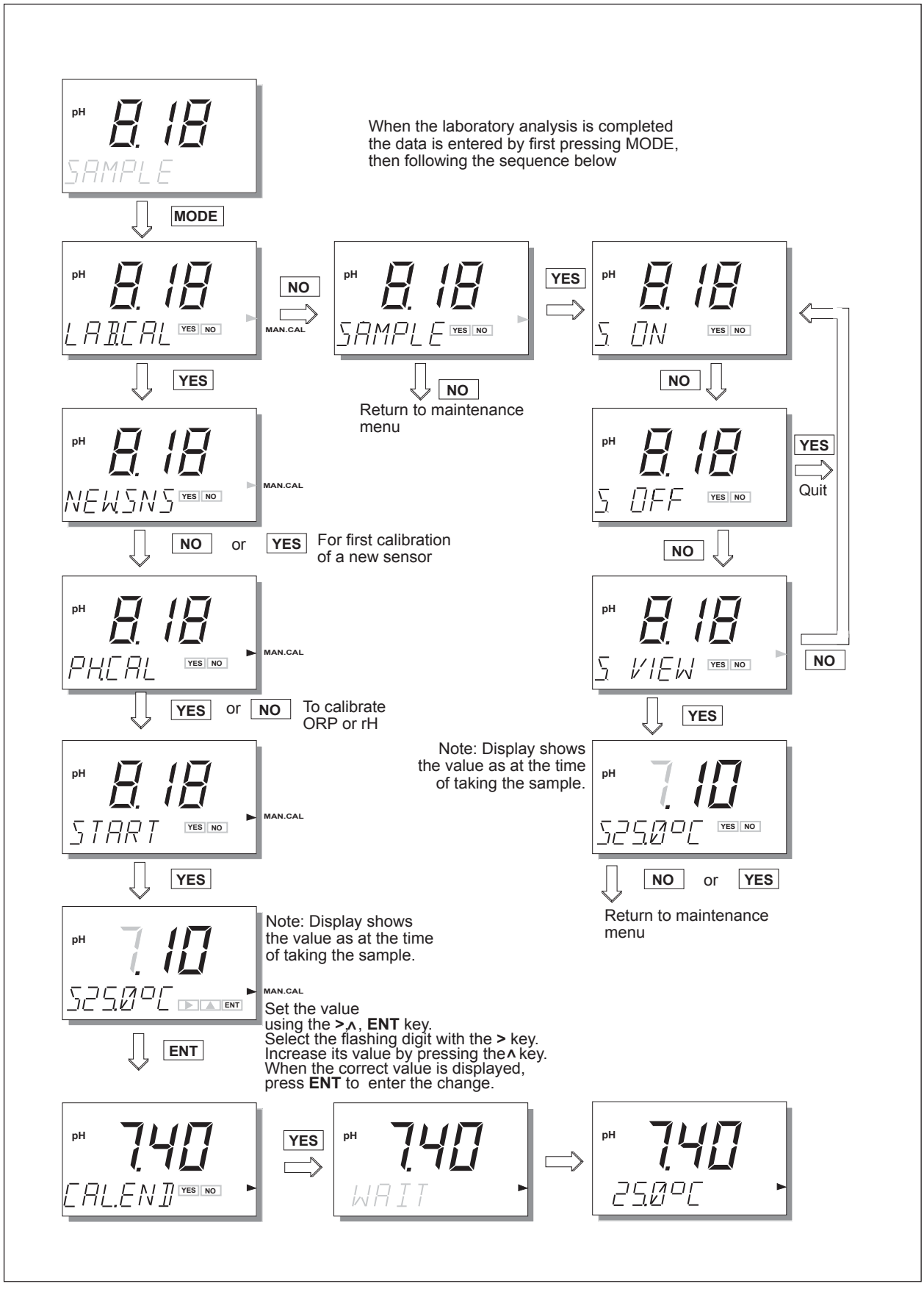




Press YES at the same time as taking sample for analysis.



PH 202 now continues to measure/control, as before. SAMPLE flashes to indicate that data is stored waiting for input of analyzed value.


When the laboratory analysis is completed the data is entered by first pressing MODE, then following the sequence below
pH 8.18 SAMPLE
MODE
pH 8.18 LABCAL YES NO
NO
MAN.CAL
pH 8.18 SAMPLE YES NO
YES
pH 8.18 S ON YES NO
NO
Return to maintenance menu
YES
pH 8.18 NEWSNS YES NO
MAN.CAL
pH 8.18 S OFF YES NO
Quit
NO or YES For first calibration of a new sensor
NO
pH 8.18 PHCAL YES NO
MAN.CAL
pH 8.18 S VIEW YES NO
NO
YES or NO To calibrate ORP or rH
YES
pH 8.18 START YES NO
MAN.CAL
Note: Display shows the value as at the time of taking the sample.
pH 7.10 S25.0°C YES NO
YES
NO or YES
Return to maintenance menu
pH 7.10 S25.0°C ▶ ▲ ENT
MAN.CAL
Note: Display shows the value as at the time of taking the sample.
Set the value using the >,∧, ENT key.
Select the flashing digit with the > key.
Increase its value by pressing the ∧ key.
When the correct value is displayed, press ENT to enter the change.
ENT
pH 7.40 CALEND YES NO
YES
pH 7.40 WAIT
pH 7.40 25.0°C

7. MAINTENANCE

7-1. Periodic maintenance for the EXA transmitter

The transmitter requires very little periodic maintenance. The housing is sealed to IP65, NEMA 4X standards, and remains closed in normal operation. Users are required only to make sure the front window is kept clean in order to permit a clear view of the display and allow proper operation of the push-buttons. If the window becomes soiled, clean it using a soft damp cloth or soft tissue. To deal with more stubborn stains, a neutral detergent may be used.

NOTE:

Never used harsh chemicals or solvents. In the event that the window becomes heavily stained or scratched, refer to the Customer Maintenance Parts Lists for replacement part numbers.

When you must open the front cover and/or glands, make sure that the seals are clean and correctly fitted when the unit is reassembled in order to maintain the housing's weatherproof integrity against water and water vapor. The pH measurement uses high impedance sensors and may otherwise be prone to problems caused by exposure of the circuitry to condensation.

The EXA analyzer contains a logbook feature which needs a clock to provide the timings. The EXA instrument contains a lithium cell (battery) to support the clock function when the power is switched off. This cell needs to be replaced at 5 yearly intervals (or when discharged). Contact your nearest Yokogawa service centre for spare parts and instructions.

7-2. Periodic maintenance for the sensor system

NOTE:

Maintenance advice listed here is intentionally general in nature. Sensor maintenance is highly application specific.

The sensor system must be kept clean to function well. This may require regular cleaning of the electrodes. (The effect of dirty electrodes will be to slow the system response and perhaps corrupt the measuring loop entirely). The frequency of cleaning and the method of cleaning will depend entirely on the process.

Where a refillable (flowing electrolyte) reference system is employed, make sure that the reservoir is kept topped up. The rate of electrolyte consumption will again be process dependent, so experience will show how often you must refill.

The periodic recalibration of the sensor system is necessary to ensure best accuracy. This takes into account the aging of the sensors, and the nonrecoverable changes that take place. These processes are slow, however. If frequent recalibration is needed, it is usually because the cleaning process is not effective, the calibration is not well executed or the pH readings are temperature dependent. Monthly calibrations should be sufficient for most applications.

If a film remains on the pH sensor after cleaning, or if the reference junction is partly plugged, then measuring errors can be interpreted as a need for recalibration. Because these changes are reversible with correct cleaning and/or proper selection or adjustment of the electrolyte flow through the junction, make sure that these items are correct before recalibrating the system.

7-3. Calibration procedures are described in step-by-step detail in chapter 6. However, follow these guidelines.

1. Before starting a calibration, make sure the electrode system is properly cleaned so that electrodes are fully functional. They must then be rinsed with clean water to avoid contamination of the calibration solution.
2. Always use fresh buffer solutions to avoid the possibility of introducing errors from contaminated or aged solutions. Buffers supplied as liquids have a limited shelf life, especially alkaline buffers which absorb CO_2 from the air.
3. Yokogawa strongly recommends NIST (primary) buffer standards in order to ensure the best accuracy and best buffer capacity is available. Commercially adjusted buffers (e.g. 7.00, 9.00 or 10.00 pH) are a compromise as a standard, and are often supplied without the temperature dependency curve. Their stability will be much worse than for NIST solutions.

NOTE:

NIST (formerly NBS) buffers are available as consumable items from any Yokogawa sales office under the following part numbers:

6C232 4.01 pH at 25°C}
6C237 6.87 pH at 25°C} A box contains 5 packets of powder. Each makes a 200 ml solution.
6C236 9.18 pH at 25°C}

8. TROUBLESHOOTING

The EXA is a microprocessor-based analyzer that performs continuous self-diagnostics to verify that it is working correctly. Error messages resulting from faults in the microprocessor systems itself are few. Incorrect programming by the user can be corrected according to the limits set in the following text.

In addition, the EXA also checks the electrodes to establish whether they are still functioning within specified limits. The transmitter checks the glass-electrode impedance for a low value to determine if it is broken or cracked, and for a high impedance to check for internal breakage or disconnection.

The reference system is prone to more faults than the glass electrode in general. The unit measures the impedance value and compares it to the programmed value in memory to determine acceptance during testing. A high impedance signals pollution or poisoning of the reference electrode diaphragm.

Also, the EXA checks the electrodes during calibration to determine if the reaction time is suitable for pH measurement. A specially timed check can be activated following each cleaning cycle. After calibration, the unit checks the calculated asymmetry potential and the slope to determine if they are still within limits specified by the software.

The slow shift of asymmetry potential could signal a poisoning of the reference electrode system by the process. The decrease of slope equals a decrease of sensitivity of the glass electrode or can show a coating buildup at the electrode.

The EXA makes a distinction among diagnostic findings. All errors are signaled by the FAIL flag in the display. Only faults in the measuring circuit can be set as HARD FAIL, with “Burn-up or Burn-down” signals on the mA output.

What follows is a brief outline of some of the EXA troubleshooting procedures, followed by a detailed table of error codes with possible causes and remedies.

NOTE:

The diagnostic function of the EXA gives a variable time interval between impedance checks, up to 5 minutes. When trouble shooting, a manual impedance check can be initiated by following the procedure in section 5-1-4.

8-1. Diagnostics

8-1-1. Off-line calibration checks

The EXA transmitter incorporates a diagnostic check of the asymmetry potential after a calibration has been completed. This is a valid check for both manual and automatic calibration routines.

The actual value can be called up from the DISPLAY routine in the maintenance menu. A large value often indicates poisoning or pollution of the reference system used. If the asymmetry potential exceeds programmable limits, the EXA generates an error (E2).

The EXA also performs diagnostics to check for the slope of the pH electrode after automatic calibration is completed. The actual value of the slope can be called up on the DISPLAY routine in the maintenance menu (SL). This value is an indication of the age of the electrode. If the value stays within the limits of 70 to 110 percent of the theoretical value (59.16 mV/pH at 25°C), it is accepted. Otherwise, the unit generates an error (E3).

Activation or deactivation of the asymmetry diagnostic check and slope check is made from the Service Codes. See Chapter 5 or Chapter 10 (Appendix).

8-1-2. On-line impedance checks

The EXA has a sophisticated impedance checking system. The sensors can be checked for their impedance over a very wide range, which makes the tool equally useful for glass, enamel, reference and metal (ORP) sensors. The measurement is temperature compensated for the characteristic of the pH glass sensor.

In order to measure accurately over such a wide range, it is necessary to split the range into two. This is done by a pair of jumper settings, high range and low range can be set on either input, making the system extremely flexible.

The following error message table gives a list of problems that are indicated when the high or low impedance limits are exceeded for a sensor. Such things as fouling, breakage and cable faults are readily detected. The non-immersion of the sensors in the process fluid is also signalled.

Table 8-1. Error Codes

Code	Error description	Possible cause	Suggested remedy
E0	Buffer solution temperature outside the programmed range	Buffer solution too hot or too cold	Adjust buffer temperature Check cabling
E1	Measurement failed to stabilize. during the calibration	Sensors fouled Sensors too slow (aged sensor)	Clean sensors Replace sensors
E2	Asymmetry potential too high. (Limits set in service code 21.)	Sensors are aged or polluted Mistake in calibration	Check buffer solution Recalibrate at pH7 Replace sensor
E3	Slope (sensitivity) is outside limits. (Limits set in service code 22.)	Measuring sensor aged Poor insulation at the connector	Replace measuring sensor Replace or dry cables
E4.1	Impedance of input 1 too low. (Limits set in service code 03.)	Measuring sensor broken Damaged or damp connections	Replace measuring sensor Replace or dry cable
E4.2	Impedance of input 2 too low. (Limits set in service code 04.)	Reference sensor broken Damaged connections	Replace reference sensor Replace cables
E5.1	Impedance of input 1 too high. (Limits set in service code 03.)	Measuring sensor disconnected Sensors not immersed in process Liquid earth disconnected	Check connections Check process Check connections
E5.2	Impedance of input 2 too high. (Limits set in service code 04.)	Reference sensor fouled Liquid earth disconnected Insufficient electrolyte	Clean or replace sensor Check sensor immersion Check electrolyte reservoir
E7	Temperature sensor open > 140°C (or <-10°C for 8k55)	Process too hot or too cold Wrong temperature sensor setting Temperature sensor damaged	Check process Check sensor & setting Check connections
E8	Temperature sensor shortened < -30 °C (or > 120 °C for 8k55)	Process too cold or too hot Wrong temperature sensor used Temperature sensor damaged	Check process Check sensor & setting Check connections
E9	Measurement out of range (-2 to 16 pH)	Sensors disconnected Sensor wrongly connected Sensor(s) defective	Check cabling Check cabling Replace sensor(s)
E10	EEPROM write failure	Fault in electronics	Try again, if unsuccessful contact Yokogawa
mA E11	Wash recovery check error (if communication is set to pH201*B in code 60)	Measuring sensor aged Sensor still coated after washing Defective wash system	Replace measuring sensor Check cleaning system If needed adjust timings
E12	ORP / rH outside of preset limits	Sensors disconnected or wrongly connected	Check cabling
E14	No valid calibration data.	Data lost after switching from pH to ORP	Recalibrate
E15	Cable resistance to temperature sensor exceeds limit value.	Cable resistance too high Corroded contacts Wrong sensor programmed	Use Pt1000Ω Clean and reterminate Reprogram
E16	Call for maintenance interval time exceeded.	System not maintained in preset time period	Perform maintenance Reset interval
mA E17	Output span too small < 1pH	Incorrect configuration by user	Reprogram
mA E18	Table values make no sense		
E19	Programmed values outside acceptable limits	Incorrect configuration by user	Reprogram
E20	All programmed data lost	Fault in electronics Very severe interference	Contact Yokogawa
E21	Checksum error	Software problem	Contact Yokogawa
E23	Zero point outside limits	Sensors are aged or polluted Mistake in calibration	Check buffer solution Recalibrate at pH7 Replace sensor

9. SPARE PARTS

See Customer Maintenance Parts List

10. APPENDIX

10-1. User setting table

FUNCTION		SETTING DEFAULTS		USER SETTINGS		
Parameter specific functions						
01	*PH.ORP	0	pH			
02	*PRM2	0	Off			
03	*Z1.CHK	1.1.1	High range, TC on check on,			
04	*Z2.CHK	0.0.1	Low range, TC off check off no TC			
05	*CAL.CK	1.1	AP on, Slope on			
Temperature functions						
10	*T.SENS	0	Pt1000			
11	*T.UNIT	0	°C			
12	*T.ADJ		None			
13	*T.COMP *T.COEF	0 -0.00	Off pH/10°C			
Calibration functions						
20	*Δt.SEC	5	Sec			
	*ΔPH	0.02	pH			
21	*AS.LOW	-120	mV			
	*AS.HI	120	mV			
22	*SL.LOW	70	%			
	*SL.HI	110	%			
23	*ITP	7.00	pH			
	*SLOPE	100.0	%			
	*ASP.1D	0.0	mV			
	*ASP.mV		mV			
24	*BUF.ID	4	NIST 4			
25	*BUF.ID	7	NIST 7			
26	*BUF.ID	9	NIST 9			
27	*ZERO.P	0	disabled			
mA outputs						
mA 31	*OUTP.F	0	pH (ORP)			
mA 32	*BURN	0	off			
mA 35	*TABLE	21 pt table	see code 31			

	FUNCTION		SETTING DEFAULTS	USER SETTINGS		
User interface						
50	*RET.	1	on			
51	*MODE	0	off			
52	*PASS	0.0.0	all off			
53	*Err.4.1	1	hard fail			
	*Err.5.1	1	hard fail			
	*Err.4.2	1	hard fail			
	*Err.5.2	1	hard fail			
	*Err.07	1	hard fail			
	*Err.08	1	hard fail			
	*Err.09	1	hard fail			
	*Err.11	0	soft fail			
	*Err.16	0	soft fail			
55	*CALL.M	0	250 days			
56	*DISP	1	0.01 pH			
Communication						
60	*COMM.	1.0	on/write ena.			
	*ADDR.	00	00			
61	*HOUR					
62	*ERASE					
General						
70	*LOAD					
79	*CUST.D					
Test and setup mode						
80	*TEST					

