

# General Specifications

## Differential pH Sensor Model PH18

GS 12B6J4-01E-A

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. One pH sensitive enamel and the second a sodium ion enamel. They are combined with an integral temperature sensor, to form a probe that does not have any internal solutions.

The differential measuring principle combines the normal potential generated by the pH enamel with the potential from the 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 enamels are directly bonded to a metallic substrate, eliminates the need for conventional internal reference elements. This unique construction makes the PH18 independent of the drift typically caused by conventional reference elements as they age or become contaminated. When used in a system which is cleaned and/or sterilized with hot water or steam, the enamels produce a signal which has long term stability unrivalled by conventional systems.



Made by **PRIMLER**

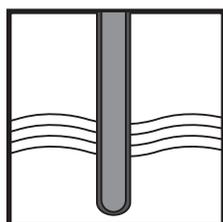
### APPLICATION

- ◆ 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

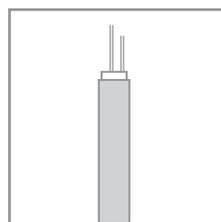
### FEATURES

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

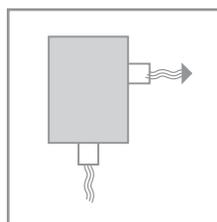
### SYSTEM CONFIGURATION



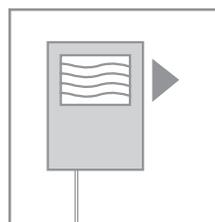
Sensors



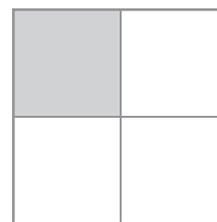
Cables



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/FLXA21 and PH402/450 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<sup>+</sup> (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.**

