

General Specifications

Differential pH Sensor Model PH18

The Model PH18 Differential pH Sensor is unique and offers the possibility of maintenance-free operation for the correct application.

Construction of the enamel coated probe is based on a rigid steel rod. A blue base enamel is overlaid with two yellow bands of sensitive enamel. A pH sensitive enamel and sodium ion enamel are combined with an integral temperature sensor, to form a probe without internal solutions.

The differential probe measuring principle combines the normal potential generated by the pH enamel with the potential from a sodium membrane. In suitable applications the level of sodium ions creates a stable reference voltage. Hence the measurement can be made without a conventional reference electrode, and drawbacks associated with a liquid junction.

The sensitive membranes are directly bonded to a metallic substrate, which eliminates the need for conventional internal reference elements. This unique construction makes the PH18 independent of the drift which can be caused as reference elements age or become contaminated. When used in a system which is cleaned and/or sterilized with hot water or steam, the membranes produce a signal which has long term stability unrivalled by conventional systems.



Made by **Paumanok**

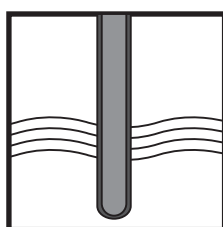
APPLICATION

- ◆ Process where KCl is forbidden
- ◆ Process containing a low water content
- ◆ High process temperature and pressure
- ◆ Process with rapid pressure/temperature changes
- ◆ Fermentation processes
- ◆ Dairy product manufacture

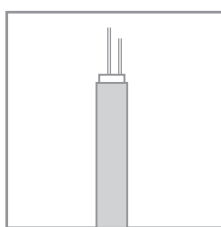
FEATURES

- ◆ Sterilizable pH sensor
- ◆ All enamel construction
- ◆ No reference electrode or junction
- ◆ Easy installation and commissioning
- ◆ No routine maintenance
- ◆ Flexible installation options
- ◆ 140 °C, 15 bar (284 °F, 214 psi)

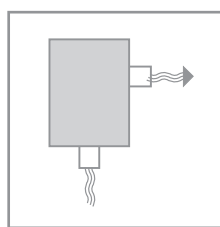
SYSTEM CONFIGURATION



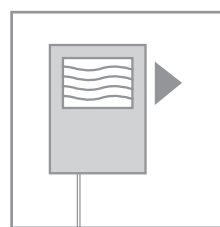
Sensors



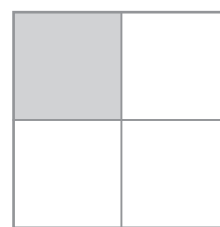
Cables



Fittings



Transmitters



Accessories

INTRODUCTION

The PH18 is not a conventional electrode. It relies on two dissimilar ion sensitive enamel membranes to generate the signal. The measuring element is like a pH electrode, and the reference like a sodium ion electrode.

Therefore the PH18 can only be used in combination with pH meters that feature:

- 1 Dual high impedance inputs
- 2 Adjustable setting for Isothermal Point
- 3 Adjustable temperature coefficient

The Yokogawa models PH202 and PH402 satisfy these requirements.

In both cases the membrane enamels are bonded directly to the metal substrate with no filling solution.

The response curves Fig. 1 (pH), Fig. 2 (reference) and Fig. 3 (application range) show the way in which the potential is generated at each element and combined in the output of the sensor.

Fig. 1 above pH11 the effect of sodium on the pH membrane starts to cause non-linearity (sodium error)

Fig. 2 below pH3 the high hydrogen ion content causes a change in the reference response

Fig. 3 a "linear" response to pH is obtained between 3 and 11 pH

Fig. 4 a plot of reference voltage against sodium content

The revolutionary measuring principle has some big advantages. The absence of filling solutions and reference junctions virtually eliminates the problems caused by aging and pollution of the reference sensor. Regular cleaning of the sensor virtually eliminates drift, and the sensor benefits from a very long working life. It is vital, however, to fit the sensor to the application correctly. The special nature of the reference element dictates that there must be a certain sodium level in the process. Fig. 4 shows a plot of reference voltage against sodium content. Because of the exponential nature of the response, it is plain that above about 0.5 N Na⁺ (30g NaCl/l) in the solution, the reference output tends towards a constant level. Of course when the sodium concentration remains constant in a process the reference voltage will also be constant at much lower levels of sodium.

