
Instruction Manual

Model SC24
Combined 12mm 4-in-1
differential pH sensor



Table of Contents

1 GENERAL	3
1.1 Introduction	3
1.2 Warranty and service	3
1.3 Unpacking & checking	3
2 GENERAL SPECIFICATIONS	4
2.1 Measuring specifications of SC24	4
2.2 Dynamic specifications	4
2.3 Operating range	4
2.4 Model and suffix codes	4
2.5 Sensor dimensions	5
3 INSTALLATION	6
3.1 Typical installation	6
3.2 Preparing the sensor for use	6
3.3 Mounting the sensor	6
3.4 Wiring to the pH analyzer	7
3.5 Commissioning of the pH analyzer	7
4 OPERATION AND MAINTENANCE	9
4.1 Initial buffer calibration	9
4.2 Process calibration	11
4.3 Maintenance	12
5 SPARE PARTS	13
6 APPLICATION DATA SHEET SC24 DIFFERENTIAL PH SENSOR	14

1 GENERAL

1.1 Introduction

The SC24 is not a standard pH sensor, it is a differential pH sensor. This means that the reference is not a (liquid) junction but a glass sensor which does not respond to pH changes (within the applicable range of the sensor). This means the sensor is truly maintenance free and the output voltage of the sensor depends only on the salt concentration of the process.

The sensor responds to pH changes rather than analyzes the accurate pH value. In that sense it is best to describe the sensor as pH control sensor rather than pH measuring sensor.

A pH sensor measures the voltage that the pH membrane measures as function of the pH value of the process sample. This voltage is then compared with the mV output of a reference cell that is independent on the pH value of the sensor.

In most pH control applications the salt concentration is rather constant, so the output of the SC24 differential sensor is only dependent on the pH of the process. A rule of thumb is that a change in salt concentration of +/- 25% has an effect of less than 0.1pH on the pH reading.

1.2 Warranty and service

Yokogawa products and parts are guaranteed free from defects in workmanship and materials 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's discretion).

The following information must be included in the letter accompanying the returned goods:

- 1 Model Code and Serial Number.
- 2 Original Purchase Order and Date.
- 3 Length of time in service and description of the process.
- 4 Description of the fault and circumstances of the failure.
- 5 Process/environmental conditions that may be related to the failure of the sensor
- 6 Statement as to whether warranty or non-warranty service is requested.
- 7 Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person that can be reached for further information.

Returned goods that have been in contact with process fluids must be decontaminated and disinfected prior to shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material Safety Data sheets must be included for all components of the process to which the sensors/fittings have been exposed.

1.3 Unpacking & Checking

Upon delivery, unpack the sensor carefully and inspect it to ensure it was not damaged during shipment. If damage is found, retain the original packing materials (including outer box) and immediately notify the carrier and the relevant Yokogawa sales office. Make sure the Model Code on the sensor is the same as on the packing list. The Model Code and Serial Number are found on the textplate of a sensor. Check that option(s) that were ordered are also included.