10-2. Configuration checklist for PH202G

	Standard Configuration	Options	Reference for change
Measured Variable(s)			
primary inputs	pH, ORP and Temp		
pH range	0-14 pH	any span within -2-16 pH	“output”
pH range linearized	disabled	21 point table	codes 31& 35
ORP range	-500 to 500 mV	spans up to 3000 mV between -1500 to 1500mV	“output”
Temperature range	-30-140°C		
Temperature unit	Celsius	Fahrenheit	code 11
mA Outputs			
analog output	4- 20 mA for pH	pH/ORP/(parameter 2)	code 01, 02, 31
output linearization	disabled	pH/ORP	codes 35
Communication			
digital interface	disabled	HART	60
communication software	external	HHC or PC202	contact factory
variables on display	pH/ORP and temp	pH/ORP, parameter 2, mA output SL, AP, Z1, Z2 etc.	“display”
burn out	disabled	burn low (3.6 or 3.9)/ high (21) on mA output	code 32
password protection	disabled	for maint/ comm./ serv level	code 52
autoreturn	return to measure in 10 min.	enable or disable	code 50
add. functions in MAINT	disabled	Impedance check start	code 51
Diagnostics			
impedance checking	active	enable or disable	code 03 & 04
check on calibration data	active	enable or disable	code 05
check on stability	0.02 pH per 5 s	choose stability level	code 20
display calibration log.	enabled with logbook	diagnostics setup	codes 03, 04 & 05
Compatibility			
pH or ORP	glass sensor/metal electrode	pH or ORP	code 01
temperature sensor	Pt 1000Ω	Pt1000; Pt100, etc	code 10
other sensors	enamel sensors (Pfaudler)	ITP & impedance check setup	codes 23, 03 & 04
2nd parameter	disabled	pH & ORP/ pH &rH	code 02
manual temp. comp.	disabled	disable or enable	“temp”
Special Features			
buffer table configuration	NIST standard	fully configurable	codes 24, 25 & 26
temperature calibration	none	adjustment +/- 20 °C	code 12
zero point calibration	disabled	disable or enable	code 27
call for maintenance		set time interval 1 - 250 days	code 55
HOLD during maintenance		hold last or hold fix	“hold”
process temp. compensation	disabled	set temperature coefficient	code 13
logbook	disabled	2 x 50 events	code 61, 62

10-3. Setup for sensor compatibility

10-3-1. General
The inputs of the EXA transmitter are freely programmable for ease of installation. Standard glass pH electrodes, Ag/AgCl reference electrodes and Pt100 and Pt1000 temperature sensors need no special programming. The EXA indicates a fault with a signal in the display field if there is a mismatch of sensors in the connection.

10-3-2. Selection of measurement and reference electrode
The EXA PH202 is preprogrammed to accept industry standard glass electrodes and reference electrodes. The unit initiates checks for asymmetry and slope during calibration. The on-line impedance checking function has been upgraded in this most recent EXA release.

The EXA is universally compatible with all types of electrodes, such as enamel and antimony. In such systems, however, the specific isothermal point of intersection (ITP), slope (pH/mV) and asymmetry potential can be set for the type of electrode.

10-3-3. Selecting a temperature sensor
The EXA PH202 reaches its highest accuracy when used with the Pt1000 temperature sensor. This element offers a 10-fold increase in resistance dependence over the Pt100 sensor. Choice of temperature sensor is made in the Service Codes found in Chapter 5 of this manual.

- **ITP**
  Most Yokogawa sensor systems use an Iso-thermal point (ITP) of pH7 and a zero point at pH7. This is the default condition for which the transmitter is set. It is only necessary to consider this adjustment when installing a system with a different ITP. Antimony systems and Pfaudler probes are good examples of systems with different ITP values. Service code 23 is used. This also permits the setting of calibration data for precalibrated sensors.

- **Temperature sensor**
  The Pt 1000Ω RTD sensor is now becoming the most commonly used for temperature compensation. The transmitter accepts inputs from several different temperature sensors to suit most sensor systems. Service code 10-19 are used to set the temperature parameters and the process temperature coefficient.

- **Temperature calibration**
  For best accuracy, the temperature sensor should be calibrated to compensate for connection cable errors. See Service code 12.

- **pH Calibration**
  Traditionally, users select buffer solutions to suit the chosen output range. This is merely a continuation of the days of analog instruments that used indicators driven by the mA output. With digital technology, it is better to choose good buffer solutions and make an effective calibration than to use commercial (adjusted) buffers which may have round number values, but are less effective buffers with lower buffer capacity. It is for this reason that Yokogawa recommends that the NIST 4, 7 and 9 standard buffers be used to calibrate solutions. The temperature responses of these are pre-programmed into Service codes 24, 25, and 26 in the EXA PH202. Where other buffers are used with the semi-automatic calibration function, their temperature response should be programmed into the relevant code.

10-4. Set up for other functions

mA • **Current outputs**
Transmission signals for the measured parameters and FAIL signals can be set up in service codes 31, 32 and 35.

• **Diagnostic Checks**
Impedance checks, response time and stability checks are all included in the PH202. In order to get the best performance from each of these features, the transmitter should be fine tuned according to experience in the installation, and for the particular sensors selected. Service codes 3, 4, 5 & 20 all contribute to the diagnostics. Please note that the default settings provide an excellent starting point and provide most valuable information about the performance of the electrode system.

mA • **Communications**
The proprietary HART (FSK) communication link allows remote configuration and data retrieval through the PC202 communication package. This is an excellent tool for the maintenance engineer, quality engineer or plant manager. Service codes 60-62 are used to set up the communications.

• **Logbook**
In combination with the communications link, a “logbook” is available to keep an electronic record of events such as error messages, calibrations and programmed data changes. By reference to this log, users can easily evaluate diagnostic information to determine predictive maintenance schedules. For example, by monitoring the deterioration in the slope of the pH sensor, it can be changed before a failure (or process shutdown) occurs.

10-5. Set up for Pfaudler Type 18 sensor

The PH202 is intended to measure with all sorts of pH sensors, including the Pfaudler Type 18 sensor. The Pfaudler design of dual membrane system uses two enamels of differing sensitivity. The first a pH sensitive membrane, and the second one that responds to Na^+ and K^+ and acts as a reference.

The analyzer has dual high impedance inputs which measure perfectly even with very high impedance sensors. However, the impedance measuring system (diagnostics) needs to be set up for best performance.

10-5-1. General set up

1. Set impedance measuring hardware. This is done by the use of links on the terminals adjacent to the input terminals. For the Pfaudler system, this means that the terminals should have the links disconnected in order to set for HIGH/HIGH impedance measuring.

2. Set the impedance check in software. Use codes 03 & 04 to enable the measurement and set for high impedance and configure appropriate limits.

Code 03 set to 1.0.1	low limit	1 Megaohm
	high limit	1 Gigaohm
Code 04 set to 1.0.1	low limit	1 Megaohm
	high limit	1 Gigaohm

3. Set the temperature compensation sensor as 100 Ohm Platinum RTD with service code 10.

   Code 10 set to 1 100 Ohms Pt.

   The system will now respond properly to the Pfaudler type 18 sensor, and the other functions of the EXA analyzer will need to be set in the normal way to suit the use to which the loop is being put. Output ranges, control functions and alarms should all be set as described elsewhere in this manual.

10-5-2. Calibration set up

4. The alternative Zero point (calibration and display) according to IEC 60746-2 may be enabled in service code 27, and set in the MAN.CAL routine. A value of 10.5 pH is a good starting point for the Pfaudler 18 sensor.

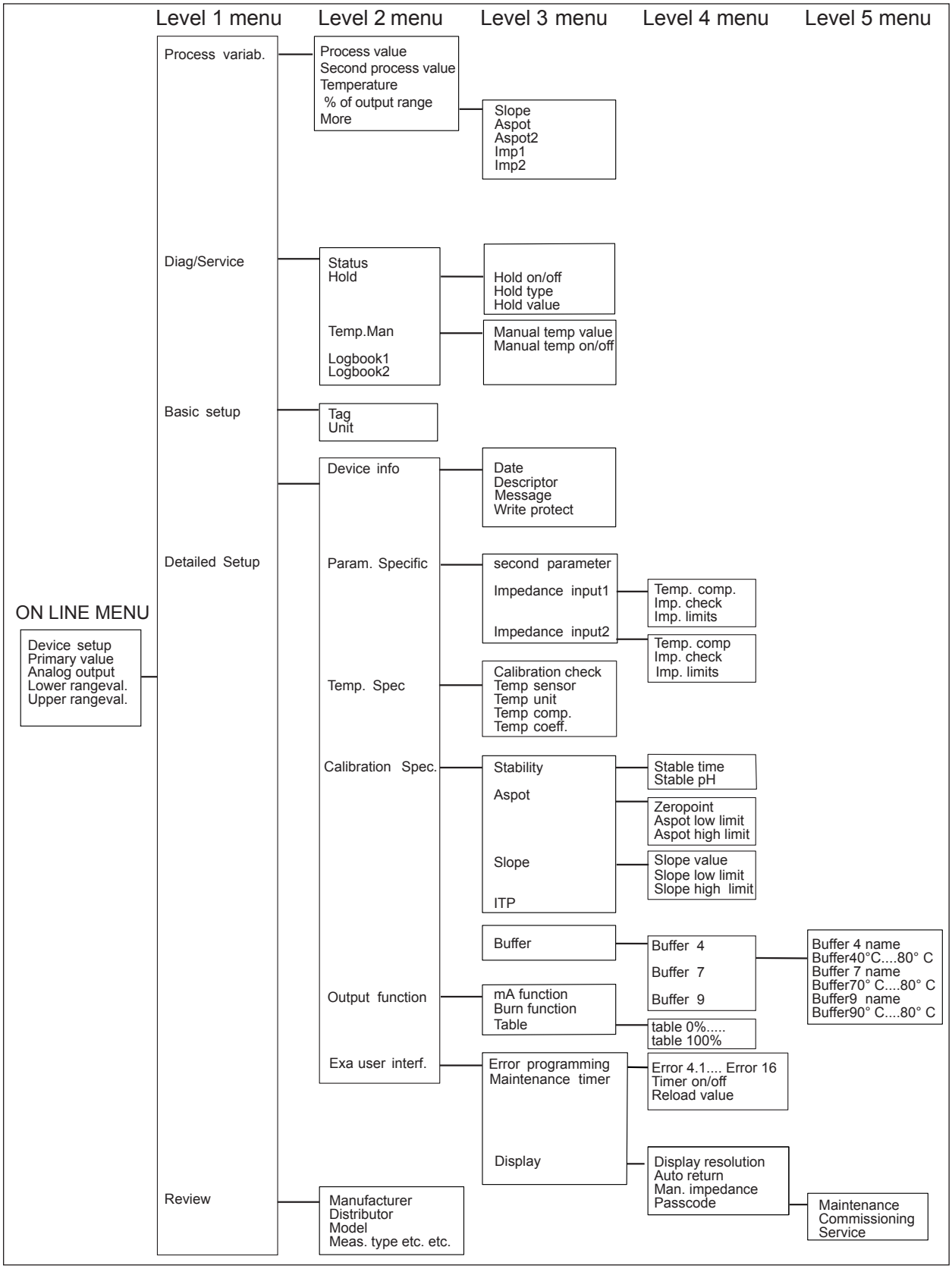
5. Where lab test data are available for the sensor, service code 23 can be used to set values for ITP & Slope (and As pot for parameter 2 when enabled).

(This method can be useful for the type 18 sensor, as it is not usual to perform regular calibrations on this system as with normal sensors. This is because the system may well respond differently, to ordinary buffers, than with the process solutions. The procedure is to determine the temperature response (ITP) and the sensitivity (Slope) of the sensor, and enter these values in code 23.)

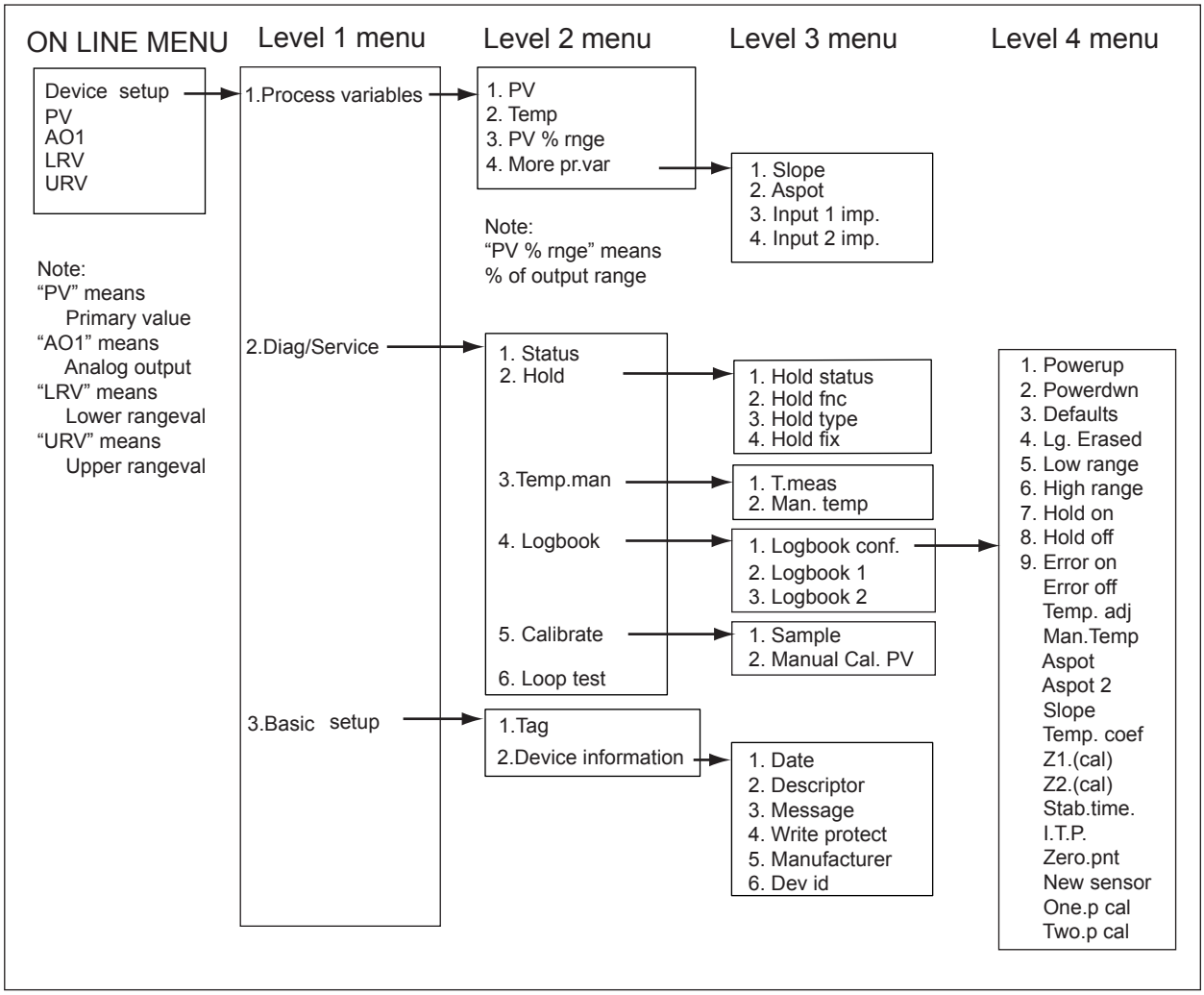
Because this is a rather complex procedure, it is recommended instead to use the default settings of ITP = 7.00, and Slope = 100 %, and make a single point (MAN.CAL) calibration in the process at the working temperature, and at the normal operating (control setpoint) pH. This ensures that the desired control point will be measured accurately, even if there may be small deviations when there is a big deviation from the setpoint. This of course has no effect on the accuracy of a control loop. The special construction of the Pfaudler sensor ensures that there is practically no drift in the calibration. All that is necessary is to keep the sensor membranes clean. This is best done by cleaning with low pressure steam, which restores the original condition of the sensor, including the original calibration values.

mA **10-6. Device Description (DD) menu structure**

The Device Description (DD) is available from Yokogawa or the HART foundation. An example is shown below of the ON LINE menu structure. This manual makes no attempt to explain the operation of the Hand Held Terminal (HHT). For detailed operating instructions, refer to the HHT user's manual and the on-line help structure. For menu structure of HHT 375, see next page.