It is because of the need to evaluate the chemistry of the process, that it is necessary to have an Application Data Sheet (page 7 of this GS) completed before approval for this sensor can be made.

The mechanical construction of the sensor also means that it may be used in processes involving both high temperatures and pressures. By eliminating the filling solutions, the sensor is truly robust and can even withstand severe thermal shocks that would ruin most systems.

The stainless steel mounting adapter forms the liquid earth (solution ground) connection needed to ensure best stability of measurement. EXA also uses this connection in the diagnostic circuit.

The PH18 is a differential pH sensor. It does not measure absolute pH except in limited applications. It does, however, measure a single control point accurately, repeatably and with minimum maintenance.

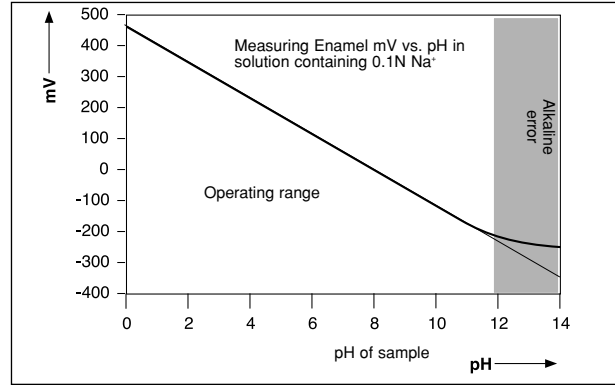


Fig. 1

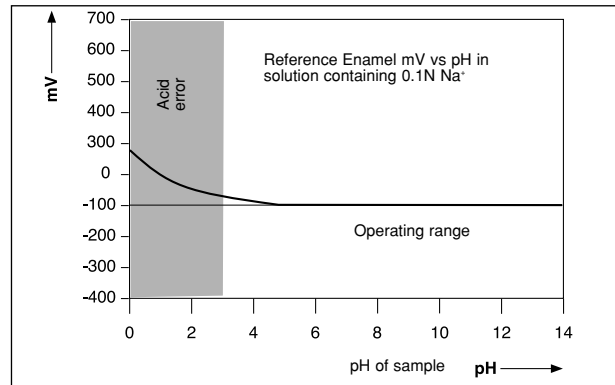


Fig. 2

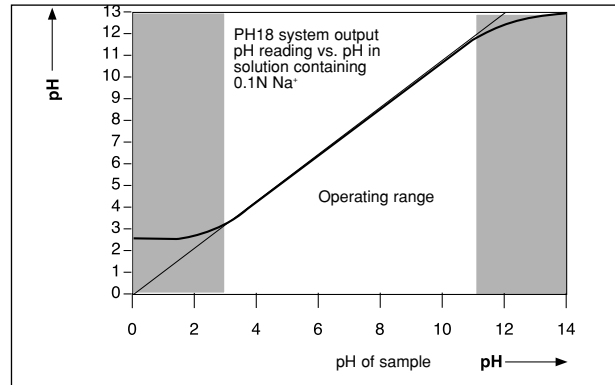


Fig. 3

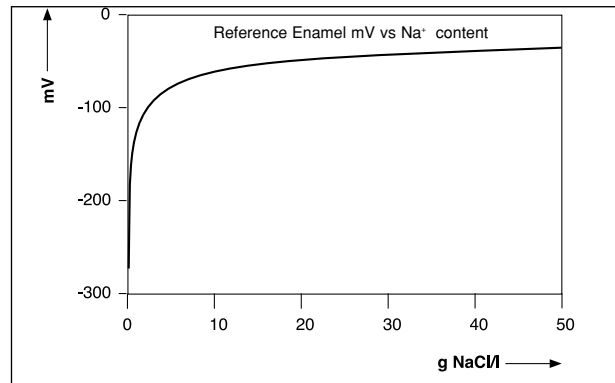


Fig. 4

GENERAL SPECIFICATIONS

Model PH18 Differential pH Sensor
Temperature sensor : Pt1000 Ω RTD
Wetted parts : pH sensor -pH sensitive enamel
 : Reference sensor - Na⁺ sensitive enamel
 : Liquid earth via SS adapter
 : O-rings (EPDM)
 : Adapters (SS 316)
Max. measuring range : 3 to 11 pH (The actual range will be advised with reference to the completed application data sheet)
Temperature range : 0 to 140 °C (284 °F)
Pressure range : -1 to 15 Bar (214 psi)

NOTE:
 The use of this sensor is highly application specific. Your local Yokogawa sales office will be pleased to advise on the suitability of your application, on receipt of the completed application data sheet. Any and all information received by Yokogawa will be treated in the strictest confidence. To maintain traceability, the completed application data sheet will form part of the contract of sale.

