



INTERNATIONAL

Water Quality: pH
(AWQ-PH)

Contents

1. Introduction	3
1.1 Description	3
1.2 Dimensions, Construction & Markings	3
2. Maintaining Good Working Order of AWQ-pH	4
2.1 Authorised Assembly and Activation	4
2.2 Product Overview	4
2.3 Applications	4
3. AWQ-pH Specifications	5
3.1 pH	5
3.2 Redox	5
3.2 Temperature	5
3.4 Sampling Rate	6
3.5 Electrical Connections	6
3.6 Sensor & Communication	7
3.7 Modbus RTU registers	7
3.8 SDI12 Frame	7
4. Installation Options	8
4.1 Considerations	8
4.2 Pole Mounting	9
4.5 Installation Accessories	11
4.6 PVC Pipe-Mounting	12
4.8 Stainless Steel Pipe-Mounting	13
5. Startup and Maintenance	14
5.2 Preparation of Sensor	14
5.4 pH Calibration - Offset	15
5.6 Check of the Redox potential	15
5.7 Maintenance	16
5.9.1 Dismantling the AWQ-pH Sensor	17
5.9.2 Reassembly of the AWQ-pH Sensor	17

1. Introduction

1.1 Description

This sensor features long-life Plastogel® reference technology, increasing the lifetime of the probe and reducing the need to refill. The AWQ-pH sensor has been designed for hand-held and in-situ applications in some of the most difficult situations for a pH/ORP sensor in term of sensor resistance, quick response, minimal flow dependence and low power consumption.

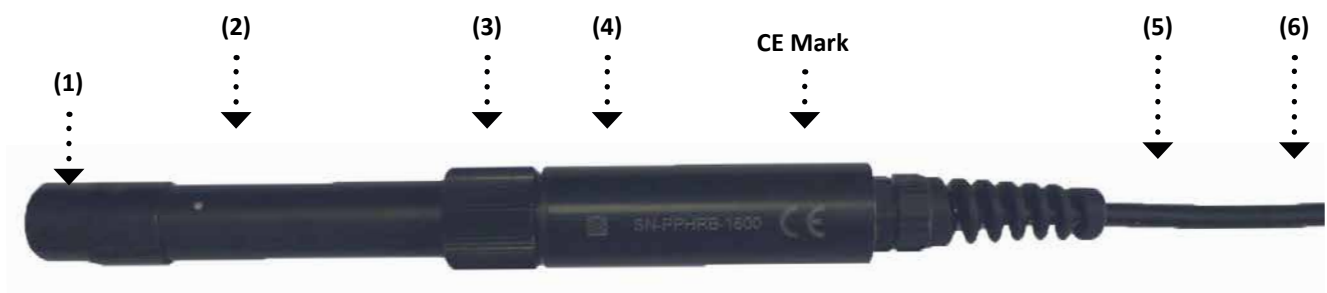
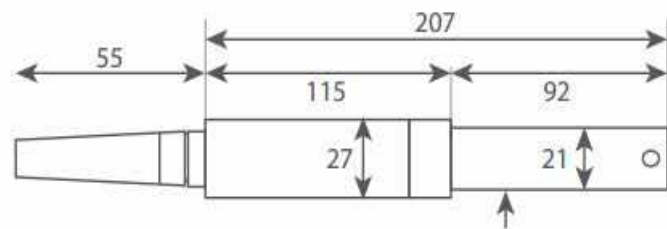


The AWQ-pH pH/Redox/Temp sensor stores calibration and history data within the sensor.

This allows for use in a plug and play system without the need for re-calibration. Thanks to the Universal Modbus RS485 protocol and SDI-12, the AWQ-pH sensor can be connected to most commonly used devices (Datalogger, Controller, Automation, Remote System). The AWQ-pH sensor has been designed to perform under hard conditions, from pure mountain water with conductivity as low as 20 $\mu\text{S}/\text{cm}$, lakes and rivers (100 – 2000 $\mu\text{S}/\text{cm}$), seawater with conductivities of 50 mS/cm , to wastewater with conductivity higher than 200 mS/cm .