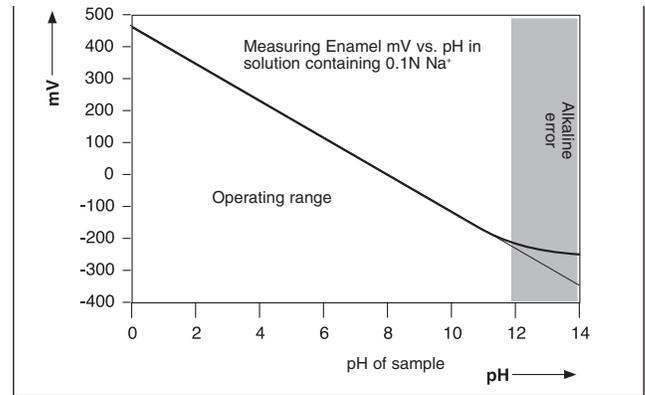


Fig. 1

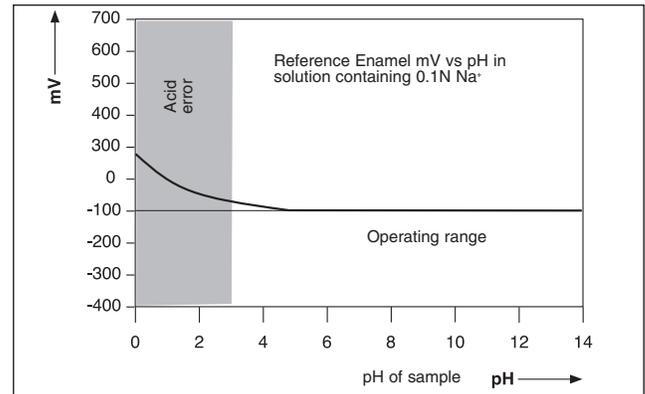


Fig. 2

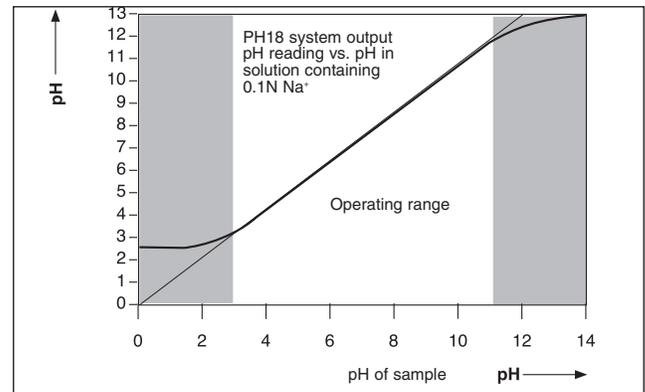


Fig. 3

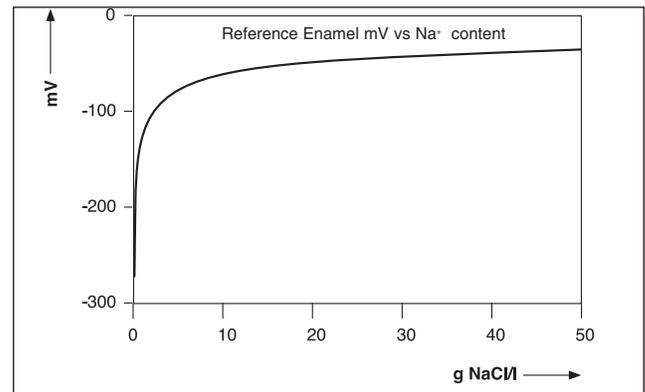


Fig. 4

## GENERAL SPECIFICATIONS

### Model PH18 Differential pH Sensor

<b>Temperature sensor</b>	: Pt1000 RTD
<b>Wetted parts</b>	: pH sensor -pH sensitive enamel : Reference sensor - Na+ sensitive enamel : Liquid earth via SS adapter : O-rings (EPDM) : Adapters (SS 316)
<b>Max. measuring range</b>	: 3 to 11 pH (The actual range will be advised with reference to the completed application data sheet)
<b>Temperature range</b>	: 0 to 140 °C (284 °F)
<b>Pressure range</b>	: -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
Options		K1520EK K1520EJ M1289BA 237230	Angled weld-in adapter (SS316) Staight weld-in adapter (SS316) Adapter 1" NPT (SS316) 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

<b>Max. temperature</b>	: 110 °C (230 °F)
<b>Material</b>	: Thermoplastic Rubber (T.P.R.)
<b>Color</b>	: Blue
<b>Shipping details sensor and adapter</b>	
Package	: wxhxd 350 x 220 x 110 mm
Weight	: approx. 1.4 kg
<b>Shipping details cable</b>	
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			
	-03		03 meter connection
	-05		05 meter connection cable
	-10		10 meter connection cable