Yokogawa offers no function guarantee for applications where the attached data sheet (page 7) has not been satisfactorily completed. This does not affect the normal Yokogawa warranty covering defects in materials or workmanship.

MODEL AND SUFFIX CODE

Model	Suffix Code	Option Code	Description
PH18			Model Ph18 Differential pH Sensor
Sensor mounting	-SA		Compatible with 25mm process connection
O-ring material	-E		Ethylene-propylene (EPDM)
Instruction manual	-E		English language
	-N		No manual
Options SA	/SWA		Angled weld-in adapter (SS316)
	/SWR		Staight weld-in adapter (SS316)
	/SNS		Adapter 1" NPT (SS316)
	/SBS		Adapter ISO 7/1-R1, JIS 1" (SS316)
	/BSA1		Blind plug SS316 (EPDM O-ring)

Note:
 The sensor is supplied with cable connector. For first installation cable must be specified as well.

Note:
 The material certificate 3.1.B is supplied with the sensor and the options

GENERAL SPECIFICATIONS

Model WU18 cable for model PH18 Differential pH Sensor
Max. temperature : 110 °C (230 °F)
Material : Thermoplastic Rubber (T.P.R.)
Color : Blue
Shipping details sensor and adapter
 Package : wxhxd 350 x 220 x 110 mm
 Weight : approx. 1.4 kg
Shipping details cable
 Package : wxhxd 350 x 220 x 110 mm
 Weight : 2 m. approx. 0.6 kg
 : 5 m. approx. 0.9 kg
 : 10 m. approx 1.4 kg

MODEL AND SUFFIX CODE

Model	Suffix Code	Option Code	Description
WU18			
	-02		02 meter connection cable
	-05		05 meter connection cable
	-10		10 meter connection cable

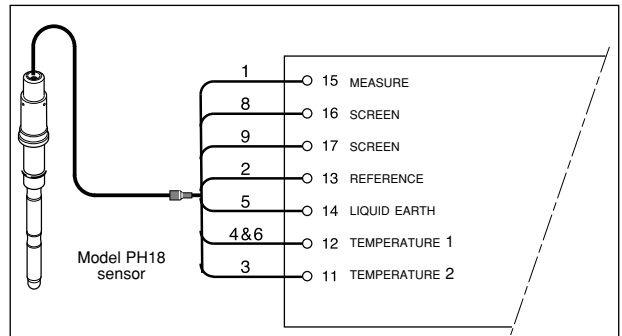


Fig. 5 Connection diagram WU18 for PH402 and PH202

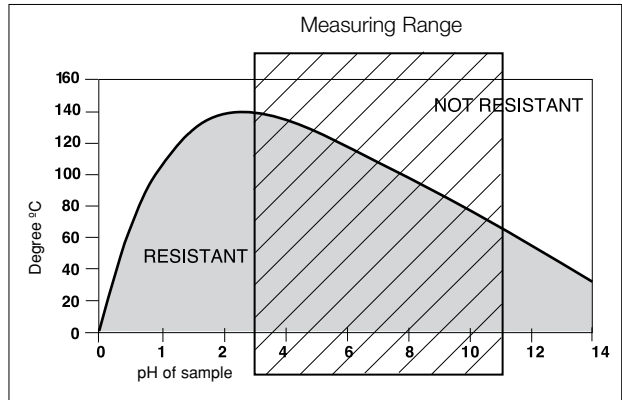


Fig. 6. Corrosion curve of the Model PH18 Enamel

DIMENSIONS PH18-SA

in mm (inches)