2.5 Sensor Dimensions

Criteria: 120 mm version

L (below plug head)	120 ± 2 mm
Ø shaft	12 ± 0.5 mm

Criteria: 225 mm version

L (below plug head)	225 ± 2 mm
Ø shaft	12 ± 0.5 mm

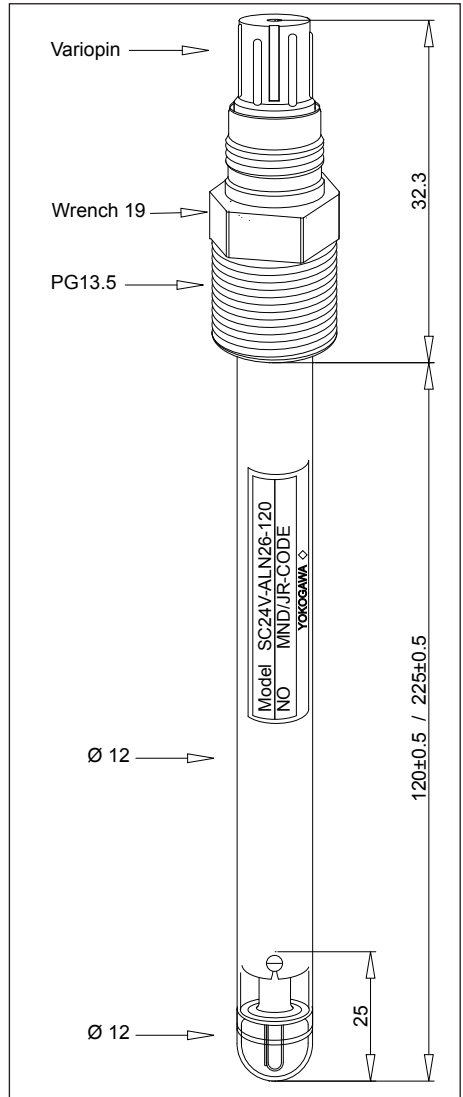


Fig 1: Dimensions

3 INSTALLATION

3.1 Typical Installation

The SC24 sensor is designed for in-line installation, via a bypass loop as an immersion assembly. For best results the SC24 should be mounted with the process flowing towards the LE/ORP pin and positioned at least 15° above the horizontal plane to eliminate air bubbles in the glass bulb. See fig 5 section 4.3

3.2 Preparing the sensor for use

Remove the sensor from its shipping box and slide off the “wet pocket” (the tube filled with solution to keep the measuring element from drying out in storage or shipment). During shipment, electrolyte in the sensor could be dislocated. To correct this, place the sensor upright for 24 hr, before calibration or installation.

IMPORTANT NOTICE

Before installing the sensor in the process it should be calibrated. The calibration procedure is normally described in the instrument Instruction Manual, but a General Guide is provided in Section 5.

3.3 Mounting the sensor

The SC24 can be mounted using the PG13,5 adapter on the sensor.