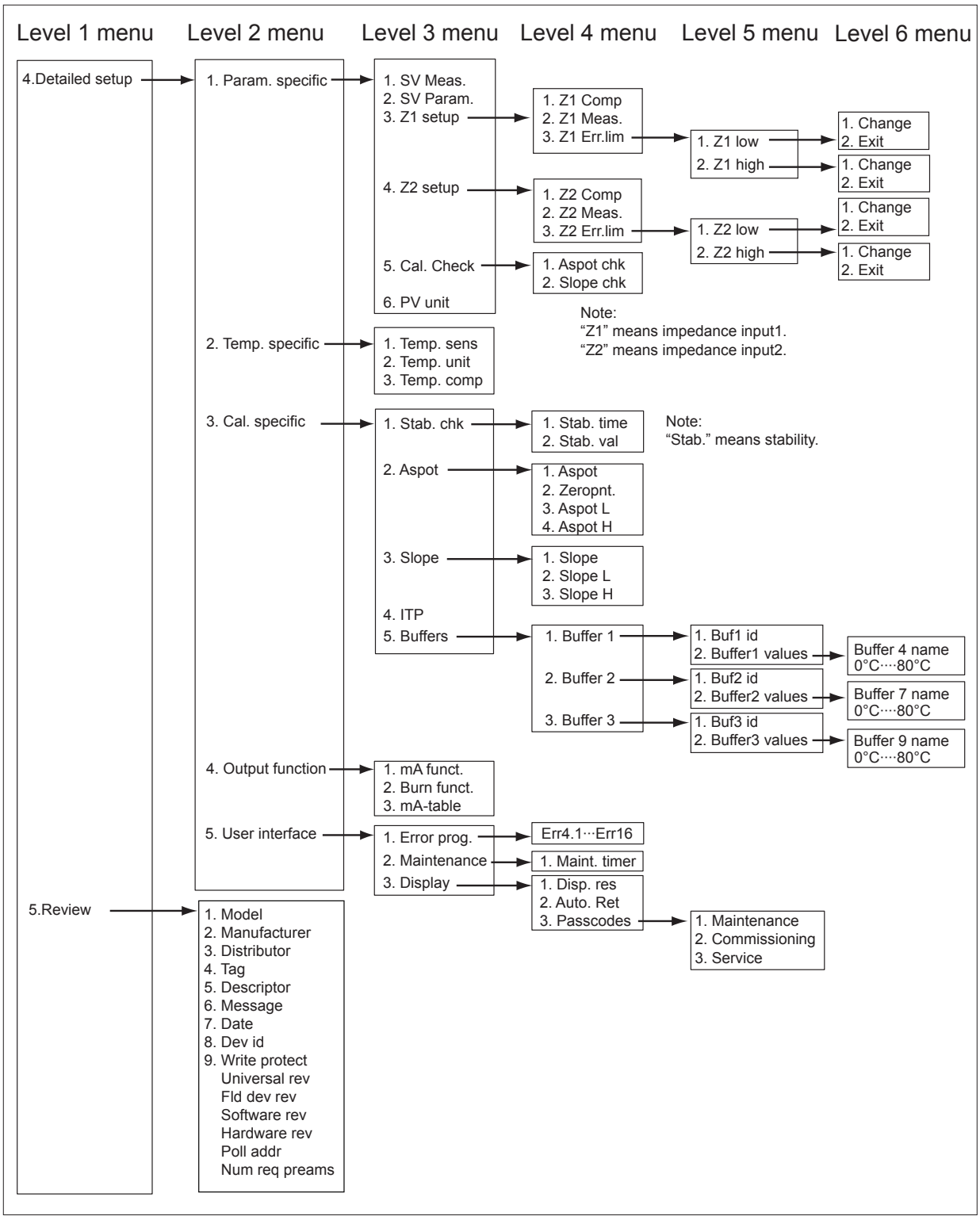
Menu structure for HHT 375 shown below.



(Note): HART protocol DD files can be downloaded by following URL.
http://www.yokogawa.com/an/download/an-dl-fieldbus-001en.htm

Continued next page

(Continued)


Level 1 menu
Level 2 menu
Level 3 menu
Level 4 menu
Level 5 menu
Level 6 menu
4.Detailed setup
1. Param. specific
1. SV Meas.
2. SV Param.
3. Z1 setup
1. Z1 Comp
2. Z1 Meas.
3. Z1 Err.lim
1. Z1 low
2. Z1 high
1. Change
2. Exit
1. Change
2. Exit
4. Z2 setup
1. Z2 Comp
2. Z2 Meas.
3. Z2 Err.lim
1. Z2 low
2. Z2 high
1. Change
2. Exit
1. Change
2. Exit
5. Cal. Check
1. Aspot chk
2. Slope chk
6. PV unit
Note:
"Z1" means impedance input1.
"Z2" means impedance input2.
2. Temp. specific
1. Temp. sens
2. Temp. unit
3. Temp. comp
3. Cal. specific
1. Stab. chk
1. Stab. time
2. Stab. val
Note:
"Stab." means stability.
2. Aspot
1. Aspot
2. Zeropnt.
3. Aspot L
4. Aspot H
3. Slope
1. Slope
2. Slope L
3. Slope H
4. ITP
5. Buffers
1. Buffer 1
2. Buffer 2
3. Buffer 3
1. Buf1 id
2. Buffer1 values
1. Buf2 id
2. Buffer2 values
1. Buf3 id
2. Buffer3 values
Buffer 4 name
0°C····80°C
Buffer 7 name
0°C····80°C
Buffer 9 name
0°C····80°C
4. Output function
1. mA funct.
2. Burn funct.
3. mA-table
5. User interface
1. Error prog.
Err4.1···Err16
2. Maintenance
1. Maint. timer
3. Display
1. Disp. res
2. Auto. Ret
3. Passcodes
1. Maintenance
2. Commissioning
3. Service
5.Review
1. Model
2. Manufacturer
3. Distributor
4. Tag
5. Descriptor
6. Message
7. Date
8. Dev id
9. Write protect
Universal rev
Fld dev rev
Software rev
Hardware rev
Poll addr
Num req preams

Glossary

pH (-log [H+])

This is a logarithmic function of the Hydrogen ion activity (concentration). This provides a quick indication of the acidic or alkaline behavior of a dilute solution. Normally measured on a scale of 0-14 pH where low numerical values are acidic (0 is approximately 1 Normal acid) and high numbers are alkaline (14 is approximately 1 Normal NaOH). The neutral point is pH 7.
Defined by Nernst in the following equation: E = Eo + RT/nF x Ln [H+]

E = measured potential
R = gas constant
T = absolute temperature
n = valence
F = Faraday number
Ln = Napierian logarithm
[H+] = activity of the Hydrogen ion
Eo = Reference potential

ORP

Oxidation reduction potential is a measure of oxidizing power of a solution. The greater the milli Volt value with a negative polarity, the greater the oxidizing power. Reducing power is indicated by positive values of mV.

rH

This is a composite value that indicates the oxidizing power of a solution compensating for the influence of the acid or alkaline components. The scale is 0-55 rH, where oxidizing solutions provide the highest readings.

Asymmetry potential

This is the difference between the isothermal point of intersection and the zero point.

Slope

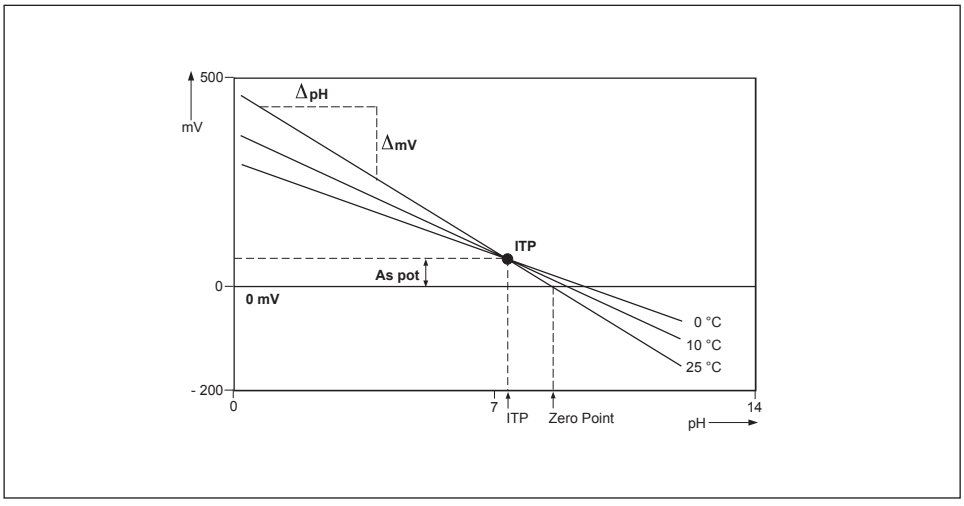
This is the sensitivity of the pH electrode (mV/pH) usually expressed as a % of the theoretical value (Nernst).

ITP

This is the isothermal point of intersection. This is the value in pH at which the temperature response of the system is at a null point. In other words, the point of intersection of the temperature lines on a graph of milli volts vs pH. This point is critical to the correct operation of the temperature compensation circuitry.

Zero point

This is the value of pH at which the electrode combination yields 0 mV as an output.



11. APPENDIX 2

11-1. Preface

Feasible combinations of the PH202G pH/ORP transmitters with different styles of the PH201G distributor are listed in the table below. The distributor has the usual distributor functions (supply power to transmitter, receive current output from transmitter, and provide analog output) as well as contact output functions (maintenance, wash and fail status signals). Since the two transmitters provide different digital signals to control the distributor contact outputs, two distributor styles are provided for compatibility. The PH202G is not intrinsically safe (explosionproof), so never install it in a hazardous area.

Conductivity transmitter PH202G	Use of Distoributor PH201G		Refference
	No use of contact output	Use of contact output	
	Style A & Style B possible	Only Style B possible	Non-Explosionproof type

T1.eps

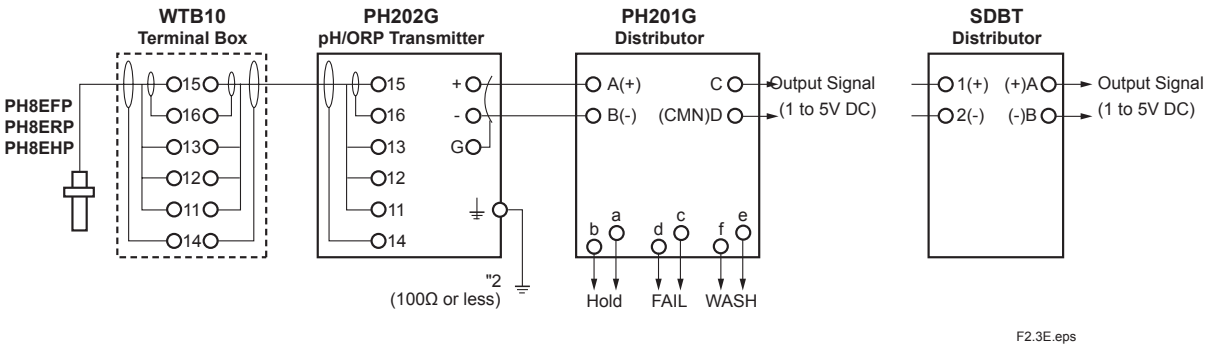
For information about instruments related to the PH202, refer to the following Instruction Manuals.

Manual Name	IM No.	Instruments mentioned
pH sensor & holders for general purpose	IM 12B7K1-02E	PH8ERP KCl Refillable pH sensor
	IM 12B7J1-01E	PH8EFP KCl Filling type pH sensor
	IM 12B7M2-01E	PH8HG Guide-pipe
	IM 12B07M01-01E	PH8HS, PH8HSF Submersion type holder
	IM 12B07N01-01E	PH8HF, PH8HFF Flow-through type holder
	IM 12B07W03-01E	PH8AX Accessories
ORP sensor for general purpose	IM 12C07J01-01E	OR8EFG KCl filling type ORP sensor
	IM 12C04K01-01E	OR8ERG KCl Refillable ORP sensor
	IM 12C04W02-01E	OR8AX Accessories
pH sensor & holder for pure water	IM 12B7J2-01E	PH8EHP pH sensor for pure water
	IM 12B07P01-01E	PH8HH holder for pH sensor for pure water
pH electrode & holder for fermentation use	IM 12B7Q1-11E	Y/465 pH sensor for fermentation use
Terminal box	IM 19D01B01-01E	WTB10-PH1, WTB10-PH2 Terminal Box
Ultrasonic oscillator	IM 19C1B3-01E	PUS400G Ultrasonic Oscillator
	IM 12B5U2-E	PH8USF (Explosionproof type)
PH201G distributor (Style B)	IM 19B01E04-02E	PH201G (style B) Distributor
SDBT, SDBS distributor	IM 1B4T1-01E	SDBT, SDBS Distributor
Attachment rack instrument	IM 1B4F2-01E	Instruments for rack attachment
HA405 pH sensor	IM 12B07E01-01E	HA405 Solid electrolyte (Xerolyt®)
HA406 pH sensor	IM 12B07E02-01E	HA406 Solid electrolyte (Xerolyt®) with temperature element
DPAS405 pH sensor	IM 12B7G1-01E	DPAS405 pH sensor for small culture tanks
DPA405 pH sensor	IM 12B07H01-01E	DPA 405 pH sensor for chemical process
DPA406 pH sensor	IM 12B07H02-01E	DPA 406 pH sensor for chemical process with temperature element
FU20 pH sensor	IM 12B07K02-01E	FU20 pH/ORP electrode
HF405 pH sensor	IM 12B07L01-01E	HF405 Hydrofluoric Acid-resistant pH sensor
BARD Safety Barrier	IM 01B04S10-01E	Model BARD-800 Safety Barrier
2-wire pH/ORP Transmitter	IM 12B07D02-01E	PH202G/PH202S 2-wire pH/ORP Transmitter

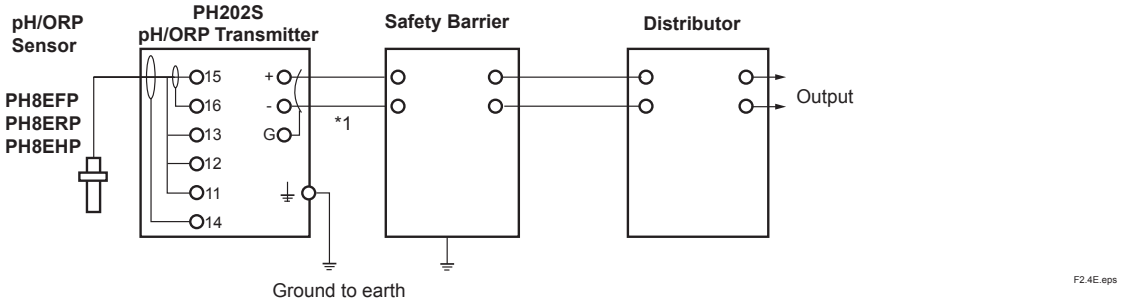
T2.eps

11-2. Wiring diagrams

11-2-1. Example of Non-Explosionproof System



11-2-2. Example of Intrinsically Safe Explosionproof System



*1: Use a 2-conductor shielded cable with an outside diameter of 6 to 12 mm. Shield must be connected to internal terminal G of transmitter and left unconnected at the other side.

*2: Transmitter must be grounded using external terminal: for general purpose version ground resistance of PH202G should not exceed 100V (Japanese Class D grounding) .

⚠ WARNING

Use an appropriate DC power supply (such as from the PH201G distributor) for the PH202 transmitter. Under no circumstances should you connect AC power such as 100V AC or similar AC power supply line. To measure pH or ORP in hazardous locations, use the PH202S or PH202SJ with intrinsic safety barriers.

Grounding:

Be sure to ground the transmitter by using the ground terminal on its case.

Connect the G terminal inside the transmitter, to the shield wire of two-core shield cable which is conneced between the distributor and transmitter.

For the PH202G transmitter (this does not apply to the PH202S) if you cannot ground the G terminal on the transmitter case then connect this G terminal to the shield of the two-wire cable connecting the transmitter and distributor, and ground it at the distributor end.

11-3. Sensor wiring

Refer to Figure 11-1 and 11-2, which includes drawings that outline sensor wiring.

The PH202 can be used with a wide range of commercially available sensor types, both from Yokogawa and other manufacturers. The sensor systems from Yokogawa fall into two categories; the ones that use a fixed cable and the ones with separate cables.

To connect sensors with fixed cables, simply match the terminal numbers in the instrument with the identification numbers in the instrument on the cable ends.

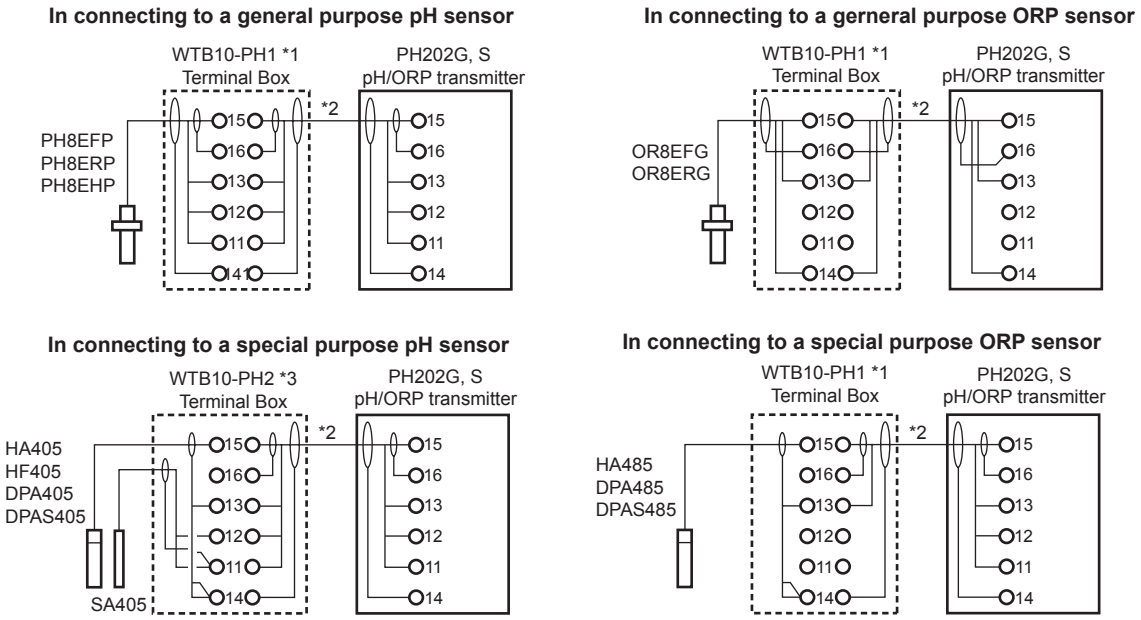
The recommended procedure is to color-code each end of the cables to match the sensors with the color strips provided with each cable. This provides a quick way to identify the ends of the cables belonging to a particular sensor when they are installed.