1.2 Dimensions, Construction & Markings

The marking on the body of the sensor indicates the serial number of the sensor (for the traceability) and the LOGO CE.



Datamatrix
(contains the serial number)

Serial Number
SN-PC4EX-YYYY
X: Version
YYYY: Number

- (1) Strainer of Protection
- (2) Cartridge (Consumable Part)
- (3) Clamp
- (4) Sensor body with measurement electronics
- (5) Cable bushing
- (6) Securely connected connection cable

2. Maintaining Good Working Order of AWQ-pH

2.1 Authorised Assembly and Activation

In order to maintain and ensure the good working order of the AWQ-pH sensor, users must comply with the safety precautions and warnings featured in this manual.

Assembly, electrical connection, activation, operation and maintenance of the measuring system must only be carried out by specialist personnel authorised by the user of the facilities. Trained personnel must be familiar with and comply with the instructions in this manual. In addition:

- Make sure the power supply complies with the specifications before connecting the device.
- A clearly-labeled power switch must be installed near the device.
- Check all connections before turning the power on.
- Do not attempt to use damaged equipment: it may represent a hazard and should be labeled as faulty.
- Repairs must only be carried out by the manufacturer or by ICT International's after-sales service department

2.2 Product Overview

The combined sensor AWQ-pH is based on a principle of measure of difference of potential between a reference electrode (Ag/AgCl) and an electrode of measure (Special pH glass for the measure of pH, and a ring of platinum for the ORP measurement). The returned measure is given for a temperature of 25°.

The AWQ-pH sensor has been designed to perform under hard conditions, featuring a "long life" reference. The Plastogel® technology increase the lifetime of the probe the need to refill. This sensor has been designed also for hand-held and in situ applications which have been the most difficult situations for a pH/ORP sensor in term of sensor resistance, quick time response, minimal flow dependence and low power consumption.

The sensor features excellent interference immunity thanks to the integrated preamplifier and digital signal processing. The measured value for pH is automatically compensated with the temperature, and transferred without interference to the connected display unit and controller via a digital interface. The cartridge is easy to replace, meaning the sensor is very easy to maintain. The current calibration data is saved directly in the sensor electronics. As a result, the Plug and Play function of the system is enabled without the need for recalibration. The sensor also includes a log book containing the last ten successful calibrations in the form of a ring buffer.

2.3 Applications

- Industrial and municipal sewage treatment plants
- Wastewater management (nitrification and de-nitrification)
- Surface water monitoring
- Drinking water monitoring

3. AWQ-pH Specifications

3.1 pH

Measurement Principle	pH/ Redox: Potentiometric measure ; pH: pair of electrodes with a reference (Ag/AgCl gel) / H3O+ ions sensitive glass Redox: pair of electrodes with a reference (Ag/AgCl gel) /platinum disk Temperature: NTC
Measurement Range	0 – 14 pH
Resolution	0.01 pH
Accuracy	+/- 0.1 pH

3.2 Redox

Measurement Principle	Combined electrode (Redox/reference): Platinum tip, Ag/AgCl AgAgCl. Gelled reference (KCl)
Measurement Range	- 1000 to + 1000 mV
Resolution	0.1 mV
Accuracy	± 2 mV

3.2 Temperature

Technology	NTC
Range	0.00 °C to + 50.00°C
Resolution	0.01 °C
Accuracy	±0.5 °C
Response Time	< 5s
Storage Temperature	0°C to + 60°C