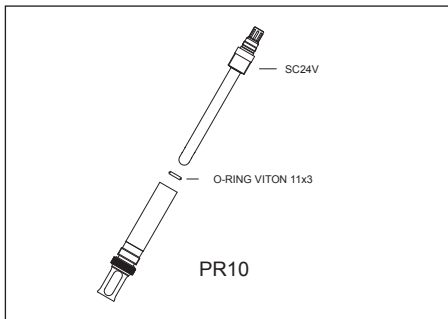


Fig 2: Mounting SC24 in PR10

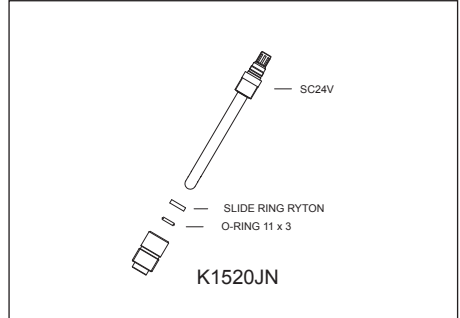


Fig 3: Mounting SC24 in K1520JN

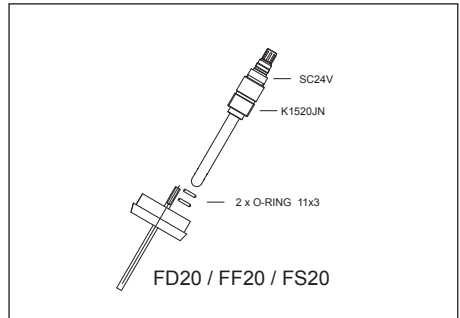


Fig 4: Mounting SC24 in FD20 / FF20 / FS20

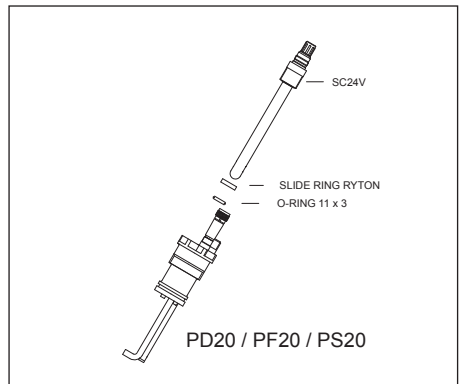


Fig 5: Mounting SC24 in FD20 / FF20 / FS20

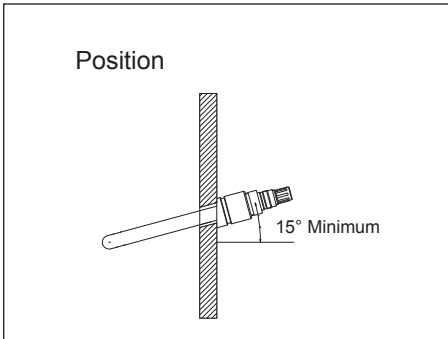


Fig 6: Positioning the SC24 in process

3.4 Wiring to the pH analyzer

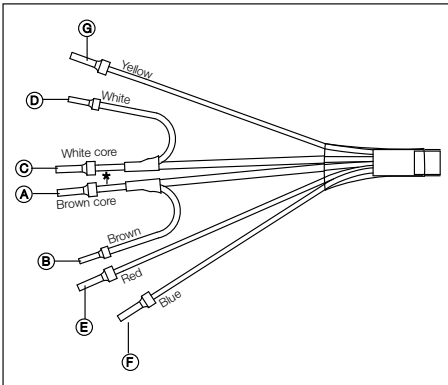


Fig 7: Wiring

Instrument connection of sensor

Signal descr.	Function	
	Differential pH measurement	
Core coax pH (Brown)	15	
Shield coax pH (Brown)	16	
Core coax pNa (White)	13	
Shield coax pNa (White)	17	
Temp (Red)	11	
Temp (Blue)	12	
Liquid earth (Yellow)	14	
///	///	

For the settings in the pH analyzer please follow the Instruction Manual of that instrument.

Cable marking and pin allocation

Signal description	XXXX cable	
	VP connector	Color
Core coax pH	A	Brown
Shield coax pH	B	Brown
Core coax pNa	C	White
Shield coax pNa	D	White
Temp	E	Red
Temp	F	Blue
Liquid earth	G	Yellow
///	H	not used

3.5 Commissioning of the pH analyzer

The EXA is programmed to pH measurement with input 1 and input 2 configured as high impedance. This is not the default setting so configuration of EXA must be changed.

PH202 and PH402

Remove the jumper that is mounted on “input 2” and verify that no jumper is present on “input 1”. There should be no jumpers in the terminal block between terminal 13 and 15.

Service **code 03** and Service **code 04**

should be set identically to **1.1.1**. The low limit should be set to **1 MOhm** and the high limit to **1 GOhm**.

In some applications the impedance measurement might cause instability, especially at low sample temperatures.

If so then service **code 03** and service **code 04** must be set to **1.1.0**

In some applications the Asymmetry Potential may be too high for standard setting if the zero offset of the reference cell is more than 120 mV. This can be resolved by setting service **code 06 to 0.1**

PH450

In the PH450 the jumpers on the terminals must be removed and placed in the “parking” slots in the cover of the instrument.

Go into commissioning mode after pressing the key with the wrench

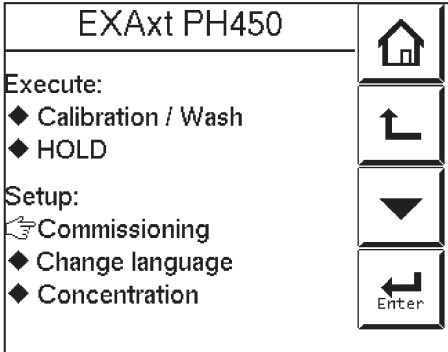


Fig 8

Then enter the ‘measurement setup’ and select impedance settings and set high

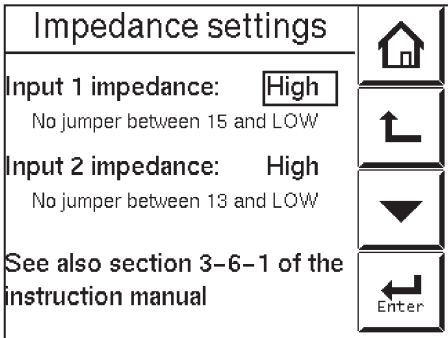


Fig 9

If the offset of the reference is high, then the adjust using “ zero and slope “ limits. Path: measurement setup / calibration / pH setting