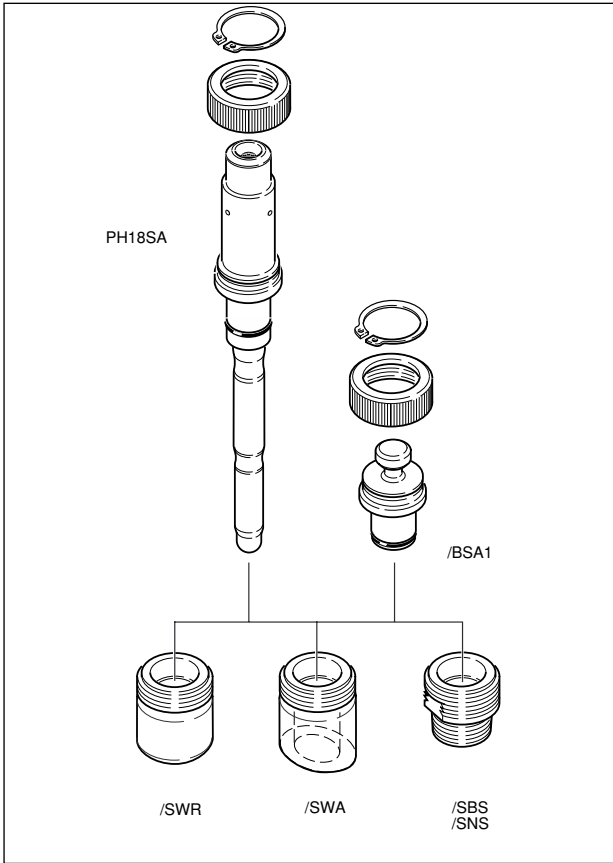


Fig. 7. PH18-SA and the adapters

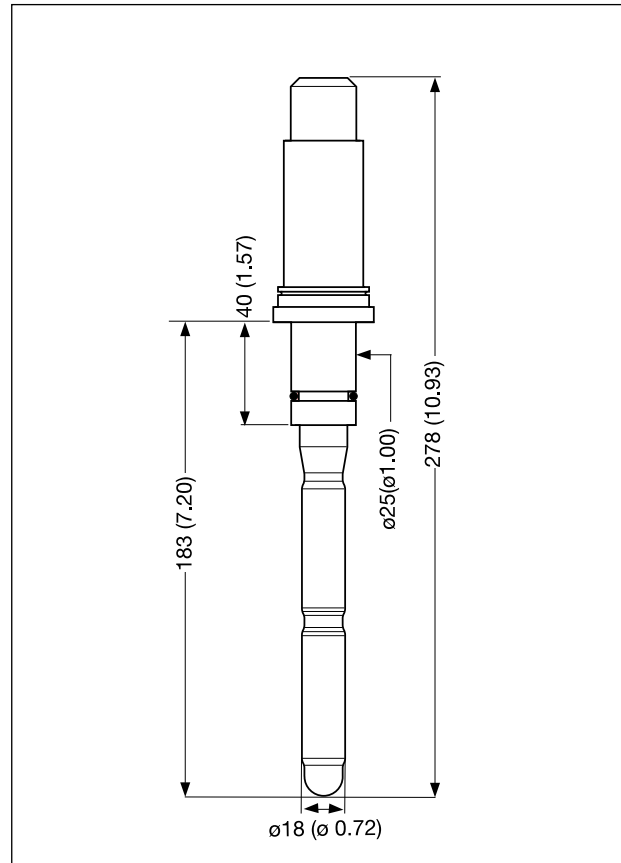


Fig. 8. External dimensions of the PH18-SA

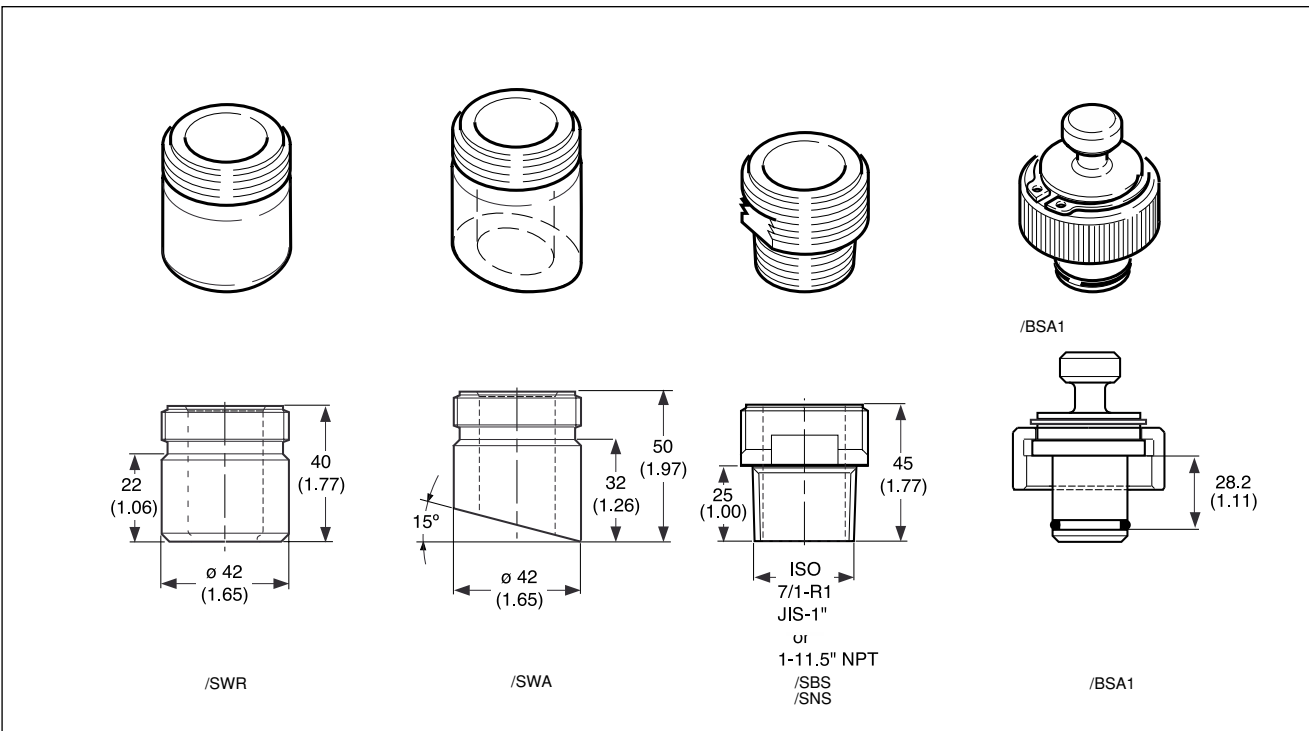


Fig. 9. Options of the PH18-SA

PH18 INSTALLATION EXAMPLES

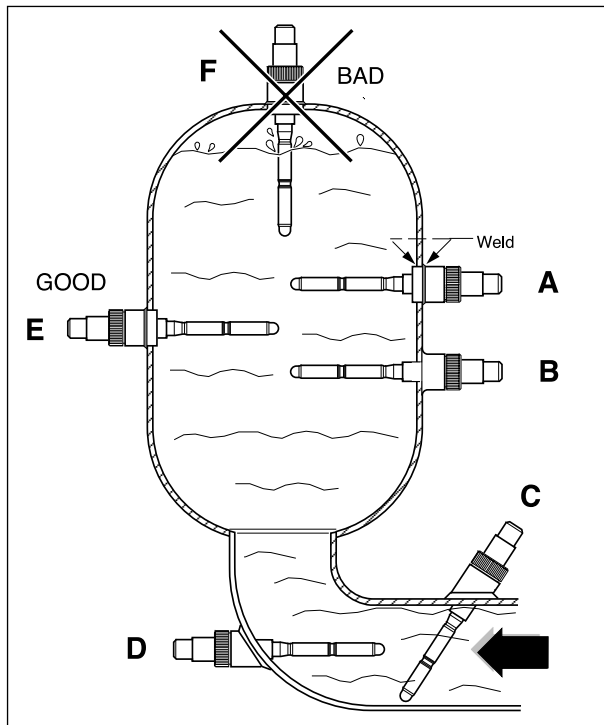


Fig. 13.
Example A. Straight weld-in adapter through a vessel wall.
Example B. 1" Screw-in adapter with existing pipe nipple through a vessel wall.
Example C. Angled weld-in adapter in large bore pipe.
Example D. Angled weld-in adapter mounted in a bend
Example E. Screw or weld-in adapter mounted in a large bore pipe.
Example F. Screw or weld-in adapter mounted on top of a large bore pipe.

Note 1: When measuring in plastic tanks or pipes, ensure that the adapter is wetted by the process. Avoid installations where an air pocket can be created (see fig 12 F). This isolates the adapter, and hence loses the liquid earth connection.
Note 2: Flow rate from the side of sensor (fig. 12 (C & D)) should not exceed 2 metres/second in low viscosity fluids. In high viscosity fluids (>5cP) use only installation as shown in fig. 12 (D).