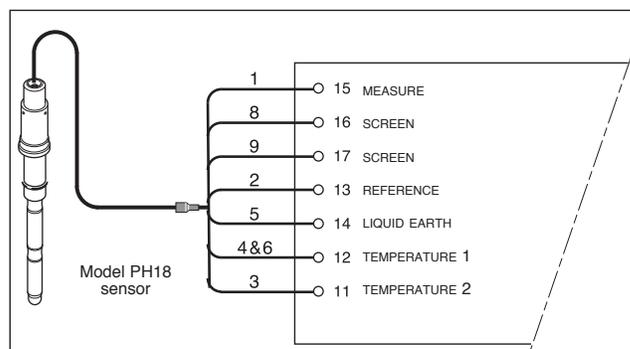


Fig. 5 Connection diagram WU18 for PH202/FLXA21 and PH402/PH450

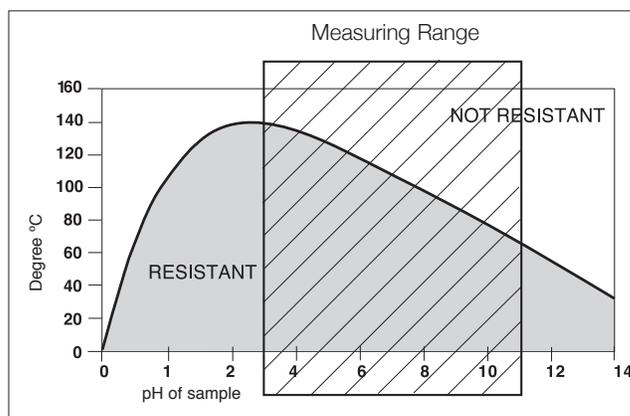
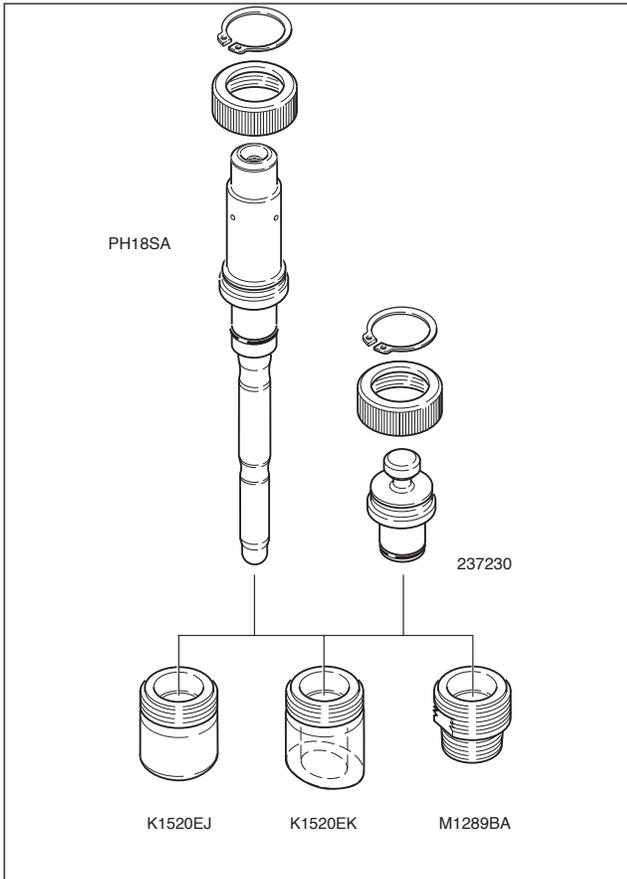


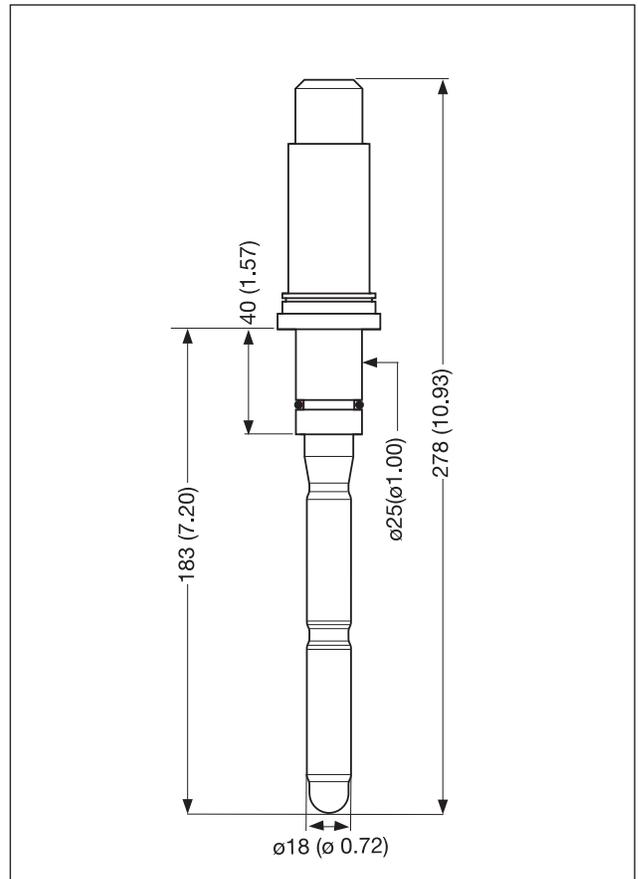
Fig. 6. Corrosion curve of the Model PH18 Enamel