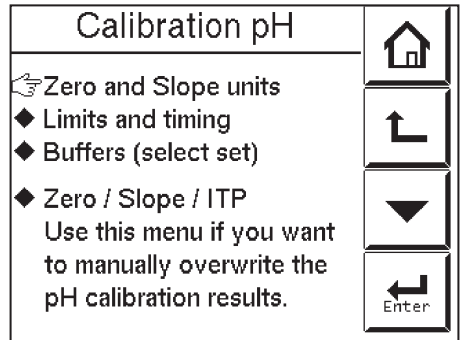


Fig 10

In some applications also the ITP can be adjusted to improve accuracy. Please do not use this function without advice from Yokogawa.

5 OPERATION AND MAINTENANCE

5.1 Initial buffer calibration

For buffer calibration it is necessary to use pH buffers that have the same ionic strength. The pH standards that are preprogrammed in the pH analyzers do not fulfill this requirement.

That is why the "AUTOCAL" mode in the analyzer will not be used for calibration of the SC24 differential pH sensor. The sensor will be calibrated using the "MANUAL" method and uses special buffer solutions. 1M ionic strength NaCl solution bottle á 500ml:

- K1520BG pH 2.00
- K1520BH pH 4.00
- K1520BJ pH 7.00
- K1520BK pH 9.00

If these buffer solutions are not available, then it is possible to use standard buffers (4.01; 6.86; 9.18) to check functionality of the sensors.

However if they are used for calibration of Asymmetry and Slope they will result in wrong SLOPE calculations.

In that case it is better to use default settings for ASY (0 mV) and SLOPE (100%) and use the buffers only to verify the proper functioning of the sensor.

The procedure is shown for PH450 analyzer, but procedure is the same as for other analyzers.

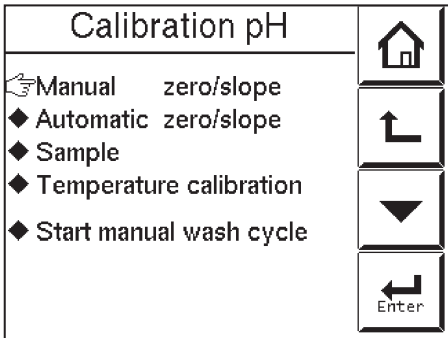


Fig 11

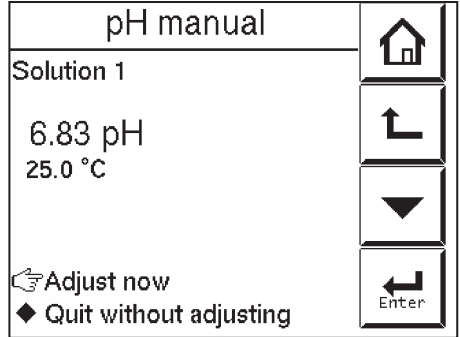


Fig 12

Wait until reading of pH and Temperature in the buffer solution are stable and then go to the next step: the reading is adjusted to the buffer value indicated on the bottle.

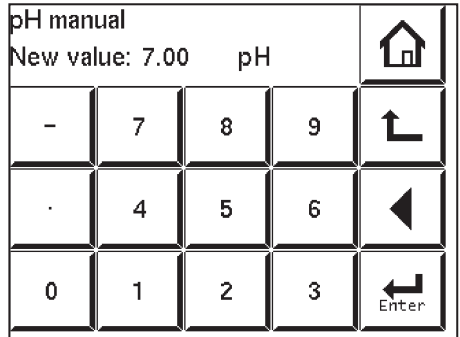


Fig 13







pH manual		
Completed (1 point)		
7.00 pH 25.0 °C		
 Go to solution 2  Calibration complete		

Fig 14

The sensor is rinsed with demineralized water and inserted in the second buffer solution, in this case 4.00 pH







pH manual		
Solution 2		
4.13 pH 25.0 °C		
 Adjust now  Quit without adjusting		

Fig 15

Wait until readings are stable and adjust the reading to the indicated standard value: 4.00






pH manual				
New value: 4.13 pH				
-	7	8	9	
.	4	5	6	
0	1	2	3	

Fig 16







pH manual		
Completed (2 point)		
4.00 pH 25.0 °C		
Zero = 10.01 mV Slope = 95.81 %		
 Accept Data  Cancel calibration		

Fig 17

It is important to understand that the SC24 differential sensor does not show the correct pH value in the process after buffer calibration. The reason is that the output voltage of the reference element must be corrected in the pH analyzer.