(The procedure for fixing the identification labels is described in detail in the instruction sheet provided with the cable.)

11-3-1. Connection cable

To connect the other sensor systems, follow the general pattern of the terminal connections as listed below:

11 & 12	Temperature compensation resistor input (Pt100, Pt1000, 3kΩPTC, 5.1kΩPTC, 8.55kΩNTC, 350ΩPTC, 6.8kΩPTC, 10kΩPTC)
13	Input no. 2 (normally the reference element)
14	Liquid earth (solution ground) connection
15	Input no. 1 (normally the measuring element)
16	Screen (shield) for input no. 1
17	Screen (shield) for input no. 2



*1 : Terminal Box is used only when pH/ORP transmitter is installed far from the cable length of pH/ORP sensor.
*2 : The cable is specified by an option code of the terminal box.
*3 : Use the box in combining PH202 with SA405.

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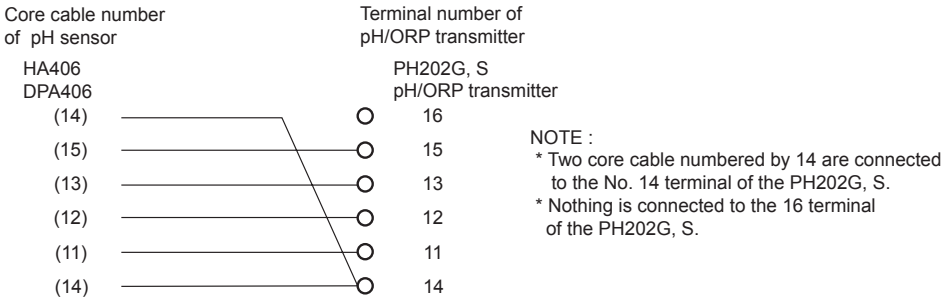
Figure 11-1 Wiring of a sensor

In connection of the PH202G, S and a special purpose pH sensor having temperature element



In connection of the PH202G, S and FU20 pH/ORP sensor

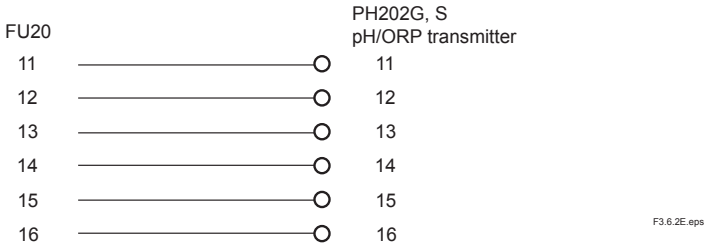


Figure 11-2 Optional Sensor wiring

NOTE:

When PH202.../TB option specified for using the sensor with folk terminal —for PH200/PH400, OR200/OR400 type—. Use the cable gland within the transmitter. For wiring, refer to right figure .

pH sensor		ORP sensor	
GE	15 (Red)	GE	15 (Red)
RE	13 (Brown)	RE	13 (Brown)
T1	11 (Black)	SE	14 (Black)
T2	12 (White)	G	16 (Green)
SE	14 (Green)		
S	16 (Yellow)		

Cables, terminals and glands

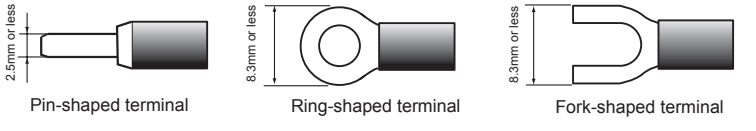
For the PH202G, PH202SJ use cable of outside diameter 6 to 12 mm. When using individual electrodes -- glass electrode, reference electrode -- and separate temperature sensor, rather than an all-in-one sensor, use the circular packing with four holes. Plug the unused hole in the packing with the black plug. When using this packing, you have to be careful to ensure that it is well enough sealed to be waterproof.

Requirement of connecting with external instruments

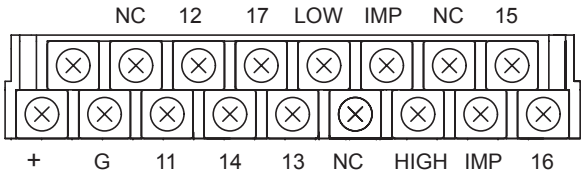
	Terminal for pin cable terminal	Screw terminal (option /TB)
Crimp contact for cable	Pin-shaped crimp contact with sleeve insulator	Ring-shaped or fork-shaped crimp contact
Usable contact	max. 2.5 mm	Crimp contact shown as the figures under this table, which meets M3 screw
Torque for fixing	0.5 N·m or less	1.35 N·m (recommended)
Example of crimp contact*	Weidmuller Co., Ltd. made: H0.34/10, H0.5/12, H1/12, H1.5/12S	JST, Mfg. Co., Ltd. made: VD1.25-3 (Ring shape), VD1.25-S3A (Fork shape)

*Note: Other crimp contact may be required , depending on core-cable diameter .

T3.2E.eps



When the option of the screw terminal "/TB" is specified, the terminal block layout is as follows.



Note: Nothing is connected to NC F3.8E.eps

When a pH sensor is used, connect both terminals LOW and IMP on the upper row with a shorting bar and nothing to both terminals HIGH and IMP on the lower row.
When an ORP sensor is used, connect both terminals LOW and IMP on the upper row with a shorting bar as well both terminals HIGH and IMP on the lower row with another one.

11-3-2. Sensor cable connection using terminal box

If you can't install a sensor close to the PH202 transmitter, you may need to connect to an intermediate terminal box (WTB10-PH1, -PH2) and use an extension cable. You should order these from Yokogawa, as these Yokogawa parts are specially designed so that system specifications will be met. The total cable length (for 5 m electrode cable plus 15 m extension cable) may be up to 20 m. Refer to Figure 11-1 for the wiring.

11-4. PH201G*B Dedicated Distributor

The PH202 supports proprietary bidirectional serial communications with the PH201G (Style B) for remote maintenance, washing and remote diagnostic purposes. This allows PH202 status (under maintenance/abnormal) to be monitored remotely, and commands to be sent to an instrument for wash. Prepare for the instrument separately. Service codes 60 relates to communication settings.

11-4-1. Communication setup

Code 60 *COMM. The settings should be adjusted to suit the communicating device connected to the output. The communication can be set to HART or to PH201G (Style B) distributor. When used with our PH201G (Style B) you can enable or disable contact outputs, namely, Fail contact and Hold contact. The PH201G (Style B) can output Hold contact and Fail contact signals. You can set Service Code 53 to “0” for “soft fail” to disable.

Fail contact output. When you set Service Code 53 to “1” for “hard fail”, set Service Code 60 to “2.0” to enable Fail contact output of PH201G (Style B), or set Service Code 60 to “0.1” to disable Fail contact output of PH201G (Style B).

*ADDR. Select address 00 for point communication with 4-20 mA transmission. Addresses 01 to 15 are used in multi-drop configuration (fixed 4 mA output).

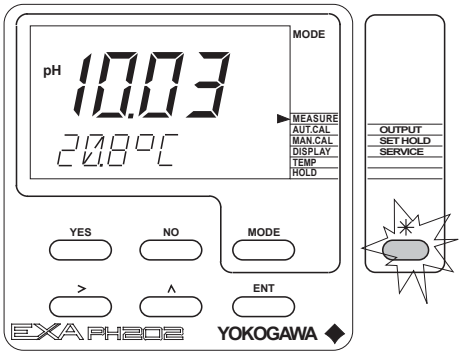
Code	Display	Function	Function detail	X	Y	Z	Ddefault values	
Communication								
60	*COMM	Communication	Set communication Off	0			1.0(*)	Off
			Set communication On	1				
			write enable		0			
			write protect		1			
			Set communication PH201G*B	2				
			Without half time check by setting 2.0		0			
			With half time check by setting 2.1		1			
	*ADDR.	Network address	Set address 00 to 15				00	

(*) Valid for instrument using software version 3.1 or later. T5.3.6.eps

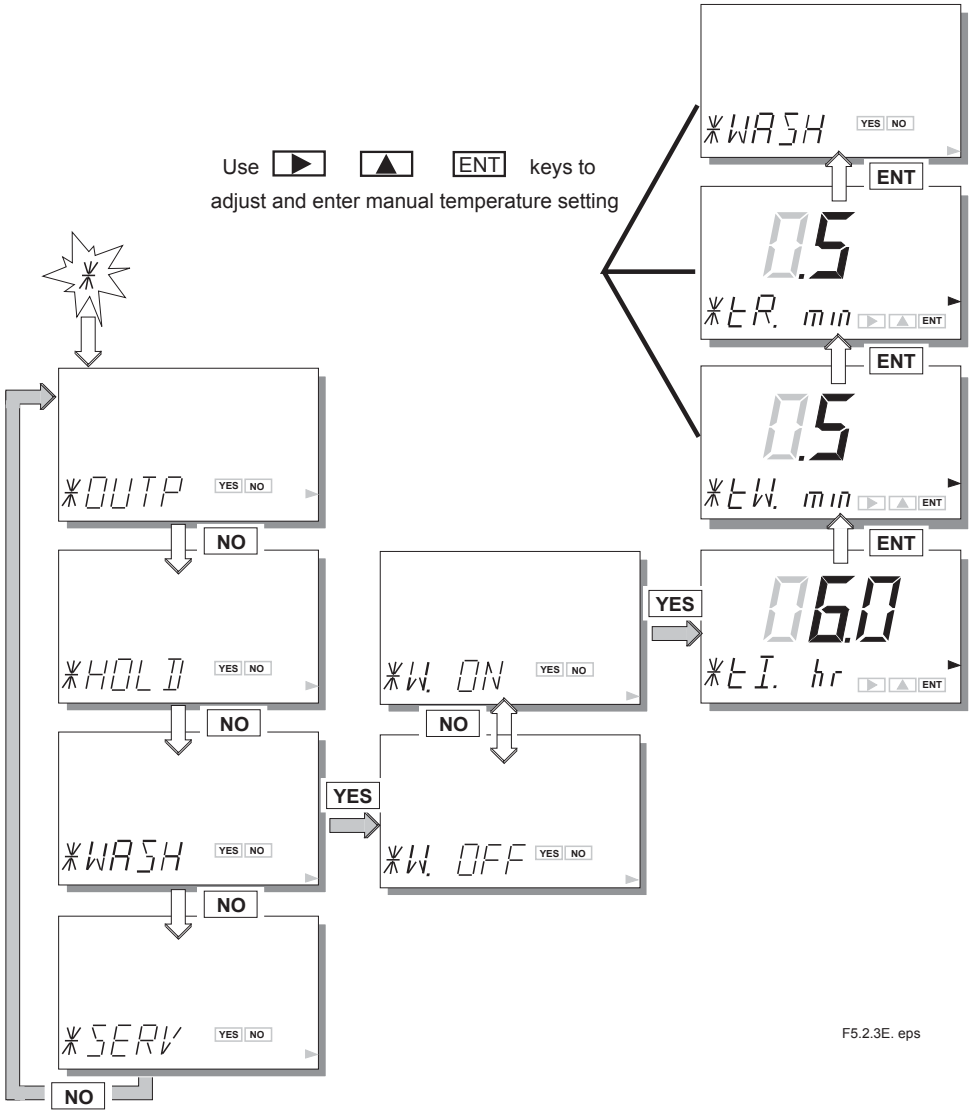
For earlier versions the default is 0.1.

11-4-2. The setting of sending WASH signal (*WASH)

*WASH Commissioning mode has the setting ability of sending signal for WASH output contact to the PH201G distributor (style B). Converning to On/Off WASH selection, when selecting "On", wash period, wash time and retention time (waiting time after wash) should be set.



To apply wash function, use the PH201G (styleB), and “2.0” or “2.1” at the service code 60 must be set.



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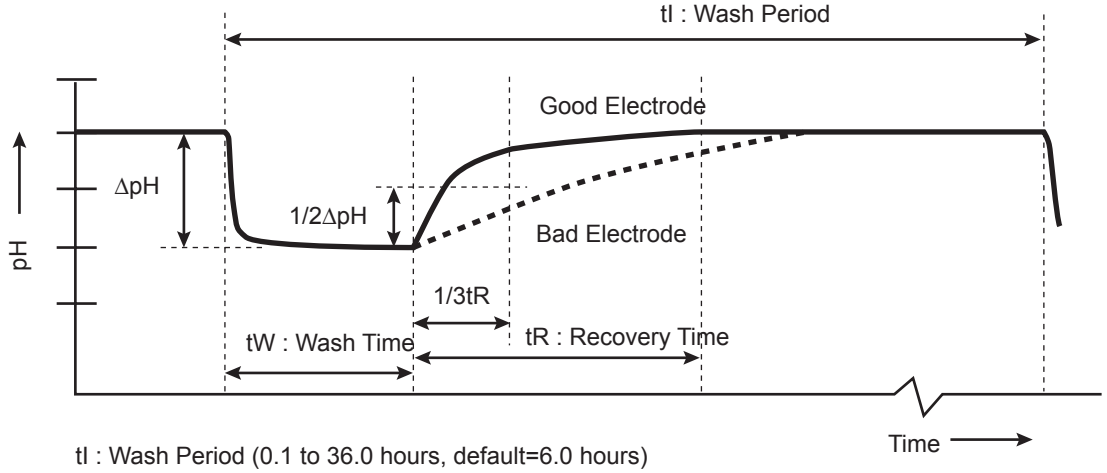
The contact output for wash can be controlled by sending wash siganals. This function is available with the PH201G (style B). Control the contact output in combination of the PH202 and the PH201G (style B). Set communication setting of the PH201G at the Service Code 60 of PH202.
You can individually set the wash period "interval between wash cycles", tI; the wash time "length of the wash phase", tw; and the recovery time, tR.

