1. GENERAL

**COMBINED PH ELECTRODES (NON-FLOW)**

- pH, temperature range: 0 to 14 pH, 0 to 110 ºC
- Maximum process pressure 500 kPa
- Glass Resistance (25ºC): 25 to 50 MΩ
- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations.
- A large area PTFE junction to resist fouling to a high degree.
- Chemical resistant, steam-sterilisable pH-glass.

**SC21-AGP24**

- pH, temperature range: 0 to 14 pH, 0 to 80 ºC.
- Maximum process pressure 500 kPa.
- Glass Resistance (25ºC): 120 to 200 MΩ
- S-Glass Resistance (25ºC): 25 to 50 MΩ.
- Ag/AgCl wire reference system.
- pH bulb with cage protection (no breakage when placed in a beaker).
- Heavy duty glass membrane for prolonged operation in corrosive, abrasive and fouling environments (withstanding traces of HF).
- A large area PTFE junction to resist fouling.
- Thickened electrolyte (3.3M).

**SC21C-AGP26**

- pH, temperature range: 0 to 14 pH, -10 to 100 ºC.
- Maximum process pressure 500 kPa.
- Glass Resistance (25ºC): 120 to 200 MΩ.
- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations.
- Double junction (thickened saturated KCl-solution). Built-in salt bridge prevents poisoning of the reference system.
- Heavy duty glass membrane for prolonged operation in corrosive, abrasive and fouling environments (withstanding traces of HF).
- A large area PTFE junction to resist fouling.
- Thickened electrolyte (3.3M).

**SC21C-AGP55**

- pH, temperature range: 0 to 14 pH, 0 to 110 ºC.
- Maximum process pressure 500 kPa.
- Glass Resistance (25ºC): 75 to 150 MΩ
- Maximum process pressure 500 kPa
- pH, temperature range: 0 to 14 pH, 0 to 80 ºC.
- Atmospheric pressure.
- Low ionic application. Positive flow of electrolyte provides the conductivity to measure pH
- Heavy duty pH-sensitive glass.
- Flowing reference system for pollution resistance, and highly stable reference potential.
- PG13.5 standard DIN electrode connection.
- Use in combination with the presurisable electrolyte reservoir to obtain a positive flow towards the processes [K1500PA].

1.2. TYPE NUMBER

The type number of a combined electrode is arranged as follows:

- **SC**
- **C** = Universal connector type
- **D** = Din connector
- **G** = Compact connector
- **P** = PTFE ballon
- **L** = high temperature
- **F** = Flow electrode
- **M** = Membrane
- **Ag/AgCl** wire reference system
- **Reference system**
- **D** = DIN 40430
- **G** = 1/4”
- **Ø 17**
- **Ø 12**
- **DIN 40430**

1.3. SPECIFICATIONS

The specifications for the sensor are clearly shown in the type plate attached to the electrode cap.

The electrical resistance of the diaphragm is <5kΩ at 25ºC. Each temperature increase of 10ºC reduces the resistance of the membrane. The resistance of the diaphragm depends on the type of the membrane but must be max. 10 kΩ at 25ºC in all circumstances.

2. INSTALLATION

2.1. PREPARATION FOR USE

For accurate pH measurement, a gel layer must be formed on the membrane surface. For this reason the pH-sensitive part of the electrode should be soaked for 24 hours before the electrode is used.

When an electrode has been stored dry and you need to use it immediately (there is no time for soaking), you may do so, but as a result initial regular calibration will be required until the gel layer is formed.

The electrode when dispatched by Yokogawa, the pH sensitive part of the electrode and protective cover cap must be removed. If required, the flow electrodes of (types SC21C-AGC55) have a refill opening, around the membrane which ensures you can use the electrode immediately. Flow electrodes (types SC21C-AGC55) have a refill opening, which is sealed with a cap or stopper.

**NOTE:**

Before installation the above mentioned stopper and protective cover cap must be removed. If required, the flow electrodes of the type SC21C-AGC55 may be connected to a reservoir of electrolyte solution. To maintain a correct flow, in non-pressurized systems, the reservoir must be placed so that the level of the electrolyte is above the level of the measuring liquid. Only under these circumstances will the correct electrical contact between reference system and measuring liquid be guaranteed.

2.2 MOUNTING

The combined electrodes must be connected with a coax cable type [K21D(D)-PC], marked with a blue strip. In areas where electrical interference is likely we recommend to use the Triax electrode cable type [K21D(D)-LT], marked with a blue strip. The cables meet the requirements of IP65 and can be used in temperatures up to 70°C (Triax) and 110°C (Coax).

The cables above are fitted with the standard Yokogawa nut (W12D) or a DIN nut (WU20D), the dimensions of which are shown in figure 12.

The Yokogawa nut can be ordered under part number: K1500DW.
3. USE AND MAINTENANCE

3.1. GENERAL

The thermistor point of intersection of the electrode is at pH 7 (±0 mV).

Regularly check there is sufficient electrolyte solution in the electrode or in the reservoir.

The SC21C-AGC55 type sensor is filled with a solution of 3.3 M KCl (4.246 g/kg KCl/1000 g demi-water), which is available as spare part nr. K1520VA.