This is done using the process calibration method.

5.2 Process calibration

The best method to correct for the output voltage of the reference cell of the differential sensor is the process calibration mode. In the Instruction manual of the pH analyzer this is referred to as Manual Calibration. Illustrations of the menu in the PH450 are shown as example. For other analyzers the procedure is similar.

Wait until the pH reading is stable and then adjust the reading to match the pH value of the sample that is analyzed using a laboratory measurement. We advise to use for this the PH72 Personal pH meter. In this example the reading of the PH72 in the process sample is 5.23 pH

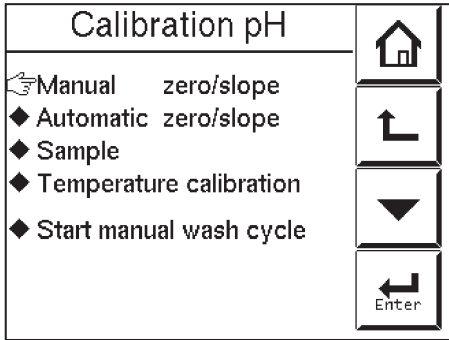


Fig 18

For process calibration we use the same procedure as we used before for the buffer calibration. Only this time we make a one point calibration only and as result the Asymmetry value will be updated in the analyzer.

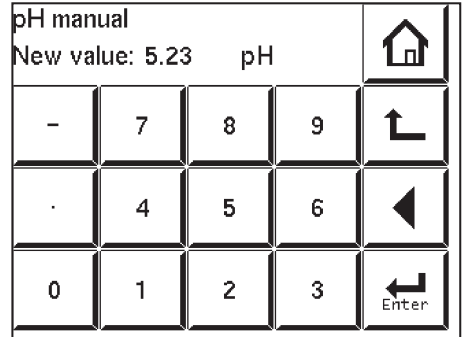


Fig 20

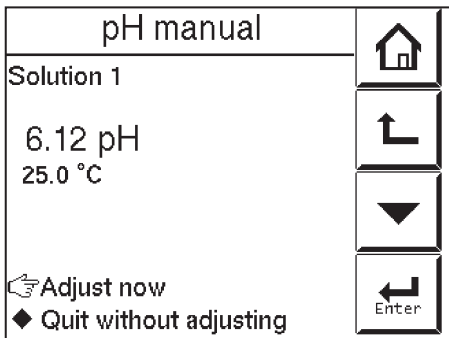


Fig 19

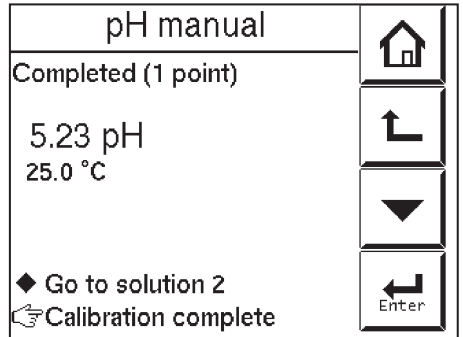


Fig 21

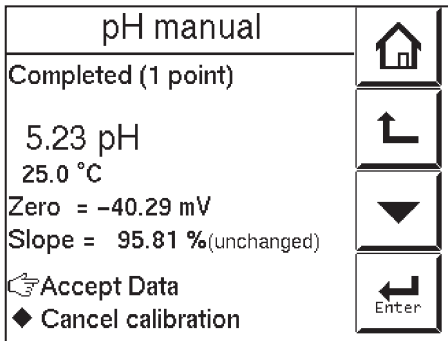


Fig 22

Now the initial calibration of the sensor is completed and the measurement will give accurate pH values.