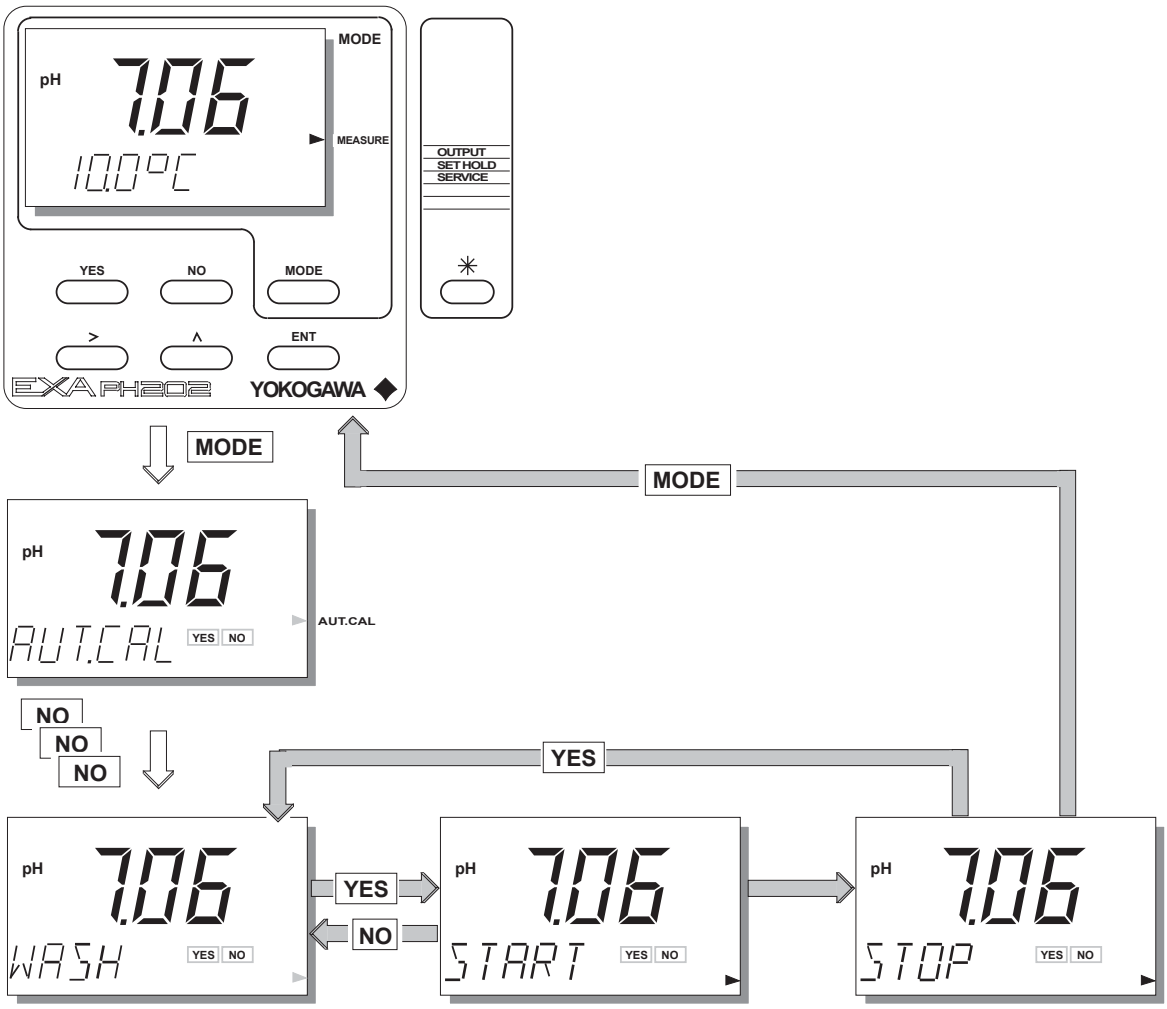
You can individually set the wash period "interval between wash cycles", tI; the wash time "length of the wash phase", tw; and the recovery time, tR
During the recovery phase of the wash cycle, the detector checks if the sensor response is sluggish -- the detector checks if the time to recover half the wash-cycle pH change (1/2ΔpH) is within one third of the recovery time (1/3tR) setting -- to determine if the sensor requires manual cleaning or is near the end of its useful life. Determine the recovery time setting accordingly. To disable this check, you need to set service code 60 accordingly.
The wash cycle pH change is ΔpH, the difference between the pre-wash pH and the pH during the wash.
If the difference between the normal pH value in process and the pH during the wash is small, then half the difference (1/2ΔpH) will be too small to measure reliably, so this check should be disabled in this case. The monitoring of waste water pH is an example of such an application.
If you select water jet cleaning in such a case, the normal pH as well as the washingtime pH will be around pH7; the difference will be approximately zero, too small for the recovery time check to measure, so the recovery time check will not work normally and should be disabled.



tI : Wash Period (0.1 to 36.0 hours, default=6.0 hours)
tW : Wash Time (0.1 ... 9.9 minutes, default : 0.5 minutes)
tR : Recovery Time (0.1 ... 9.9 minutes, default : 0.5 minutes)

F5.0.eps

11-4-3. How to output manual wash signal



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Note : Wash functuon is only avairable when using the PH201G(style B) distributor.
In using the function, it is necessary to set 2.0 or 2.1 at service code 60, enabling the PH202 to communicate with the PH201G (Style B).
In addition, set the wash function on, enabling wash function (*WASH.ON) on parameter setting.
In this time, ► on the LCD shows because "Wash" isn't made on MODE of the text plate.

11-4-4. Setting of errors (FAIL contact)

Code 53 *Err.4.1-*Err .16 (9 items)

These set how errors are notified to the user. Either of two modes can be set. "Hard Fail" mode lights the "FAIL" indicator on the LCD panel. When "enable status output contact" is set for the PH201G distributor (Style B), the FAIL contact remains closed and the "wash" contact stops operating. If Burnout functions are enabled by Code 32, then the output becomes Burnout Upscale or Burnout Downscale.

"Soft Fail" mode blinks the "FAIL" indicator on the LCD panel. When "enable status output contact" is set for the PH201G distributor (Style B), the FAIL contact pulses and the "wash" contact and maintenance contact continue to operate normally. In "Soft Fail" mode, notification that "periodic maintenance is due" still functions (service code 55) so – for this reason – it is better to set "Soft Fail" mode than "Hard Fail" mode.

Code	Display	Function	Function detail		X	Y	Z	Ddefault values	
User interface									
53	*Err.4.1	Error setting	Impedance low (input 1)	Soft fail	0				
			Impedance low (input 1)	Hard fail	1			1	Hard
	*Err.5.1		Impedance higt (input 1)	Soft fail	0				
			Impedance high (input 1)	Hard fail	1			1	Hard
	*Err.4.2		Impedance low (input 2)	Soft fail	0				
			Impedance low (input 2)	Hard fail	1			1	Hard
	*Err.5.2		Impedance higt (input 2)	Soft fail	0				
			Impedance high (input 2)	Hard fail	1			1	Hard
	*Err.07		Temperrature too high	Soft fail	0				
			Temperrature too high	Hard fail	1			1	Hard
	*Err.08		Temperrature too low	Soft fail	0				
			Temperrature too low	Hard fail	1			1	Hard
	*Err.09		pH out of range	Soft fail	0				
			pH out of range	Hard fail	1			1	Hard
	*Err.11		Wash recovery check	Soft fail	0			0	Soft
			Wash recovery check	Hard fail	1				
	*Err.16		Call for maintenance	Soft fail	0			0	Soft
			Call for maintenance	Hard fail	1				

T5.3.5E.eps

11-5. Calibration in ORP Mode

For an ORP meter, unlike the case for a pH meter, there is no predefined "standard solution" that you must use for calibration. For an ORP meter, normal maintenance is limited to a check of the electrodes. Electrode checks and calibration are performed in the following circumstances:

Electrode Check

* When you change the ORP sensor, or when you stop continuous operation.
* When you wash the sensor tip or liquid path of the ORP sensor.

Calibration

* When the electrode potential is out of limits.
* When you want two or more ORP meters to read as near as possible to the same value.

Note: There are two ways of calibrating the PH202 in ORP mode, but both are one-point calibration (zero shift).

1. Manual calibration (MAN.CAL) and
2. Calibration with sample (SAMPLE).

If you use the FU20 combination pH and ORP sensor, then you can calibrate ORP using the “2nd parameter” setting as per the section 6-5-3. Manual Calibration.

11-5-1 Electrode Check

To determine whether the ORP electrode is normal or not, a solution of known ORP is measured to check if the measured value is within tolerance (see Fig. 11-3). This is done in measurement mode.

Electrode test solution

A solution of known ORP (Oxygen Reduction Potential) is used. Usually quinhydrone or ferric chloride solution is used as the test solution.

Yokogawa sells the following chemicals for making test solution. The procedure for mixing solution is described below.

Quinhydrone salts (P/N K9024EC) and Ferrous & Ferric salts (P/N K9024ED)

Procedure for Electrode Test

You determine whether or not the ORP sensor is normal by measuring the ORP of a test solution of known ORP and determining if the measured value is within tolerance.

Before starting normal operation, when you need to check if the ORP sensor is normal or not, use the procedure below:

A solution of known ORP is measured to check if the measured value is within tolerance.

Here we describe how to mix test solutions using the quinhydrone salts supplied with the OR8AX accessory kit, or the ferrous salts that are sold separately by Yokogawa.

(1) Mix test solution

<To mix quinhydrone test solution>

Pour one packet of quinhydrone into a wide-mouth (250 ml) beaker and dissolve in pure water to make 250 ml of solution. If the pure water is cold, the powder will not completely dissolve and some may float on the surface, but this will not cause any problems in practice.

<To mix ferrous & ferric chloride test solution>

Pour one packet of the light purple or light green powder to a wide-mouth (250 ml) beaker and add a 2 mol/l solution of sulfuric acid to make 250 ml of solution. If you want to start with concentrated sulfuric acid, mix one packet of the powder with approximately 150 ml of pure water in a wide-mouth beaker then, stirring vigorously, add 14 ml of concentrated sulfuric acid. Top up with pure water to make 250 ml.

(2) Transfer about 50-100 ml of test solution to a clean 200 ml beaker.

(3) Remove the ORP sensor from its holder. If an immersion holder is used, first remove the holder then remove the (sensor) protector from the holder.

(4) Wash off any of the measured solution adhering to the sensor using tap water, then wipe off any moisture droplets adhering to the sensor.

(5) Immerse the sensor tip in the test liquid (see (2.) above), wait for the ORP reading to stabilize (this typically takes 5 to 10 minutes).

(6) After the display reading has stabilized, read and note it. Measure the temperature of the test solution, and check the ORP of the test solution at that temperature using Fig. 11-3.
If the ORP reading is within the tolerance shown in Fig. 11-3 then the sensor is normal.
Note: If the measurement value is only slightly out of tolerance, you should check whether the test solution was fresh and whether it was mixed in the correct amounts (see mixing instructions above).

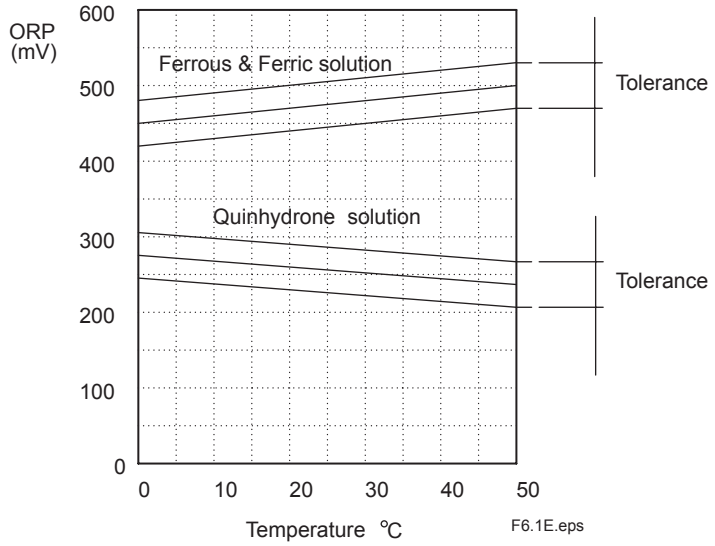


Fig. 11-3 ORP of Test Solution

(7) Replace the sensor in its holder.

⚠ WARNING

Be careful to make sulfuric acid solution.

11-5-2. Manual Calibration

The procedure for calibration is described in 11-5-5 (1).
Calibration is performed by using a solution of known ORP value, and adjusting the PH202 to read the same value. Alternatively you may calibrate the PH202 to read the same as another 'standard' instrument in a given solution. The electrode check described in 11-5-1 above is performed if the measured value appears to be well out of tolerance. Calibration of the ORP value is performed by zero-shift one-point calibration.

11-5-3. Calibration with Sample

The procedure is described in 11-5-5 (2).
Calibration with a sample enables measuring a representative sample (e.g. by laboratory analysis) while the ORP sensor is on line and measuring the same sample solution, saving the measured data in the memory of the PH202, and then adjusting the PH202 to read the same value (as obtained e.g. by laboratory analysis). So normal on-line control or pH measurement is not affected. The ORP measurement is calibrated by zero-shift one-point calibration.

11-5-4. Data Entry

If the above methods of calibration present problems, another alternative is the direct entry of calibration data using the Service Code Menu (refer to Chapter 5). For example, the sensor may be calibrated in a test laboratory and then transported to its location in the field and the sensor parameters entered into the associated PH202.
Service Code 23 allows you to access and enter ITP, Asymmetry Potential (or Zero Point) and Slope parameters.

11-5-5. Calibration Procedure

(1) Manual Calibration

This involves calibration by direct entry of ORP sensor zero offset.

1) Press the MODE key.
2) MAN.CAL is displayed. (If you press NO then you will proceed to calibration with sample).
3) Press YES.
4) NEW.SNS is displayed, asking if you wish to change the sensor parameters as for a new sensor.
5) If you press YES then the existing calibration data stored in PH202 memory is deleted. If replacing the sensor is not desired, press NO.
6) In either case, ORP.CAL is displayed.
7) If you press YES then START is displayed, and you should immerse the sensor in the test solution. (If you press NO then you will proceed to Calibration with Sample − see (2) following).
8) Next press YES again then 0000 mV is displayed, so enter a suitable zero offset value and press ENT. CAL.END is displayed.
9) Press YES and WAIT is displayed for a moment, then the PH202 reverts to measurement mode.

(2) Calibration with Sample

This involves calibration by adjusting the PH202 to read the same as the ORP value derived by laboratory analysis, for example.

1) Press the MODE key.
2) MAN.CAL is displayed.
3) Press NO.
4) SAMPLE is displayed. (To abort calibration, press NO and S.OFF is displayed, then press YES to revert to MEAS mode).
5) While SAMPLE is displayed, and when the measured value stabilizes, acquire some sample liquid for laboratory analysis and at the same time press YES. S.ON is displayed, so press YES again to confirm. SAMPLE is displayed, flashing, on thedisplay, and the PH202 waits for a value -- derived by laboratory analysis or the like -- to be entered.
6) To enter the value derived by laboratory analysis or the like, while SAMPLE is lashing press the MODE key. LAB.CAL is displayed. (To abort calibration, press NO and you will be returned to step (4) above).
7) Press YES. NEW.SNS is displayed. If you want to change the sensor, press YES, otherwise press NO. ORP.CAL is displayed.
8) Press YES. START is displayed, so press YES again.
9) 0000 mV is displayed, so enter a suitable zero offset value and press ENT.
10) CAL.END is displayed.
11) Press YES to exit Calibration with Sample.

11-6. Supplement of troubleshooting

11-6-1. Error Codes

The following error message table gives a list of problems that are indicated when the high or low impedance limits are exceeded for a sensor. Such things as fouling, breakage and cable faults are readily detected. The non-immersion of the sensors in the process fluid is also signalled.

Table 11-1. Error Codes

Code	Error description	Possible cause	Suggested remedy
E0	Buffer solution temoerature outside the programmed range	Buffer solution too hot or too cold	Adjust buffer temperature Check cabling
E1	Measurement failed to stabilize. during the calibration	Sensors fouled Sensors too slow (aged sensor)	Clean sensors Replace sensors
E2	Asymmetry potential too high. (Limits set in service code 21)	Sensors are aged or polluted Mistake in calibration	Check buffer solution Recalibrate at pH7 Replace sensor
E3	Slope (sensitivity) is outside limits. (Limits set in service code 22)	Measuring sensor aged Poor insulation at the connector	Replace measuring sensor Replace or dry cables
E4.1 (Note 1)	Impedance of input 1 too low. (Limits set in service code 03)	Measuring sensor broken Dameged or damp connections	Replace measuring sensor Replace or dry cable
E4.2 (Note 1)	Impedance of input 2 too low. (Limits set in service code 04)	Measuring sensor broken Dameged connections	Replace measuring sensor Replace cable
E5.1 (Note 1)	Impedance of input 1 too high (Limits set in service code 03)	Measuring sensor disconnected Sensors not immersed in process Liquid earth disconnented	Check connections Check porocess Check connentions
E5.2 (Note 1)	Impedance of input 2 too high (Limits set in service code 04)	Reference sensor fouled Liquid earth disconnented Insufficient electrolyte	Check or replace sensor Check sensor immersion Check electrolyte reservoir
E7 (Note 2)	Temperature sensor open >140 ˚C or , <10 ˚C for 8.55kΩ	Process too hot or too cold Wrong temperature sensor setting Temperaure sensor damaged	Check process Check sensor & setting Check connections
E8 (Note 2)	Temperature sensor open < -30 ˚C or >120 ˚C for 8.55kΩ	Process too hot or too cold Wrong temperature sensor used Temperaure sensor damaged	Check process Check sensor & setting Check connections
E9	Measurement out of range (-2 to 16 pH for pH) (-1500 to 1500 mV for ORP)	Sensors disconnected Sensor wrongly connected Sensor(s) defective	Check cabling Check cabling Replace sensor(s)
E10	EEPROM write failure	Fault in eledtronics	Try agein, if unsuccessful contact Yokogawa
E11	Wash recovery check error (if communication is set to PH201(Style B) in code 60)	Measring sensor aged Sensor still coated after washing Defective wash system	Replace measuring sensor Check cleaning system if needed adjust timings
E12	ORP / rH outside of preset limits	Sensors disconnected or wrongly connected	Check cabling
E14	No valid calibration data.	Data lost after switching from pH to ORP	Recalibrate
E15	Cable resistance to temperature sensor exceeds limit value.	Cable resistance too high Corroded contacts Wrong sensor programmed	Use Pt1000 Clean and reterminate Reprogram
E16	Call for maintenance interval time exceeded	System not maintained in preset time period	Perform maintenance Reset interval
E17	Output span too small <1pH	Incorrect configuration by user	Reprogram
E18	Table values make no sense		
E19	Programmed values outside acceptable limits	Incorrect configuration by user	Reprogram
E20	Programmed data lost	Fault in electronics Very severe interference	Reprogram
E21	Checksum error	Software problem	Contact Yokogawa
E23	Zeropoint outside limits	Sensors are aged or poluted Mistake in calibration	Check buffer solution Recalibration at pH7 Replace sensor

T11.1E.eps

Note 1; see section 11-6-2, Note 2; see section 11-6-3.

11-6-2. On-line impedance checks

This check can be applied to a sensor with liquid earth electrode. In using a sensor having no liquid earth electrode, set impedance check off on service code 3 and 4.