The electrodes of the type SC21(D)-2, are filled with a gelled electrolyte solution and refilling is not necessary. When there is insufficient electrolyte solution this type of electrode has probably been used at at a temperature too high for this electrode and therefore replacement by another type of electrode is re-commended.

3.2. CALIBRATION AND BUFFERING

To calibrate a pH sensor, two buffer solutions with known pH values are required. It is recommended that one buffer solution has a value has near to pH 7.00 (9TP). Depending on the process value to be measured, the second buffer solution should be either acidic (below 7.00) or alkaline (above 7.00). Normally, the IEC buffers (4.01, 6.87 and 9.18) are used. The following is a very general 2-point calibration procedure:

1. Refer to appropriate Instrument Instruction Manual for Calibration procedures (Auto Manual, Sample, etc.).
2. Clean the sensor (deposits may be removed using a 5% (approximate) solution of HCL).
3. Rinse the sensor thoroughly with clean (demi) water.
4. Immerse the sensor in the first buffer (6.87 pH is recommended).
5. Rinse sensor thoroughly with clean (demi) water.
6. Immerse the sensor in the second buffer (4.01 or 9.18 recommended).
7. Repeat Step 4.

During calibration the temperature compensation is not necessary. When there is insufficient electrolyte solution this type of electrode has probably been used at at a temperature too high for this electrode and therefore replacement by another type of electrode is re-commended.

NOTE: During buffering the liquid earth and the temperature compensation must be connected. The temperature of the buffer solution must be within the limits of the technical specifications as indicated on the type plate.

4. STORAGE

When an electrode is to remain unused for a long period, it is necessary to fill the electrode completely with electrolyte solution, to close the refill opening, and to fit the protective cover over the membrane. This must be filled with water.

5. TROUBLE SHOOTING

Generally faults are caused by:

a. Sensitivity decrease of the membrane. When this occurs the electrode must be cleaned with a suitable detergent.
   1. Deposits of hydroxides lime, iron, hydroxide can be removed by immersing the electrode in a diluted solution of hydrochloric acid and then rinsing with water.
   2. Deposits of oil or fat can be removed by means of hot water in conjunction with a domestic washing solution. When the result is unsatisfactory, a domestic abrasive may be carefully used.
   3. Albuminous depositions can be removed by means of a solvent containing 8.5 ml concentrated hydrochloric acid, 1.0 g pepsin and 1 lter demi-water.

b. Leakage to earth. Fault indications can be expected when the resistance between the reference system and the screening falls below 10 MΩ.

When a fault occurs, first check if the electrode cable is in a good condition. Second check if the connector contacts and the terminals in the measuring instrument or connection box are clean and dry.

c. Short circuit by break or leakage.

The pH meter reading remains approximately pH 7 and is not dependent on the pH value of the liquid being measured. If this occurs the electrode should be replaced.

d. Diaphragm poisoning

Strongly polluted liquids can cause the diaphragm to foul very quickly. As a result, there will be a transition resistance over the diaphragm. When this resistance exceeds 10Ω instability of reading and incorrect indication of the measured value will occur.

The above fault occurs frequently with flow type electrodes when the flow of electrolyte solution is insufficient e.g. with adverse pressure variations due to the medium, pumps or too low electrolyte level.

Fouled electrodes can be cleaned with hot water in conjunction with a domestic washing solution if necessary. When the fouling is caused by fat or hydrocarbons (lube) cleaning with an organic solvent or diluted acid respectively is recommended.

The ceramic diaphragm of electrode types SC21C-AGC55, can be cleaned by lightly rubbing with fine emery paper. It may be necessary with non-flow type electrodes types SC21(D)-2, to place the electrode for a period in an electrolyte solution at 80°C and let them remain until the solution has completely cooled.

e. Poisoning

An electrode can be poisoned by the penetration of the process liquid or by diffusion of components of the process medium through the diaphragm. In addition, the inner liquid in combination with dissolved particles from the process medium may give deposits which block the diaphragm (e.g. silver chloride + sulfate). Diaphragm poisoning can be corrected with hot water or demineralized water.

Poisoning can be corrected with:

1. A quick check of the correct functioning of the reference input of the measuring instrument gives a correct adjustment the known good reference electrode to the reference input of a pH meter. A known good reference electrode with the same reference system should be connected to the glass electrode input of the meter. After immersing both electrodes in a buffer solution. The meter reading should be stable and adjustable to pH 7 (asymmetry potential).

2. A quick check of the correct functioning of the pH part of the combined electrode can be made by connecting the pH sensitive part to the glass electrode input of a pH meter and a known good reference electrode to the reference lead of this meter. If the calibration procedure described in 3.2 gives a correct adjustment the pH sensitive part of the combined electrode is functioning correctly.

WARNING:

As a result of strong etching properties of the acid, the handling should be done carefully and in consultation with a safety officer.

6. CHECK

A quick check for correct functioning of a combined electrode can be made as follows. First operating the reference lead of this electrode to the reference input of a pH meter. A known good reference electrode with the same reference system should be connected to the glass electrode input of the meter. After immersing both electrodes in a buffer solution. The meter reading should be stable and adjustable to pH 7 (asymmetry potential).

If this is possible the reference part of the electrode is functioning correctly.

Yokogawa maintains an extensive sales and distribution network.

Please refer to the European website www.yokogawa.com/eu to contact your nearest representative.