5.3 Maintenance

The sensor requires very little maintenance, since it does not have an open reference junction to the process. The sensor is hermetically sealed from the process and does not suffer from poisoning, diffusion, fouling.

The only maintenance required is to keep the glass surface free from deposits from the process like scaling (CalciumCarbonate, Hydroxydes) or Hydrocarbons (oil, tar, grease). If the surface is coated, then remove the coating with suitable cleaner:

- 5-10% Hydrochloric acid to remove the scaling
- Organic solvent or detergent to remove the organic deposits

A soft toothbrush may be used to accelerate the cleaning process.

On regular intervals a buffer calibration and a process calibration need to be performed to assure a correct pH reading.

The best practice is to use the buffers only to check the proper functioning and only make adjustments with process calibration.

6 SPARE PARTS

Buffer solutions

Prod. No.	Description
K1520BG	Buffer Solution PH 2 + PNA 0
K1520BH	Buffer Solution PH 4 + PNA 0
K1520BJ	Buffer Solution PH 7 + PNA 0
K1520BK	Buffer Solution PH 9 + PNA 0
K1520BF	Buffer Solution PH 4/7/9 + PNA 0

Connection equipment

Prod. No.	Description
WU10-V-D-02	Cable Variopin dual coax
WU10-V-D-05	Cable Variopin dual coax
WU10-V-D-10	Cable Variopin dual coax
WU10-V-D-15	Cable Variopin dual coax
WU10-V-D-20	Cable Variopin dual coax
BA10	Junction box for pH extension cables
WF10-XXX-F	pH signal cable with terminated ends. Specify length in whole meters (e.g. XXX = 005, 010, 025, 050)

Sealings

Prod. No.	Description
K1500BV	O-Rings EPDM 11X3 (6 PCS.)
K1500BZ	O-Rings VITON 11X3 (6 PCS.)
K1500GR	O-Rings SILICON 11X3 (8 PCS)
K1524AA	Set O-Ring / Slide Ring SC24

Adapters

Prod. No.	Description
K1523JA	Adapter for mounting PG13,5-sensors in F*40
K1520JN	Adapter M25x1.5 - PG13.5 PVC
K1520JP	Adapter M25x1.5 - PG13.5 RVS
K1500DV	Adapter M25x1.5 - PG13.5 PVDF
K1523JB	Adapter PG13.5 to 3/4"NPT
K1598AC	Flow fitting (3.1), for SC4A (In combination with K1523JB)
K9148NA	Adapter for mounting PG13,5-sensors in HA405-120-S3
K9148NB	Adapter for mounting PG13,5-sensors in HA405-120-PP
K9148NC	Adapter for mounting PG13,5-sensors in HA405-120-PV

YOKOGAWA ELECTRIC CORPORATION

World Headquarters
5-32, Nakacho 2-chome, Musashino-shi
Tokyo 180-8750
Japan
www.yokogawa.com

YOKOGAWA CORPORATION OF AMERICA

2 Dart Road
Newnan GA 30265
USA
www.yokogawa.com/us

YOKOGAWA EUROPE BV

Euroweg 2
3925 HD AMERSFOORT
The Netherlands
www.yokogawa.com/eu

YOKOGAWA ELECTRIC ASIA Pte. LTD.

5 Bedok South Road
Singapore 469270
Singapore
www.yokogawa.com/sg

YOKOGAWA CHINA CO. LTD.

3F Tower D Cartelo Crocodile Building
No.568 West Tianshan Road Changing District
Shanghai, China
www.yokogawa.com/cn

YOKOGAWA MIDDLE EAST B.S.C.(c)

P.O. Box 10070, Manama
Building 577, Road 2516, Busaiteen 225
Muharraq, Bahrain
www.yokogawa.com/bh

Yokogawa has an extensive sales and distribution network. Please refer to the European website (www.yokogawa.com/eu) to contact your nearest representative.



YOKOGAWA ◆

IM 12B6J7-02-E-E

Subject to change without notice

Copyright ©

Printed in The Netherlands, 01-907 (A) I