Code	Display	Function	Function detail	X	Y	Z	Ddefault values	
Parameter specific functions								
03	*Z1.CHK	Impedance check 1	Low	0			1.1.1	
			High	1				High
			Temp comp off		0			
			Temp comp on		1			On
			Imp check off			0		
			Imp check on			1		On
	*Z.L.xV	Low impedance limit	Press NO to step through choice of units.					1 MΩ
		x=None, K, M or G	press YES to select units, then use the					
			>, ∧ ENT keys to set the value					
	*Z.H.xV	High impedance limit	Press NO to step through choice of units.					1 GΩ
		x=None, K, M or G	press YES to select units, then use the					
			>, ∧ ENT keys to set the value					
04	*Z2.CHK	Impedance check 2	Low	0			0.0.1	Low
			High	1				
			Temp comp off		0			Off
			Temp comp on		1			
			Imp check off			0		
			imp check on			1		On
	*Z.L.xV	Low impedance limit	Press NO to step through choice of units.					100 Ω
		x=None, K, M or G	press YES to select units, then use the					
			>, ∧ ENT keys to set the value					
	*Z.H.xV	High impedance limit	Press NO to step through choice of units.					200 Ω
		x=None, K, M or G	press YES to select units, then use the					
			>, ∧ ENT keys to set the value					

T5.3.1E.eps

Yokogawa sensors with the liquid earth electrode include the PH8EFP, PH8ERP, PH8EHP, OR8ERG, OR8EFG and FU20.
The liquid earth electrode is inside the sensor, and at the potential of the measured solution. The liquid earth electrode is also used for an impedance check (to determine if a functional sensor is connected). Be sure to connect the wire from the liquid earth electrode to terminal 14 on the transmitter.

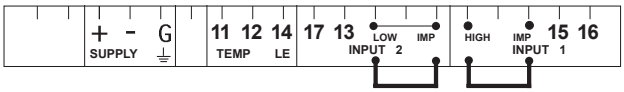
CAUTION

The impedance check detects when the glass electrode is broken, and also provides a check of junction contamination and junction clogging. Such checks are qualitative rather than absolute , and relatively loose high/low limits for "acceptable" values are usually set.
In the measurement in low conductivity water such as pure water, the impedance check does not work. Set the impedance check function for the reference electrode to off in Service Code 04.

If the sensor doesn't have a liquid earth electrode, it's not possible to perform an automatic impedance check to determine if the sensor is connected. Turn the functions of Service Codes 3 and 4 off when using such a sensor.
Yokogawa sensors without liquid earth terminals include the HA405, HA406, DPA405, DPAS405, DPA406, HF405, HA485, DPA485 and DPAS485.

When the OR8EFG or OR8ERG sensor is used, set both INPUT1 and INPUT2 to the low impedance measurement. Confirm the position of the jumper cable of the wiring diagram.

Setting for ORP



The temperature compensation of the impedance measurement is for conventional pH glass sensors. When other sensors are used, switch this feature off.

11-6-3. Supplement of temperature sensor

When the temperature sensor is not connected with the transmitter (when no connections are made to terminals 11 and 12), set the manual temperature compensation (refer to Section 5-1-1). Yokogawa's pH sensors, Models HA405, DPA405, DPAS405 and HF405, do not have a built-in temperature sensor.

11-6-4. Auto-Return

Manual HOLD is automatically turned OFF.
Calibration mode or Commissioning mode is changed to Measurement mode automatically.
If no key is operated for 10 minutes in any mode other than measurement mode or after 10 minutes in Hold status, Auto-Return (factory setting: On (1) in service code 50) will be activated to return the transmitter to measurement mode. To disable Auto-Return, set the service code 50 to Off (0) .

CAUTION

If you disable Auto-Return function then the transmitter does not automatically return to Measurement Mode. You need to press [MODE] key to return to Measurement mode.

11-6-5. CALEND

After CAL.END appears once during calibration, it blinks and calibration starts again.
For the PH202, even after CAL.END is displayed, a measurement stability check continues for the time interval set by service code 20. If the reading changes significantly* during this interval*, then recalibration will start automatically. In auto-calibration mode (AUT.CAL) immediately after CAL.END is displayed, you can press YES or NO within time interval set by service code 20 to confirm or reject (repeat) the reading.
This applies to both calibration points.

1. If the reading does not stabilize (and CAL.END appear) within 10 minutes of start of calibration, then error E1 (measurement unstable during calibration) is generated.
2. If you press YES or NO then you can continue immediately to the next step.
3. If you don't press YES or NO and the pH is stable (within (pH) for time interval (t)), then calibration continues to the next step.

11-6-6. How to cancel sample calibration

In case of stopping calibration at data aquisition situation (waiting for measured value input with blinking "SAMPLE") after sample calibration start, cancel the calibration in accordance with the right table.

T03.ai

Indication on LCD	Key Operation
"SAMPLE" blink	Push "MODE" key
"LAB.CAL" light	Push "NO" key
"SAMPLE" light	Push "YES" key
"S. ON" light	Push "NO" key
"S.OFF" light	Push "YES" key

12. APPENDIX 3 QUALITY INSPECTION

12-1. PH202G, PH202SJ 2-Wire pH/ORP Transmitter

Quality Inspection Standards

PH202G, PH202SJ 2-Wire pH/ORP Transmitter

1. Scope

This inspection standard applies to the PH202G, PH202SJ 2-Wire pH/ORP Transmitter.

2. Inspection Items

2.1 Insulation resistance test
2.2 Current output test
2.3 Temperature indication check
2.4 pH indication check
2.5 ORP indication check

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1.
- Performance tests should be done in the inspection mode where the tests from Section 3.3 through Section 3.5 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.

3.1 Insulation Resistance Test

As for the PH202G, follow the instructions below.

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

As for the PH202SJ, follow the instructions below.

(1) Apply 125 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 9.5 MΩ or greater.

(2) Apply 125 V DC between the input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Current Output Test

Connect the instruments as shown in Figure 1, and set them as follows.
Connect a shorting bar between terminals LOW and IMP.

Decade resistance box:	921.6 Ω
Standard voltage/current source:	0 mV
DC source:	24 V DC

Use the following procedure to enter the inspection mode.

(1) Entering Service Code 87
a. Press the [∗] key. The message display will show “∗OUTP.”
b. Press the [NO] key until the message display shows “∗SERV.”
c. Press the [YES] key. The data display will show “0̲0” with the first digit of 0 flashing.
d. Press the [∧] key eight times. The data display will show “8̲0” with the first digit of 8 flashing.
e. Press the [>] key once. The data display will show “80̲” with the second digit of 0 flashing.

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f. Press the [∧] key seven times. The data display will show “87” with the second digit of 7 flashing.
g. Press the [ENT] key. The message display will show “∗PASS∗.”

(2) Setting Password 070
a. Press the [>] key once. The data display will show “000” with the second digit of 0 flashing.
b. Press the [∧] key seven times. The data display will show “070” with the second digit of 7 flashing.
c. Press the [ENT] key. The message display will show “HIF.”
d. Press the [YES] key.

(3) Checking the date and time
a. Press the [ENT] key. The data display will show the date in day-month-year order.
b. Press the [ENT] key. The data display will show the time in hour-minute-second order.
c. Press the [ENT] key. The message display will show “mA.”

This is the inspection mode. When the message display shows “mA”, check the current outputs.

Each time the [ENT] key is pressed, the value on the data display increases in steps of 4.0 like “4.0,” “8.0” and “12.0.” Check the current outputs. Corresponding to the data display, the current output must be within the range shown in Table 1.

When the data display shows “12.0,” pressing the [ENT] key causes the message display to show “RIPPLE” and the data display to remain unchanged. Press the [ENT] key again. The message display will show “mA” and the data display “16.0.”

Table 1

Data Display	Current Output (mA)
4.0	4 ±0.02
12.0	12 ±0.02
20.0	20 ±0.02

3.3 Temperature Indication Check

Following Section 3.3, press the [ENT] key until the message display shows “PT1000.” In this state, change the resistance value of the decade resistance box as shown in Table 2 and check the data display. The corresponding value on the data display must be within the range shown in Table 2.

Table 2

Reference Temperature (°C)	Resistance Box Resistance (Ω)	Data Display (°C)
-20	921.6	-20.0 ±0.3
+25	1097.3	+25.0 ±0.3
+130	1498.3	+130.0 ±0.3

3.4 pH Indication Check

Following Section 3.4, press the [ENT] key until the message display shows “PH.INP.” In this state, change the simulation input as shown in Table 3 by means of the standard voltage/current source and check the data display. The corresponding value on the data display must be within the range shown in Table 3.

Table 3

Check Point (pH)	Simulation Input (mV)	Data Display (pH)
0	+414.1	0.00 ±0.01
7	0.0	7.00 ±0.01
14	-414.1	14.00 ±0.01

3.5 ORP Indication Check

Following Section 3.5, press the [ENT] key. The message display shows “ORP.INP.” In this state, change the simulation input as shown in Table 4 by means of the standard voltage/current source and check the data display. The corresponding value on the data display must be within the range shown in Table 4.

Table 4

Simulation Input (mV)	Data Display (mV)
-1500	-1500 ±1
0	0 ±1
+1500	+1500 ±1

Press the [ENT] key until the message display shows “READY.”
Press the [ENT] key again to end the tests.

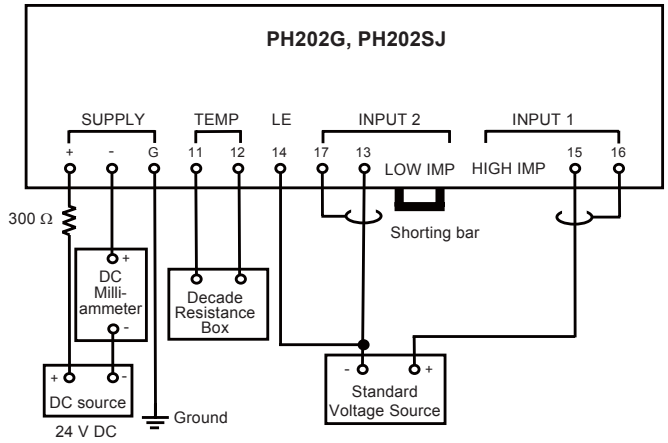

Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	pH/ORP伝送器 pH/ORP TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	PH202G, PH202SJ		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検 査 項 目 INSPECTION ITEM		結 果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －) 一括とアース端子(G)間 □100MΩ以上 / 500V DC(PH202G) □9.5MΩ以上 / 125V DC(PH202SJ) BETWEEN POWER SUPPLY TERMINALS(+,–) AND EARTH TERMINAL(G) □100MΩ OR MORE/500V DC(PH202G) □9.5MΩ OR MORE/125V DC (PH202SJ)	
	入力端子(11～17)一括とアース端子(G)間 □100MΩ以上 / 500V DC (PH202G) □100MΩ以上 / 125V DC (PH202SJ) BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) □100MΩ OR MORE/500V DC(PH202G) □100MΩ OR MORE/125V DC (PH202SJ)	

出力電流 CURRENT OUTPUT

許容差 : ±0.02mA ACCURACY : ±0.02mA

表示 INDICATION	出 力 OUTPUT (mA) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
4.0	4		
12.0	12		
20.0	20		

温度表示 TEMPERATURE INDICATION

許容差 : ±0.3℃ ACCURACY : ±0.3℃ PT1000

抵抗 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
921.6	−20		
1097.3	+25		
1498.3	+130		

pH表示 pH INDICATION

許容差 : ±0.01pH ACCURACY : ±0.01pH

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (pH) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
+414.1	0		
0.0	7		
−414.1	14		

ORP表示 ORP INDICATION

許容差 : ±1mV ACCURACY : ±1mV

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (mV) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
−1500	−1500		
0	0		
+1500	+1500		

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM. ℃ & %
検査者 INSPECTOR	承認者 APPROVED BY

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QIC-12B07D02-01
Ed6: Mar.2007

12-2. PH202S 2-Wire pH/ORP Transmitter

Quality Inspection Standards

PH202S 2-Wire pH/ORP Transmitter

1. Scope

This inspection standard applies to the PH202S 2-Wire pH/ORP Transmitter.

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Current output test
2.4 Temperature indication check
2.5 pH indication check
2.6 ORP indication check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Performance tests should be done in the inspection mode where the tests from Section 3.3 through Section 3.6 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.

3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric strength test

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)

(2) Between the input terminals shorted together (11 to 17) and the earth terminal (G)

(3) Between the input terminals shorted together (11 to 17) and the power supply terminals shorted together (+ and –)

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3.3 Current Output Test

Connect the instruments as shown in Figure 1, and set them as follows.

Connect a shorting bar between terminals LOW and IMP.

Decade resistance box:	921.6 Ω
Standard voltage/current source:	0 mV
DC source:	24 V DC

Use the following procedure to enter the inspection mode.

(1) Entering Service Code 87

a. Press the [∗] key. The message display will show "∗OUTP."
b. Press the [NO] key until the message display shows "∗SERV."
c. Press the [YES] key. The data display will show "00" with the first digit of 0 flashing.
d. Press the [∧] key eight times. The data display will show "80" with the first digit of 8 flashing.
e. Press the [>] key once. The data display will show "80" with the second digit of 0 flashing.
f. Press the [∧] key seven times. The data display will show "87" with the second digit of 7 flashing.
g. Press the [ENT] key. The message display will show "∗PASS∗."

(2) Setting Password 070

a. Press the [>] key once. The data display will show "000" with the second digit of 0 flashing.
b. Press the [∧] key seven times. The data display will show "070" with the second digit of 7 flashing.
c. Press the [ENT] key. The message display will show "HIF."
d. Press the [YES] key.

(3) Checking the date and time

a. Press the [ENT] key. The data display will show the date in day-month-year order.
b. Press the [ENT] key. The data display will show the time in hour-minute-second order.
c. Press the [ENT] key. The message display will show "mA."

This is the inspection mode. When the message display shows "mA", check the current outputs.

Each time the [ENT] key is pressed, the value on the data display increases in steps of 4.0 like "4.0," "8.0" and "12.0." Check the current outputs. Corresponding to the data display, the current output must be within the range shown in Table 1.

When the data display shows "12.0," pressing the [ENT] key causes the message display to show "RIPPLE" and the data display to remain unchanged. Press the [ENT] key again. The message display will show "mA" and the data display "16.0."

Table 1

Data Display	Current Output (mA)
4.0	4 ±0.02
12.0	12 ±0.02
20.0	20 ±0.02

3.4 Temperature Indication Check

Following Section 3.3, press the [ENT] key until the message display shows "PT1000." In this state, change the resistance value of the decade resistance box as shown in Table 2 and check the data display. The corresponding value on the data display must be within the range shown in Table 2.

Table 2

Reference Temperature (°C)	Resistance Box Resistance (Ω)	Data Display (°C)
-20	921.6	-20.0 ±0.3
+25	1097.3	+25.0 ±0.3
+130	1498.3	+130.0 ±0.3

3.5 pH Indication Check

Following Section 3.4, press the [ENT] key until the message display shows “PH.INP.” In this state, change the simulation input as shown in Table 3 by means of the standard voltage/current source and check the data display. The corresponding value on the data display must be within the range shown in Table 3.

Table 3

Check Point (pH)	Simulation Input (mV)	Data Display (pH)
0	+414.1	0.00 ±0.01
7	0.0	7.00 ±0.01
14	-414.1	14.00 ±0.01

3.6 ORP Indication Check

Following Section 3.5, press the [ENT] key. The message display shows “ORP.INP.” In this state, change the simulation input as shown in Table 4 by means of the standard voltage/current source and check the data display. The corresponding value on the data display must be within the range shown in Table 4.

Table 4

Simulation Input (mV)	Data Display (mV)
-1500	-1500 ±1
0	0 ±1
+1500	+1500 ±1

Press the [ENT] key until the message display shows “READY.”
Press the [ENT] key again to end the tests.

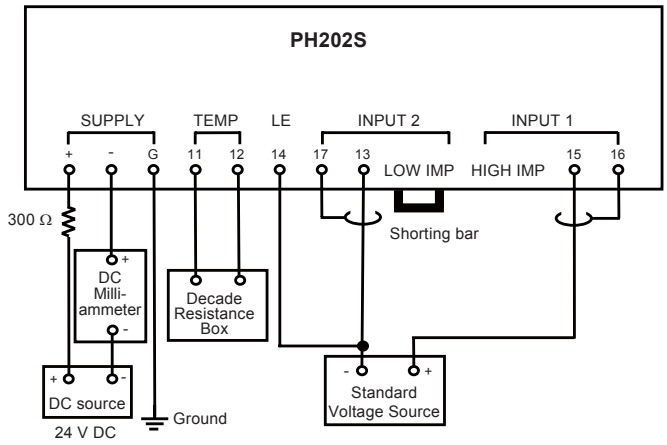

Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	pH/ORP伝送器 pH/ORP TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	PH202S		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検 査 項 目 INSPECTION ITEM		結 果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －) 一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
	入力端子(11～17)一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
耐電圧 DIELECTRIC STRENGTH	電源端子(＋, －) 一括とアース端子(G)間 600V AC/2秒 BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17)一括とアース端子(G)間 600V AC/2秒 BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17)一括と電源端子(＋, －) 一括間 600V AC/2秒 BETWEEN INPUT TERMINALS(11 TO 17) AND POWER SUPPLY TERMINALS(+,−) 600V AC/2 SEC	

出力電流 CURRENT OUTPUT

許容差 : ±0.02mA ACCURACY : ±0.02mA

表示 INDICATION	出 力 OUTPUT (mA) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
4.0	4		
12.0	12		
20.0	20		

温度表示 TEMPERATURE INDICATION

許容差 : ±0.3℃ ACCURACY : ±0.3℃ PT1000

抵抗 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
921.6	−20		
1097.3	+25		
1498.3	+130		

pH表示 pH INDICATION

許容差 : ±0.01pH ACCURACY : ±0.01pH

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (pH) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
+414.1	0		
0.0	7		
−414.1	14		

ORP表示 ORP INDICATION

許容差 : ±1mV ACCURACY : ±1mV

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (mV) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
−1500	−1500		
0	0		
+1500	+1500		

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM. ℃ & %
検査者 INSPECTOR	承認者 APPROVED BY

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QIC-12B07D02-21
Ed1: Mar.2007

12-3. PH202G, PH202S 2-Wire pH/ORP Transmitter (Fieldbus Communication)

Quality Inspection Standards

PH202G, PH202S 2-Wire pH/ORP Transmitter (Fieldbus Communication)

1. Scope

This inspection standard applies to the PH202G and PH202S 2-Wire pH/ORP Transmitters (Fieldbus specification).