3. AWQ-pH Specifications

3.3 Temperature Compensation

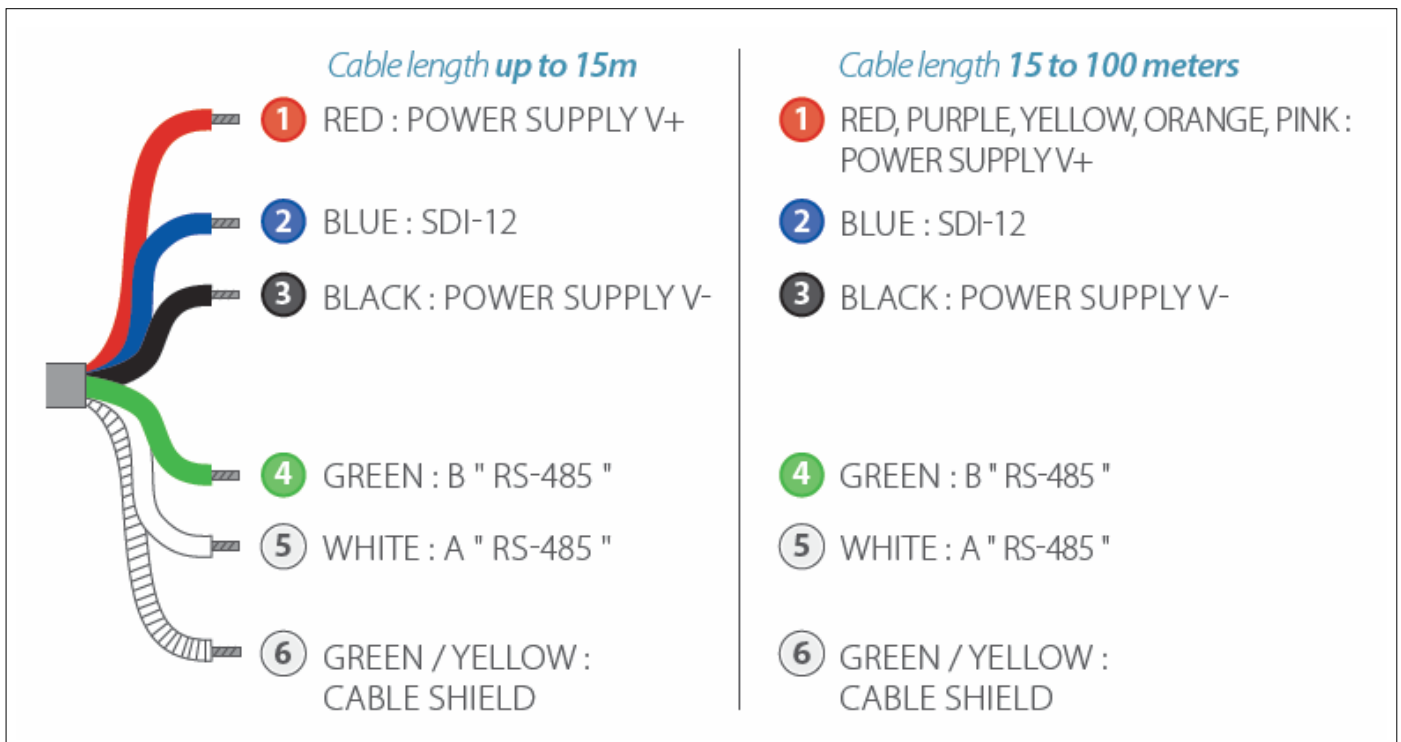
The pH measurement is dependent on parameters: The temperature of the measurement medium. This dependency is stored in the sensor's measurement electronics in the form of functions. The sensor can therefore determine the pH of the measurement medium, in order to digitally transmit the influencing factors above, in compensated form, to the transmitter/controller. The temperature compensation is automatic and managed directly by the sensor via the integrated sensor of temperature (NTC).

3.4 Sampling Rate

AWQ-pH sensors do not carry out any continuous measurements but it is possible to have a measure all 500mS.

3.5 Electrical Connections

Power Requirements	5 to 12 volts DC (for Cable 0-15m), 7-12 volts (for Cable >15m), Max. 13.2 V
Current Draw (Consumption)	Standby: 25 μ A Average RS485 (1 measurement/second): 3.9 mA Average SDI-12 (1 measurement/second): 6.8 mA Current pulse: 500 mA; Heating time: 100 mS Protection against the inversions of polarity