**DIMENSIONS PH18-SA**

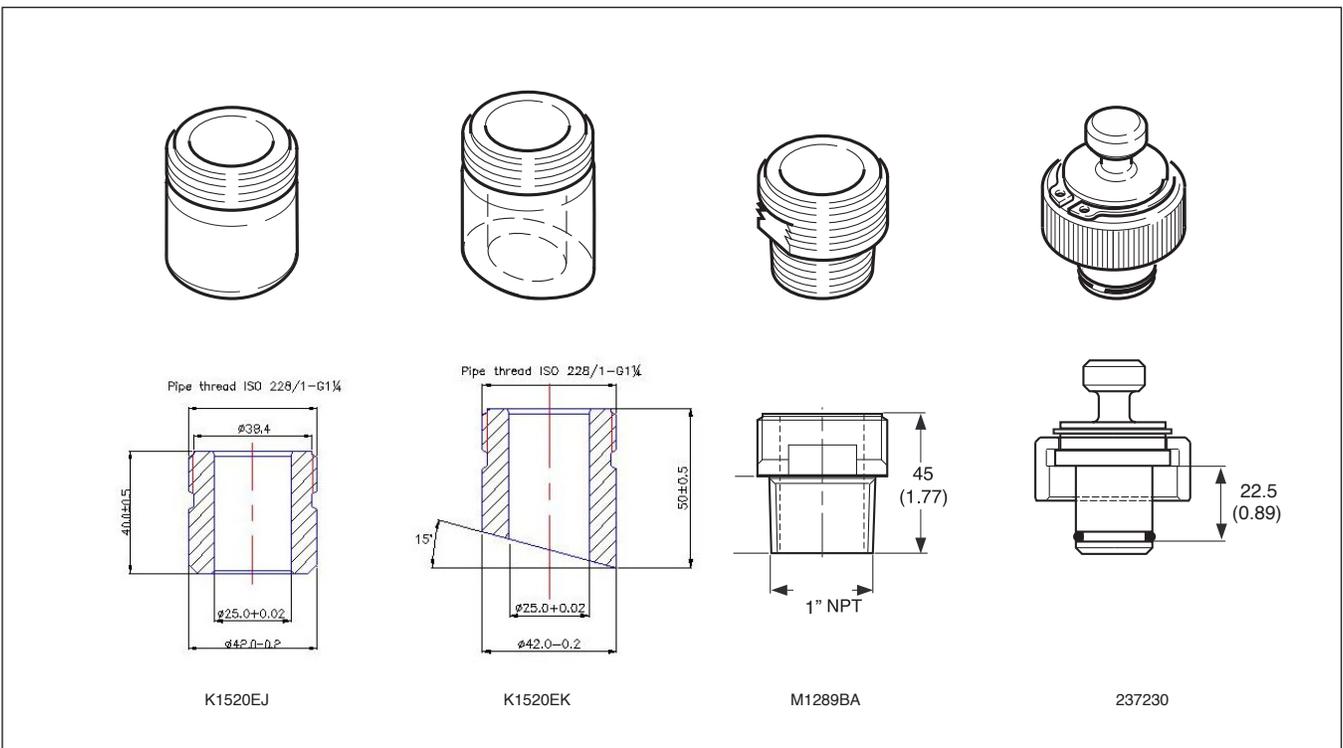
in mm (inches)



**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

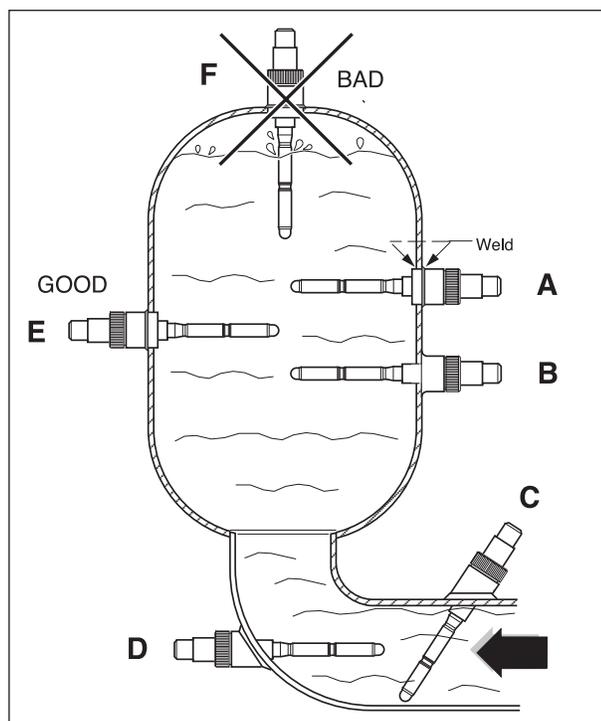


Fig. 13.