MODEL 18 ELEMENTS

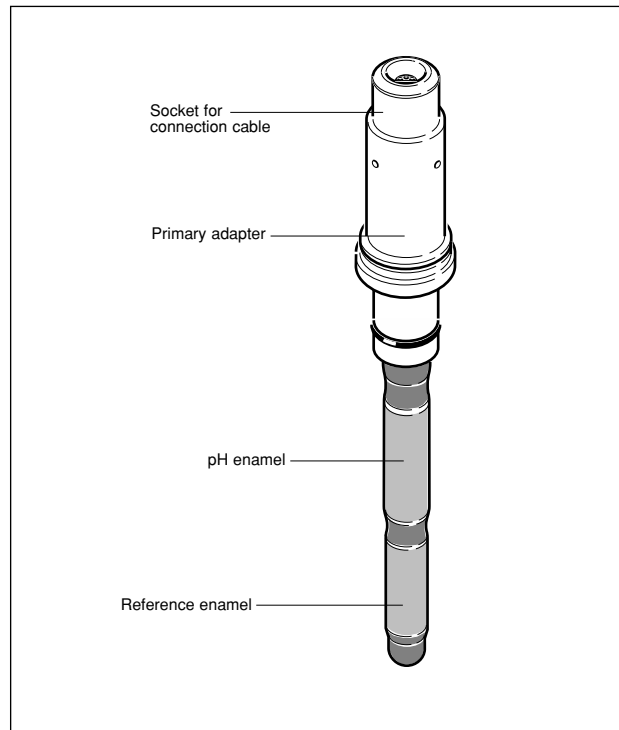


Fig. 14.
 The primary adapter is used to make a connection to the process used by the transmitter as the liquid earth (solution ground). This is needed for optimum stability of the measurement and is used in the impedance checking circuit.

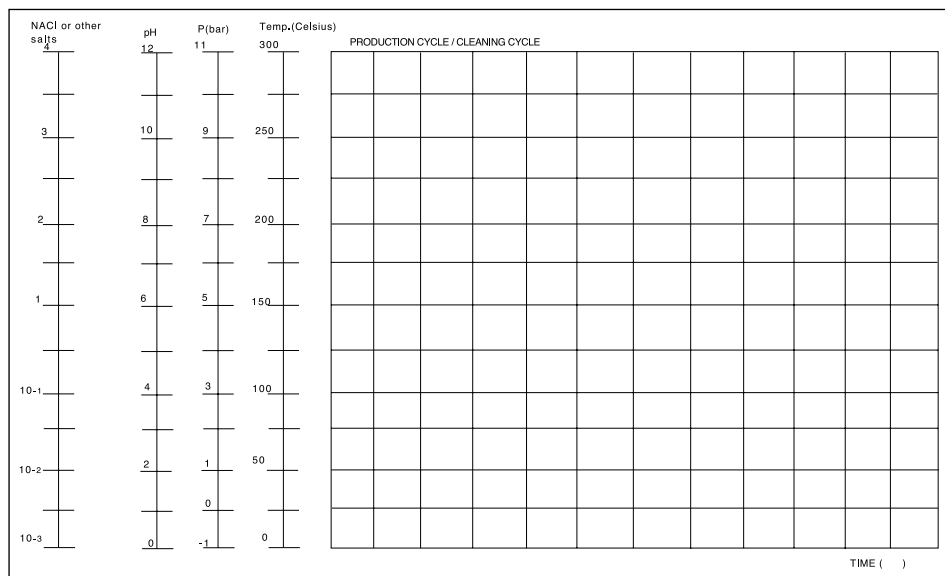


Fig. 15.
 Should be used to show process variations. The changes in pH and sodium content should be plotted against time for batch processes. Changes in temperature and pressure can also be plotted if appropriate. Where CIP is used, plot the cleaning cycle, and any sterilization stages. This leads to a clearer understanding of the process.