3. AWQ-pH Specifications

3.6 Sensor & Communication

Sensor Dimensions	Sensor Size: Diameter: 27 / 21 mm; Length: 207 mm Sensor Weight (Including 3 Meter Cable): Approx. 350gms IP Classification: IP68 Maximum Pressure: 5 bars
Wetted Material	Body (Electrical Part) & Clamp: PVC body Cartridge: In DELRIN, Special pH Glass, Platinum, Inox 316L (protective sleeve of the temperature probe) Cable: polyurethane jacket Steam Gland: Polyamide Patch with active material (black) - DO DISK: Optical isolation silicon
Sensor Connection	9 armoured connectors, polyurethane jacket, bare-wires or waterproof Fisher connector
Sensor Cable	Standard: 3, 7 and 15 m (other length on request). 100 m Max. Up to 100 m with junction box.
Safeway	The glass electrode is vulnerable to: chemicals (organic solvents, acids and strong bases, peroxide, hydrocarbons), and mechanical treatments (impacts). The Redox potential electrode is sensitive to sulphide adsorption on platinum.
Signal Interface	Modbus RS-485 (standard); SDI-12 (optional)

3.7 Modbus RTU registers

The link protocol must correspond to MODBUS RTU. The Modbus memory plane is identical for each parameter of the Sensors. The Modbus protocol for the Sensors allows you to measure the parameter (+ temperature) of the Sensor and to calibrate the parameter (+ temperature). Functions include:

- Select the averaging value
- Read the Sensor description
- Return to default coefficients
- Modify the Sensor address
- Information on measures conducted (Out Of Specification measurement, measurement in progress etc.)
- Date and name of the operator who performed the calibration etc

3.8 SDI12 Frame

A list of SDI12 registers is available for network communication.

4. Installation Options

4.1 Considerations

For the installation of the sensors in conditions of immersion or in-pipe insertion, we advise to use accessories adapted and proposed by ICT INTERNATIONAL.

For immersion conditions, it is necessary to maintain the sensor by the body and not to leave the sensor suspended by the cable at the risk of damaging the sensor.

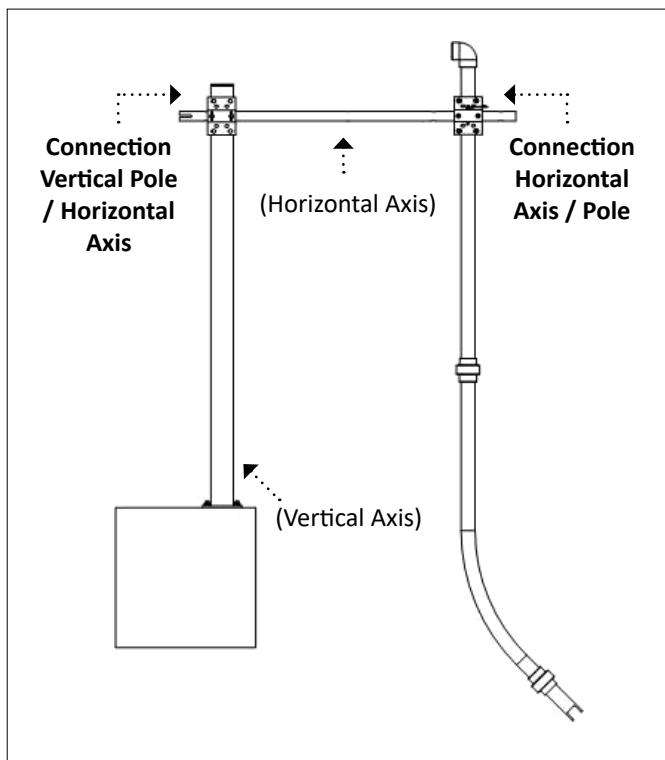
For open basins ICT INTERNATIONAL proposes a range or pole (short and long version) in order to install the sensor. It can be positioned a considerable distance from the basin edge with the bracket suspended on a chain, for example.

Please note the following when planning your set-up:

- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- Do not allow the fitting (and thus also the sensor) to swing against and hit the basin edge
- When working with systems involving pressure and/or temperature, ensure that the fitting and sensor meet all relevant requirements
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance).