**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 PH 18 ELEMENTS

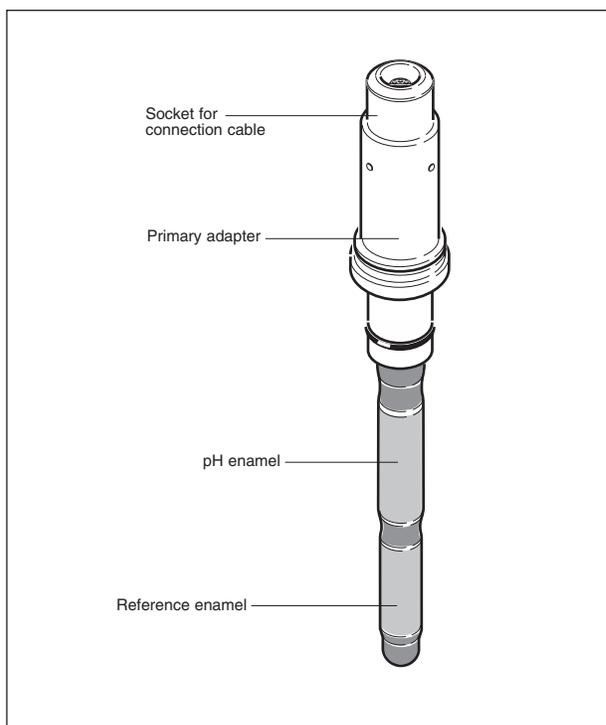


Fig. 14.

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 also used in the impedance checking circuit.

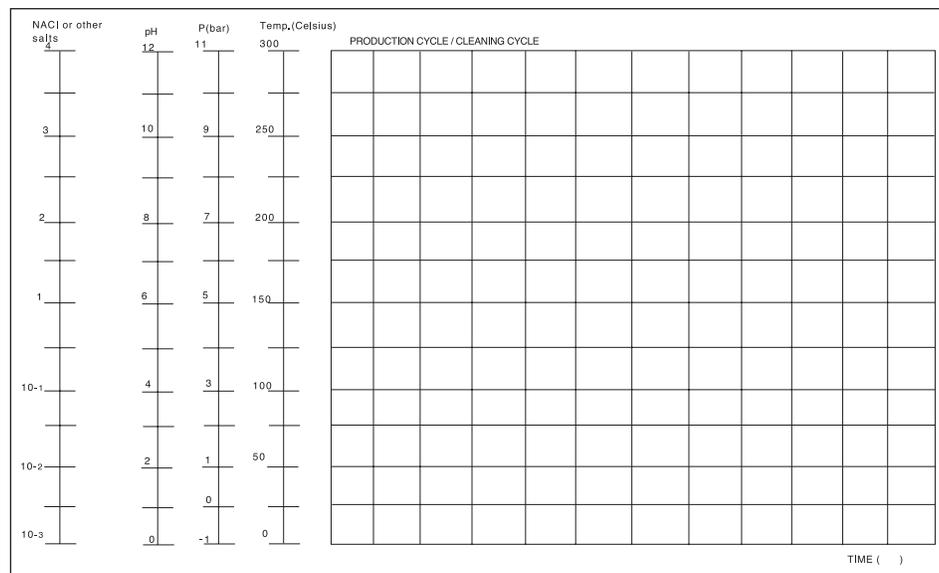


Fig. 15.

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.