APPLICATION DATA SHEET PH18 DIFFERENTIAL pH SENSOR

Customer _____ Address _____ _____ Contact _____ Telephone _____ Fax _____	Please complete a separate form for each process stream to be analyzed and return, marked for the attention of: <div style="border: 1px solid black; padding: 5px; text-align: center;"> Authorization No. </div>
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1. Process data

Description _____

Application Operation Pulp & Paper Power Chemical Pharmaceutical Other
 Batch Continuous Monitor Control

Type of Solution _____

pH Value	Nor _____	Min _____	Max _____
Conductivity Value	Nor _____	Min _____	Max _____
Temperature (°C, °F)	Nor _____	Min _____	Max _____
Pressure (psig, bar, kg/cm ²)	Nor _____	Min _____	Max _____
Flow Rate (m/s : ft/s)	Nor _____	Min _____	Max _____

Concentration of Salts _____ Concentration of Organics _____
 Type(s) _____ Type(s) _____

Problems with present measuring procedure Fouling Poisoning Coating Abrasion Other

Cleaning/Sterilization w/Product Steam Caustic Hot Water Other

Description (Other) Value (pH)	Nor _____	Min _____	Max _____
Temperature (°C, °F)	Nor _____	Min _____	Max _____
Pressure (gal/hr.)	Nor _____	Min _____	Max _____

2. Type 18 probe data

Sensor Mounting Connection 25 mm 1" NPT
 Others.....

Wetted Materials 316 Stainless Steel Enamel O-rings: EPDM
 Immersion Length **150 mm (5.9 Inches)** Distance between Sensor and Instrument _____ (feet or meters)

Sensor model code PH18-.....
 Cable model code WU18-.....



Caution - Inappropriate handling can cause damage.

Striking or scratching the sensor against hard surfaces such as steel, stone, glass or ceramic, may cause damage to the enamel. Such damage may not affect the sensor performance immediately, but after prolonged exposure to the process, flaking of the enamel may occur.



Note - Enable impedance checks in the PH202 or PH402

The sensor impedance checking can give early warning of damage to the enamel layers. If the transmitter signals an impedance failure of the PH18, the sensor should be removed from the process, as soon as possible (within 24 hours). The loss of significant amounts of enamel may thus be avoided.

SPARE PARTS

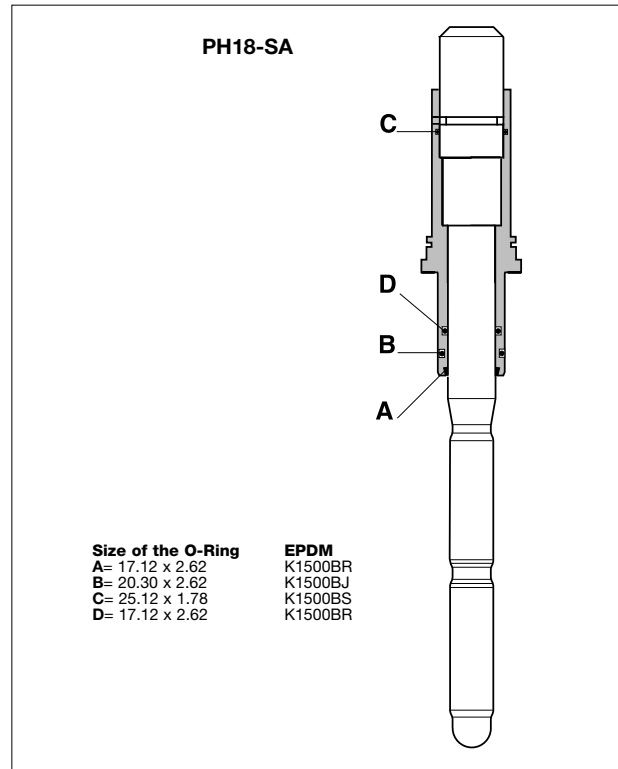


Fig. 16. Location of the O-rings

ACCESSORIES

Spare parts for model PH18 differential pH sensor

Number	Description	Quantity
K1500BJ	Set O-rings 20.3 X 2.62 (EPDM) unit	5
K1500BR	Set O-rings 17.12 X 2.62 (EPDM) unit	5
K1500BS	Set O-rings 25.12 X 1.78 (EPDM) unit	1
K1500BT	Nut	1
K1522BR	/SWR Straight weld-in adapter	1
K1522EQ	/SWA Angled weld-in adapter	1
K1522ET	/SBS Adapter ISO 7/1 - R1, JIS 1"	1
K1522ES	/SNS Adapter 1" NPT	1
K1522MV	/BSA1 Blind plug	1

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