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
2.4 pH indication check
*2.5 ORP indication check
*2.6 Fieldbus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric Strength Test (Required Only for PH202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)

(2) Between the input terminals shorted together (11 to 17) and the earth terminal (G)

(3) Between the input terminals shorted together (11 to 17) and the power supply terminals shorted together (+ and –)

3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Connect a shorting bar between terminals LOW and IMP.
Decade resistance box: 921.6 Ω
Standard voltage source: 0 mV
DC source: 24 V DC

change the resistance value of the decade resistance box as shown in Table 1. The corresponding temperature indication must be within the range.

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QIS 12B07D02-61E
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Table 1

Reference Temperature (°C)	Resistance Box Resistance (Ω)	Data Display (°C)
-20	921.6	-20.0 ±0.3
+25	1097.3	+25.0 ±0.3
+130	1498.3	+130.0 ±0.3

3.4 pH Indication Check

Set the instrument as follows.
Decade resistance box: 1000 Ω

Change the simulation input value of the standard voltage generator as shown in Table 2. The corresponding pH data must be within the range.

Table 2

Check Point (pH)	Simulation Input (mV)	Data Display (pH)
0	+414.1	0.00 ±0.01
7	0.0	7.00 ±0.01
14	-414.1	14.00 ±0.01

3.5 ORP Indication Check

Put the instrument in ORP mode by following the steps below.

a. Press the [∗] key. The message display will show “∗SERV.”
b. Press the [YES] key. The message display will show “∗CODE” and the data display will show “00” with the first digit of 0 flashing.
c. press the [>] key once. The second digit of 0 flashes.
d. press the [∧] key once. The data display will show “01” with 1 flashing.
e. Press the [ENT] key. The message display will show ∗PH.ORP.”
f. Press the [∧] key once. The data display will change from “0” to “1.”
g. Press the [ENT] key.
h. Turn on power again.

In this state, change the simulation input of the standard voltage generator as shown in Table 3. The corresponding data must be within the range.

Table 3

Simulation Input (mV)	Data Display (mV)
-1500	-1500 ±1
0	0 ±1
+1500	+1500 ±1

Return to PH mode by following the steps below and then the tests are completed.

a. Press the [∗] key. The message display will show “∗SERV.”
b. Press the [YES] key. The message display will show “∗CODE” and the data display will show “00” with the first digit of 0 flashing.
c. press the [>] key once. The second digit of 0 flashes.
d. press the [∧] key once. The data display will show “01” with 1 flashing.
e. Press the [ENT] key. The message display will show ∗PH.ORP.”
f. Press the [∧] key once. The data display will change from “1” to “0.”
g. Press the [ENT] key.

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3.6 Fieldbus Communication Functional Check

Check for normal function using Fieldbus equipment specified by Yokogawa.

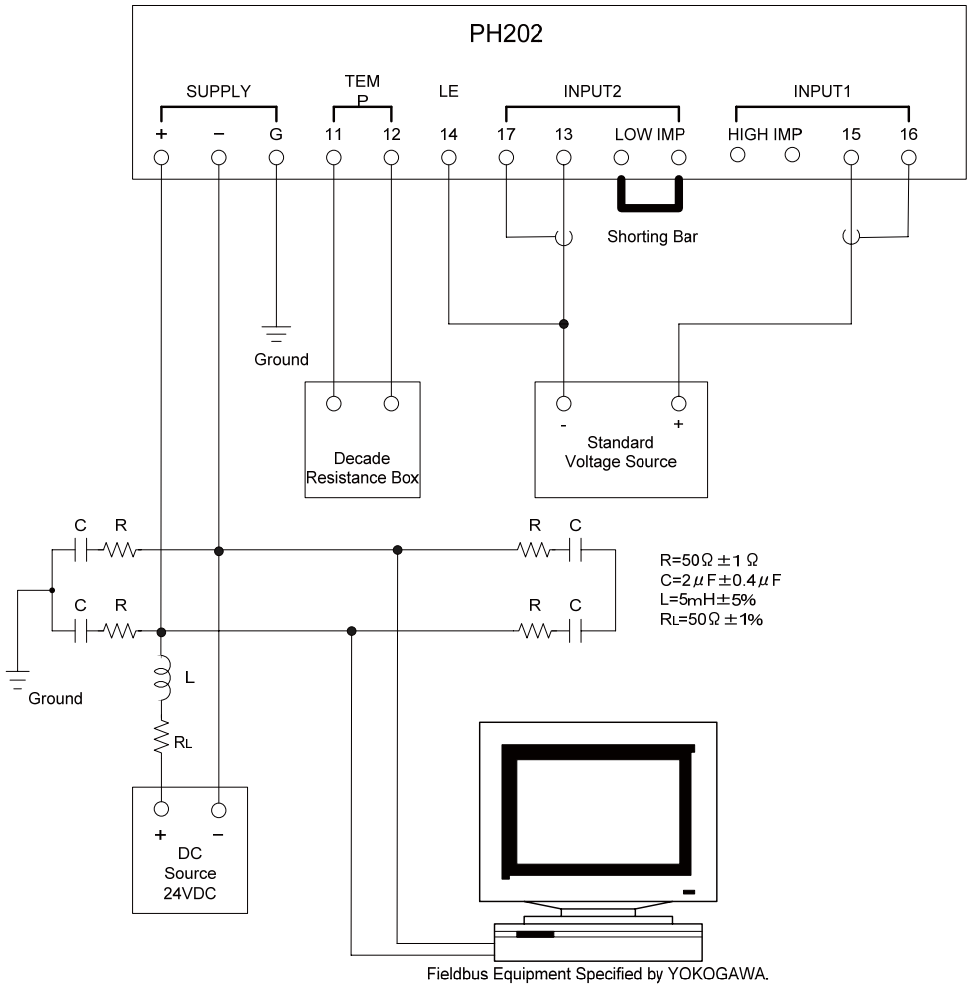

Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	pH/ORP伝送器 pH/ORP TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	PH202		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検 査 項 目 INSPECTION ITEM		結 果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －) 一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 100MΩ OR MORE / 500V DC	
	入力端子(11～17)一括とアース端子(G)間 100MΩ OR MORE/500V DC BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
耐電圧 DIELECTRIC STRENGTH (PH202Sのみ) (ONLY FOR PH202S)	電源端子(＋, －) 一括とアース端子(G)間 600V AC/2秒間 BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17) 一括とアース端子(G)間 600V AC/2秒間 BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17) 一括と電源端子(＋、－)間 600V AC/2秒間 BETWEEN INPUT TERMINALS(11 TO 17) AND POWER SUPPLY TERMINALS(+,−) 600V AC/2 SEC	

温度表示 TEMPERATURE INDICATION

許容差 : ±0.3℃ ACCURACY : ±0.3℃ PT1000

抵抗 RESISTANCE (Ω)	表 示 INDICATION (℃)		
	基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
921.6	−20		
1097.3	25		
1498.3	130		

pH表示 pH INDICATION

許容差 : ±0.01pH ACCURACY : ±0.01pH

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (pH)		
	基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
+414.1	0		
0.0	7		
−414.1	14		

ORP表示 ORP INDICATION

許容差 : ±1mV ACCURACY : ±1mV

入力電圧 INPUT VOLTAGE (mV)	表 示 INDICATION (mV)		
	基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
−1500	−1500		
0	0		
+1500	+1500		

フィールドバス機能 FIELDBUS FUNCTION	フィールドバス機能確認 FIELDBUS FUNCTION CHECK	

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM.	℃ & %
検査者 INSPECTOR	承認者 APPROVED BY	

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QIC-12B07D02-61
Ed1Apr. 2007

12-4. PH202G, PH202S 2-Wire pH/ORP Transmitter (Profibus Communication)

Quality Inspection Standards

PH202G, PH202S 2-Wire pH/ORP Transmitter (Profibus Communication)

1. Scope

This inspection standard applies to the PH202G and PH202S 2-Wire pH/ORP Transmitters (Profibus specification).

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
2.4 pH indication check
*2.5 ORP indication check
*2.6 Profibus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric Strength Test (Required Only for PH202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)

(2) Between the input terminals shorted together (11 to 17) and the earth terminal (G)

(3) Between the input terminals shorted together (11 to 17) and the power supply terminals shorted together (+ and –)

3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Connect a shorting bar between terminals LOW and IMP.
Decade resistance box: 921.6 Ω
Standard voltage source: 0 mV
DC source: 24 V DC

Change the resistance value of the decade resistance box as shown in Table 1. The corresponding temperature indication must be within the range.

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Table 1

Reference Temperature (°C)	Resistance Box Resistance (Ω)	Data Display (°C)
-20	921.6	-20.0 ±0.3
+25	1097.3	+25.0 ±0.3
+130	1498.3	+130.0 ±0.3

3.4 pH Indication Check

Set the instrument as follows.
Decade resistance box: 1000 Ω

Change the simulation input value of the standard voltage generator as shown in Table 2. The corresponding pH data must be within the range.

Table 2

Check Point (pH)	Simulation Input (mV)	Data Display (pH)
0	+414.1	0.00 ±0.01
7	0.0	7.00 ±0.01
14	-414.1	14.00 ±0.01

3.5 ORP Indication Check

Put the instrument in ORP mode by following the steps below.

a. Press the [∗] key. The message display will show “∗SERV.”
b. Press the [YES] key. The message display will show “∗CODE” and the data display will show “00” with the first digit of 0 flashing.
c. Press the [>] key once. The second digit of 0 flashes.
d. Press the [∧] key once. The data display will show “01” with 1 flashing.
e. Press the [ENT] key. The message display will show ∗PH.ORP.”
f. Press the [∧] key once. The data display will change from “0” to “1.”
g. Press the [ENT] key.
h. Turn on power again.

In this state, change the simulation input of the standard voltage generator as shown in Table 3. The corresponding data must be within the range.

Table 3

Simulation Input (mV)	Data Display (mV)
-1500	-1500 ±1
0	0 ±1
+1500	+1500 ±1

Return to PH mode by following the steps below and then the tests are completed.

a. Press the [∗] key. The message display will show “∗SERV.”
b. Press the [YES] key. The message display will show “∗CODE” and the data display will show “00” with the first digit of 0 flashing.
c. Press the [>] key once. The second digit of 0 flashes.
d. Press the [∧] key once. The data display will show “01” with 1 flashing.
e. Press the [ENT] key. The message display will show ∗PH.ORP.”
f. Press the [∧] key once. The data display will change from “1” to “0.”
g. Press the [ENT] key.

3.6 Profibus Communication Functional Check

Check for normal function using Profibus equipment specified by Yokogawa.
In the tests of Item 3.3 to 3.5, check the communication function using Profibus communication.

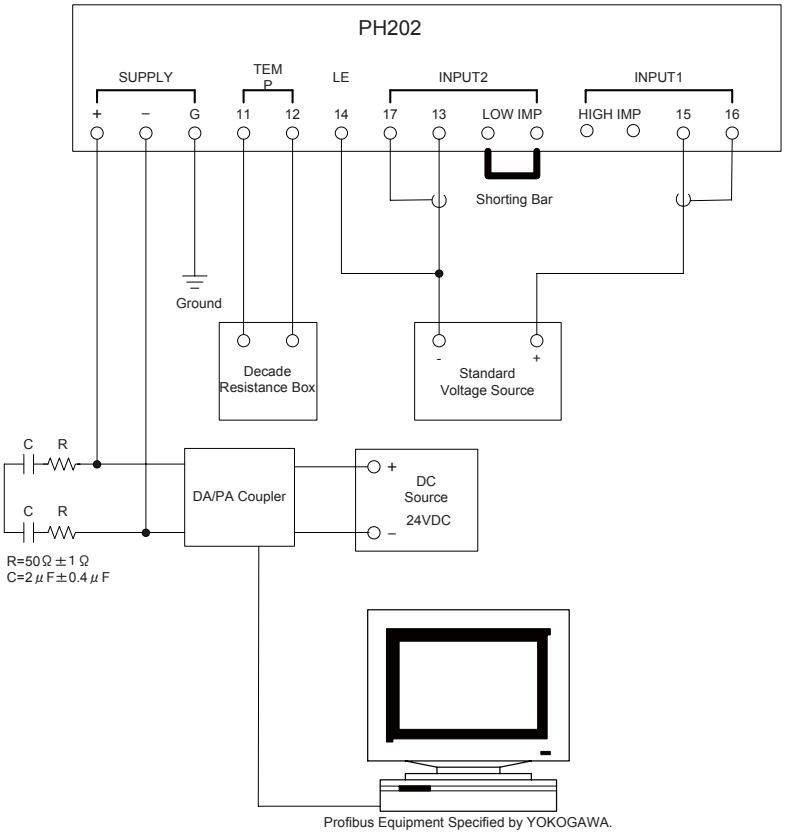

Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	pH/ORP伝送器 pH/ORP TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	PH202		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検査項目 INSPECTION ITEM		結果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －) 一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,-) AND EARTH TERMINAL(G) 100MΩ OR MORE / 500V DC	
	入力端子(11～17)一括とアース端子(G)間 100MΩ OR MORE/500V DC BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
耐電圧 DIELECTRIC STRENGTH (PH202Sのみ) (ONLY FOR PH202S)	電源端子(＋, －) 一括とアース端子(G)間 600V AC/2秒間 BETWEEN POWER SUPPLY TERMINALS(+,-) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17) 一括とアース端子(G)間 600V AC/2秒間 BETWEEN INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 600V AC/2 SEC	
	入力端子(11～17) 一括と電源端子(＋、－)間 600V AC/2秒間 BETWEEN INPUT TERMINALS(11 TO 17) AND POWER SUPPLY TERMINALS(+,-) 600V AC/2 SEC	
温度表示 TEMPERATURE INDICATION	許容差 : ±0.3℃ ACCURACY : ±0.3℃ PT1000	

抵抗 RESISTANCE (Ω)	表示 INDICATION (℃) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
921.6	−20		
1097.3	25		
1498.3	130		

pH表示 pH INDICATION

許容差 : ±0.01pH ACCURACY : ±0.01pH

入力電圧 INPUT VOLTAGE (mV)	表示 INDICATION (pH) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
+414.1	0		
0.0	7		
−414.1	14		

ORP表示 ORP INDICATION

許容差 : ±1mV ACCURACY : ±1mV

入力電圧 INPUT VOLTAGE (mV)	表示 INDICATION (mV) 基準値 REFERENCE	実測値 ACTUAL	誤差 ERROR
−1500	−1500		
0	0		
+1500	+1500		

プロフィバス機能 PROFIBUS FUNCTION	プロフィバス機能確認 PROFIBUS FUNCTION CHECK	

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM.	℃ & %
検査者 INSPECTOR	承認者 APPROVED BY	

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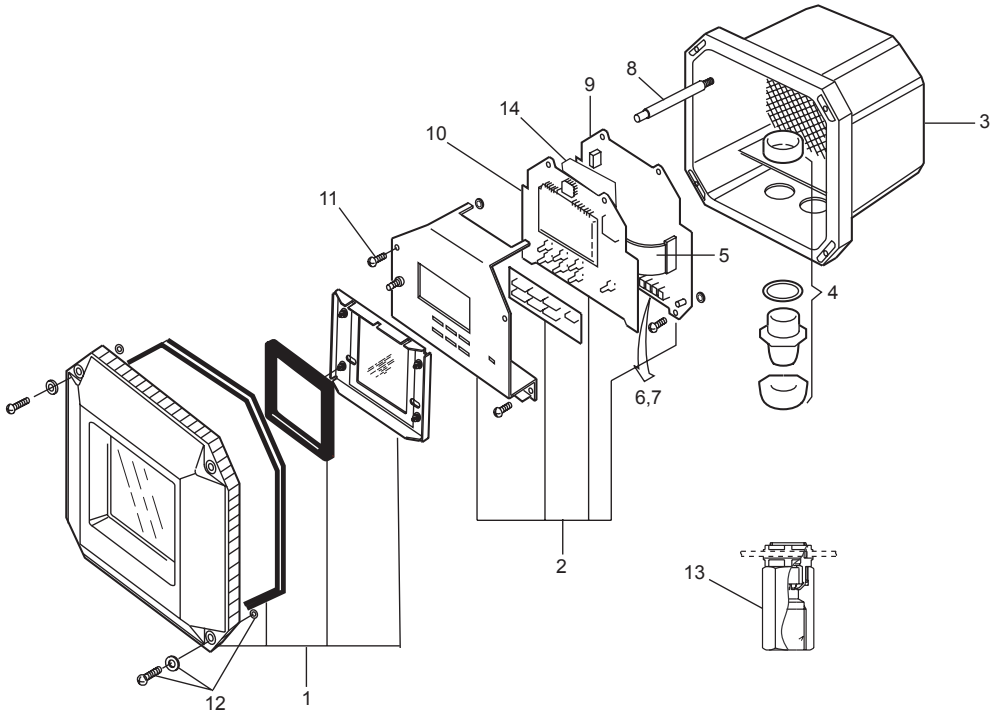
QIC-12B07D02-71
Ed1Sep. 2007