**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/FLXA21 and PH420/PH450**

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

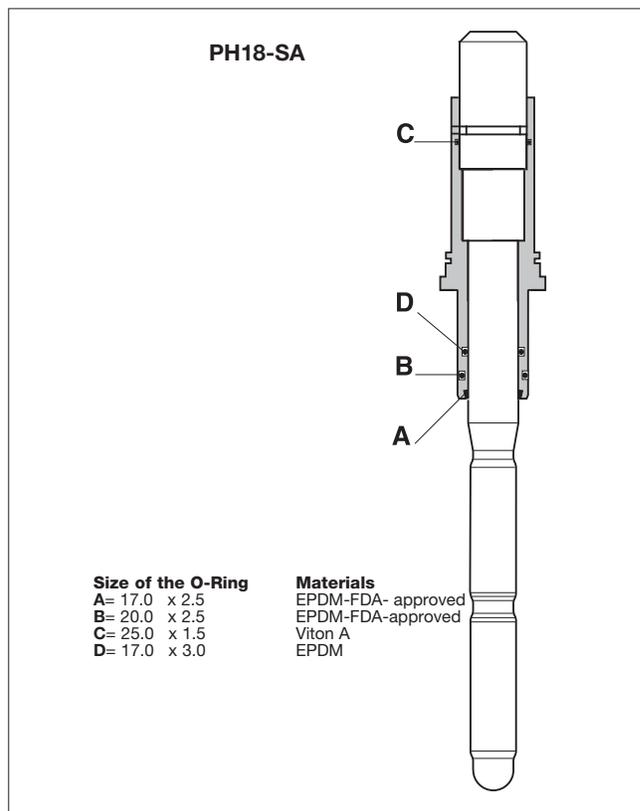


Fig. 16. Location of the O-rings

## ACCESSORIES

Spare parts for model PH18 differential pH sensor

Number	Description	Quantity
M1263XY	O-ring set contains Qty 1 each of A, B, C&D from figure 16	
K1520EJ	Straight weld-in adapter	1
K1520EK	Angled weld-in adapter	1
M1289BA	Adapter 1" NPT	1
237230	Blind plug and mounting out	1

# SC24V or PH18 Application Data Sheet



Customer: \_\_\_\_\_  
 Tag No: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Contact: \_\_\_\_\_  
 Telephone: \_\_\_\_\_  
 Email: \_\_\_\_\_  
 Rep Name: \_\_\_\_\_

*Please complete a separate form for each process stream to be analyzed and return to the attention of:*

Yokogawa Corporation of America  
 Analytical Business Unit  
 2 Dart Road  
 Newnan, Georgia 30265 - 1040  
 FAX - (770) 304-1613

**Authorization No.** \_\_\_\_\_

## 1. PROCESS DATA:

**Sensor Selection:**     PH18         SC24V

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

**Type of Solution:** \_\_\_\_\_  
 \_\_\_\_\_

## 2. PROCESS CONDITIONS:

**Description:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

pH Value	Min _____	Norm _____	Max _____
Conductivity Value	Min _____	Norm _____	Max _____
Sodium Concentration	Min _____	Norm _____	Max _____
Temperature (°C/°F)	Min _____	Norm _____	Max _____
Pressure (psig)	Min _____	Norm _____	Max _____
Flow Rate (ft/sec)	Min _____	Norm _____	Max _____
	Min _____	Norm _____	Max _____
	Min _____	Norm _____	Max _____

Concentration of Solids: \_\_\_\_\_      Concentration of Organics: \_\_\_\_\_  
 Type(s): \_\_\_\_\_                              Type(s): \_\_\_\_\_

**Problems:**             Fouling     Abrasion     Coating       Poisoning     Other  
**Describe:** \_\_\_\_\_  
 \_\_\_\_\_

**Cleaning/Sterilization:**     w/ Product     Caustic       Steam         Hot Water     Other  
**Describe:** \_\_\_\_\_  
 \_\_\_\_\_

## 3. INSTALLATION DATA:

**Mounting:**             Insertion     Flow Through     Retractable     Immersion     Other  
                               Off Line     On Line Pipe     On Line tank     Sample Line     Flanged

**Wetted Materials:**     316SS     EPDM         Kynar         Kalrez

**Distance to Converter:** \_\_\_\_\_ ft

**Instrument:**         General Purpose                               Intrinsic Safe

**Power Supply:**       115 VAC     24 VDC

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