Customer Maintenance Parts List

Model PH202G [Style : S3]
2-wire pH/ORP Transmitter



Item	Part No.	Qty	Description
1	—		Cover Assembly
	K9315CA	1	Polyurethane Coating
	K9315CN	1	Epoxy-polyester Coating
2	—		Internal Works Assembly with amplifier assembly
	K9661AD	1	For mA + HART
	K9661AE	1	For FF
	K9661AF	1	For Profibus
3	—		Housing Assembly
	K9661HA	1	Polyurethane Coating
	K9661HB	1	Epoxy-polyester Coating
4	L9811FV	2	Cable Gland Assembly
5	K9660AQ	1	Flat Cable
6	A1726JD	1	Pin Terminal Unit 3 terminals type
7	K9184AA	1	Screw Terminal Unit when /TB specified
8	K9661HR	2	Stud
*9	—		Analog Board Assembly
	K9661PA	1	For mA + HART
	K9661PC	1	For FF/Profibus
*10	—	1	Digital/Display Board
	K9661AV	1	For mA + HART
	K9661AW	1	For FF/Profibus
11	K9660YQ	1	Screw Assembly to fix amplifier
12	K9660YP	1	Stainless steel screw assembly to fix cover
13	—		Adapter Assembly
	K9414DH	1	For G1/2 screw when /AFTG specified (2 units).
	K9414DJ	1	For 1/2NPT screw when /ANSI specified (2 units).
*14	—		Comm. Board Assembly
	K9661MA	1	For FF
	K9661NA	1	For Profibus

* Do not exchange these parts. Call service personnel.

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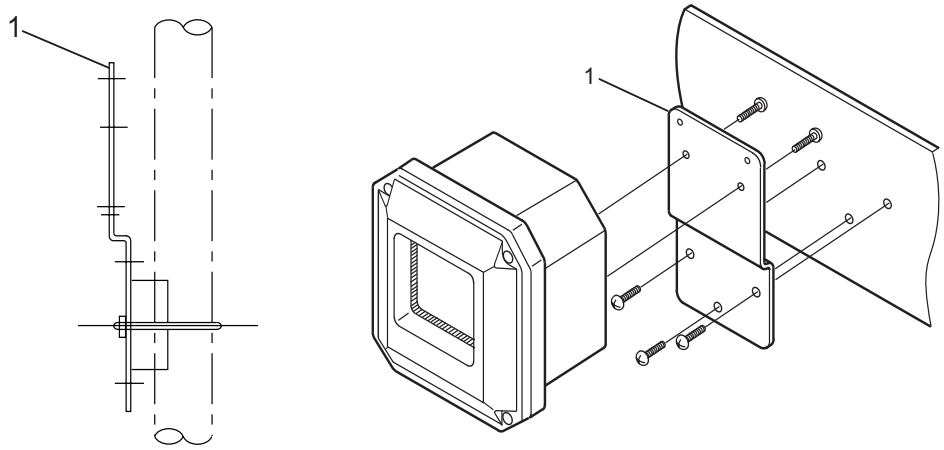
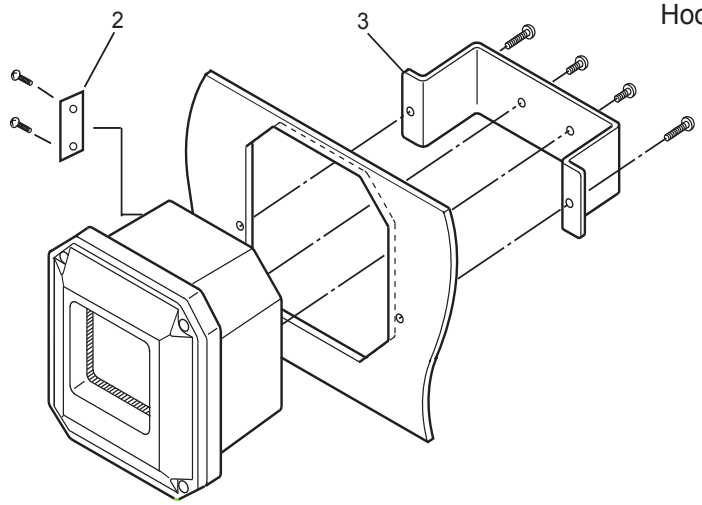
Pipe/Wall Mounting Hardware (Option Code : /U)



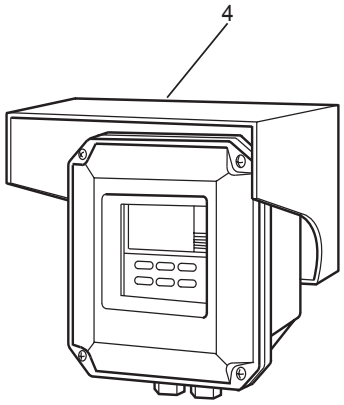
Panel Mounting Hardware

(Option Code : /SCT)



(Option Code : /PM)

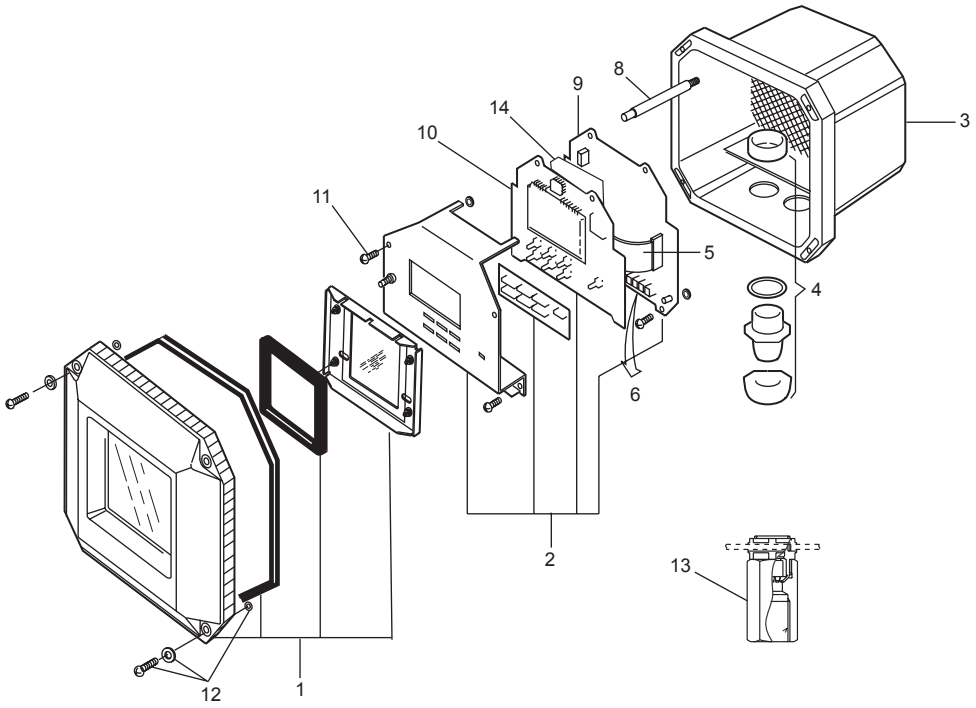
Hood to sun protection (Option Code : /H /H2)



Item	Parts No.	Qty	Description
1	K9171SS	1	Universal Mount Set (/U)
2	K9311BT	1	Tag Plate (/SCT)
3	K9311KA	1	Fitting Assembly (/PM)
4	K9311KG	1	Hood Assembly (/H)
	K9660JA	1	Hood Assembly (/H2)

Customer Maintenance Parts List

Model PH202S [Style : S3]
2-wire pH/ORP Transmitter



Item	Part No.	Qty	Description
1	—		Cover Assembly
	K9315CA	1	Polyurethane Coating
	K9315CN	1	Epoxy-polyester Coating
2	—		Internal Works Assembly with amplifier assembly
	—	1	For mA + HART
	—	1	For FF
	—	1	For Profibus
	—	1	For mA + HART (Non-incendive)
3	—		Housing Assembly
	—	1	Polyurethane Coating
	—	1	Epoxy-polyester Coating
4	L9811FV	2	Cable Gland Assembly
5	—	1	Flat Cable
6	—	1	Pin Terminal Unit 3 terminals type
8	—	2	Stud
9	—		Analog Board Assembly
	—	1	For mA + HART
	—	1	For FF/Profibus
	—	1	For mA + HART (Non-incendive)
10	—	1	Digital/Display Board
	—	1	For mA + HART
	—	1	For FF/Profibus
11	—	1	Screw Assembly to fix amplifier
12	K9660YP	1	Stainless steel screw asssembly to fix cover
13	—		Adapter Assembly
	K9414DH	1	For G1/2 screw when /AFTG specified (2 units).
	K9414DJ	1	For 1/2NPT screw when /ANSI specified (2 units).
14	—		Comm. Board Assembly
	—	1	For FF
	—	1	For Profibus

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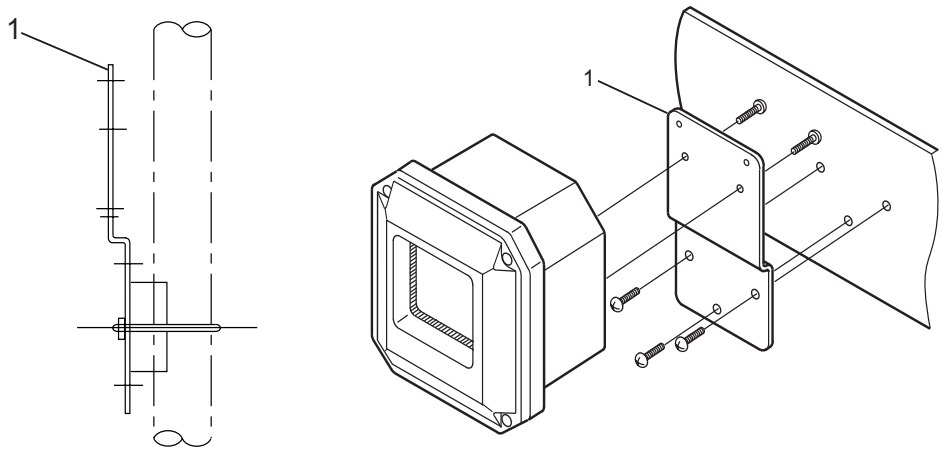
CMPL 12B07D02-23E
2nd Edition : Nov.2008 (YK)

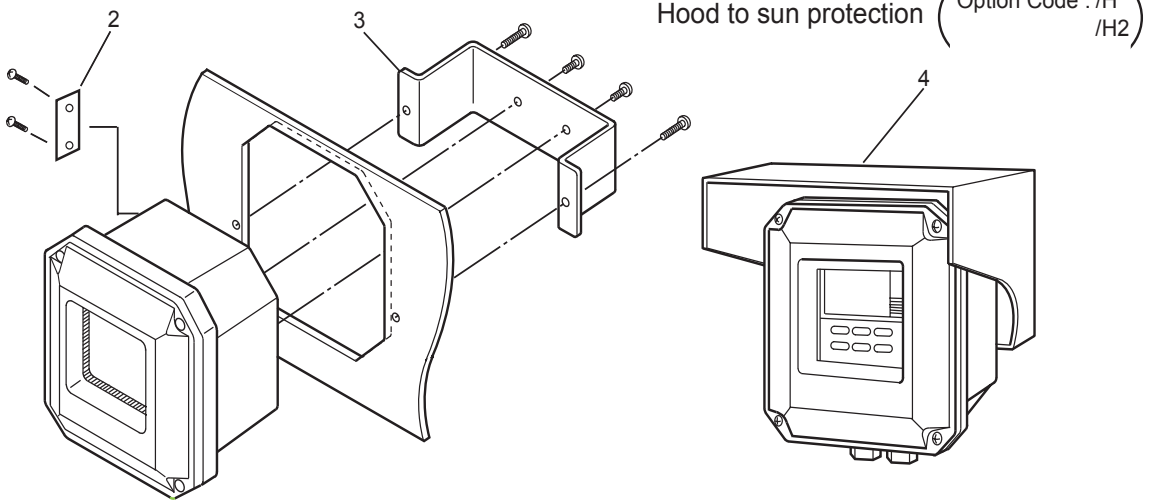
Pipe/Wall Mounting Hardware (Option Code : /U)



Panel Mounting Hardware

(Option Code : /SCT)

Hood to sun protection (Option Code : /H /H2)



(Option Code : /PM)

Item	Parts No.	Qty	Description
1	K9171SS	1	Universal Mount Set (/U)
2	K9311BT	1	Tag Plate (/SCT)
3	K9311KA	1	Fitting Assembly (/PM)
4	K9311KG	1	Hood Assembly (/H)
	K9660JA	1	Hood Assembly (/H2)

Revision Record

Manual Title : Model PH202G [Style: S3], PH202S [Style: S3]
2-wire Type pH/ORP(Redox) Transmitter
Manual Number : IM 12B07D02-01E

Edition	Date	Remark (s)
1st	Apr. 2000	Newly published
2nd	May. 2002	CENELEC Certification changed to ATEX (KEMA). CSA Certification added. Apart from a general rewite of English.
3rd	Feb. 2004	Style changed to S2.
4th	May. 2004	HART Communication function is additionally described.
5th	Dec. 2004	TIIS intrinsic safe version PH202S [Style : S1] added, etc.
6th	Dec. 2005	Write in some error correction.
7th	Nov. 2006	Model name of TIIS intrinsic safe version PH202S [style : S1] changed to PH202SJ [style : S1].
8th	Mar. 2007	All over revised (style of PH202G changed to S3, and PH202S changed to S2.)
9th	Oct. 2007	PREFACE-1, Some of warning description modified; P. 1-1, Some of nameplate in Figure 1-1 changed; P. 1-2, Some of nameplate in Figure 1-2 changed; P. 2-2, EN 61000-3-3 deleted from "N. Regulatory compliance"; P. 2-3, Certificate no. of CENELEC ATEX and IECEx Scheme explosionproof added, CSA explosionproof description added; P. 2-4, CSA explosionproof description added; P. 2-5, P. layout changed; P. 2-6, Miss spering of Model and suffix code corrected; P. 2-9, Control Drawing for mA HART Specification (FM Intrinsically safe design) corrected; P. 2-10, Control Drawing for mA HART Specification (FM Non-incendive design) corrected; P. 2-11, Control Drawing for mA HART Specification (CSA) corrected; P. 2-12, Control Drawing for FF/PB Specification (IECEx) corrected; P. 2-13, Control Drawing for FF/PB Specification (ATEX) corrected; P. 2-14, Control Drawing for FF/PB Specification (FM) corrected; P. 2-16, Control Drawing for FF/PB Specification (FM Intrinsically safe FISCO) corrected; P. 2-18, Control Drawing for FF/PB Specification (FM Non-incendive Entity) corrected; P. 2-19, Control Drawing for FF/PB Specification (FM Non-incendive FNICO) corrected; P. 2-20, Control Drawing for FF/PB Specification (CSA) corrected; P. 11-1, 11-5, 11-6, 11-11, 11-13 Some error corrected; Sec. 12 APPENDIX 3 QUALITY INSPECTION added; CMPL 12B07D02-03E, -22E revised to 2nd edition because some part no. changed.
10th	Apr. 2008	Style of PH202S changed to S3 and related description changed as follows. P.2-6, Style of PH202S changed to S3 for FM approval; P.3-1, Some of dimensions in Figure 3-1 corrected; P.10-7 (Appendix), Note of HART protrocol DD files URL added; CMPL 12B07D02-23E 1st edition added for PH202S style S3.

Edition	Date	Remark (s)
11th	Oct. 2009	PREFACE, "Zone 0" added to Warning label explanation; P.1-2, Name plate of PH202S-K (NEPSI) added to Figure 1-2; P.2-2, Some revision of N. Regulatory compliance (description for EMC revised); P.2-3 to 2-4, Some revision of IECEx Intrinsically safe description ("Zone 0" added), and NEPSI Certification added to page 2-4; P.2-6, NEPSI suffix code of "-K" added to the PH202S MS-code; CMPL 12B07D02-23E of PH202S(S3) revised to 2nd edition (some parts no. deleted).