Material	PVC
Admissible Temperature	0°C to +60°C
Maximum Pressure:	5 bar

4. Installation Options

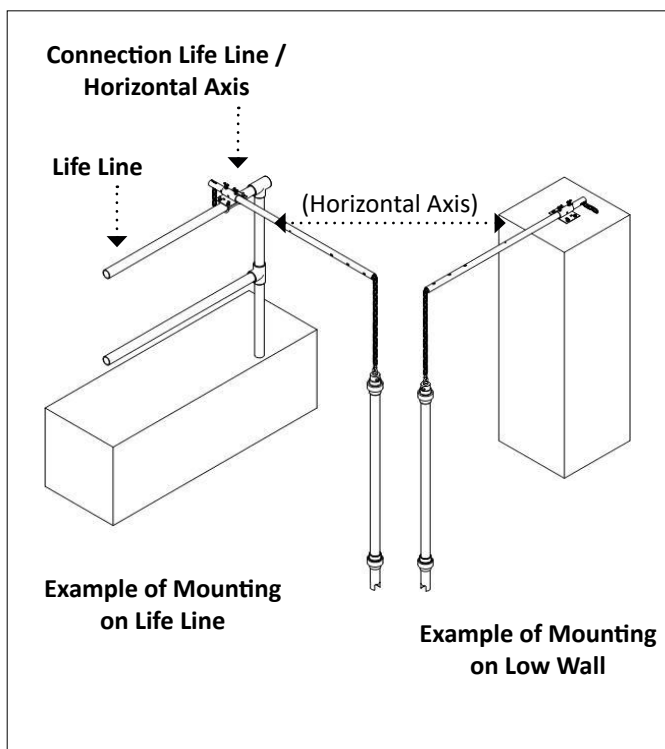


4.2 Pole Mounting

The elements of fixation for the poles are flexible and specially studied to adapt themselves to the different configurations of assembly.

Pole Kit Fixation:

- NC-ACC-C-00009: POLE FIXATION KIT FOR NUMERICAL SENSOR (ON LOW WALL)
- NC-ACC-C-00010: POLE FIXATION KIT FOR NUMERICAL SENSOR (ON LIFE LINE)
- NC-ACC-C-00011: POLE FIXATION KIT FOR NUMERICAL SENSOR (ON VERTICAL AXIS)
- PF-ACC-C-00272: VERTICAL AXIS FOR NUMERICAL SENSOR POLE (FIXED ON SOIL)



Accessories Kit for assembly of poles with chain:

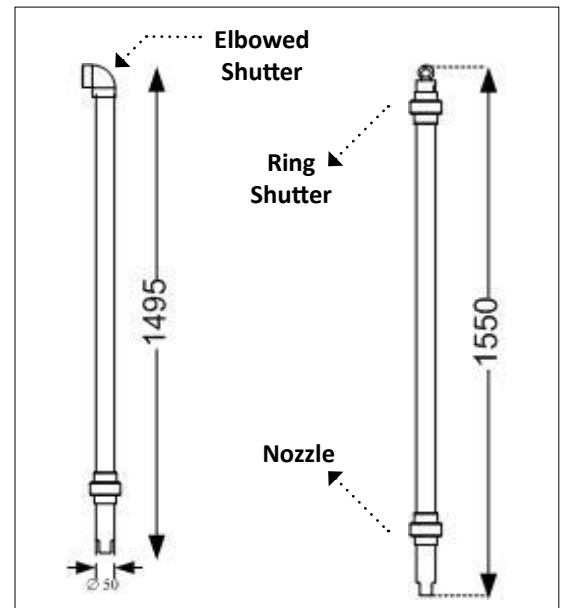
- NC-ACC-C-00012: SHORT POLE FIXATION KIT FOR NUMERICAL SENSOR (ON LOW WALL)
- NC-ACC-C-00013: SHORT POLE FIXATION KIT FOR NUMERICAL SENSOR (ON LIFE LINE)
- NC-ACC-C-00014: SHORT POLE FIXATION KIT FOR NUMERICAL SENSOR (ON VERTICAL AXIS)

4. Installation Options

4.3 Short Pole Examples

The short pole is available in 2 versions:

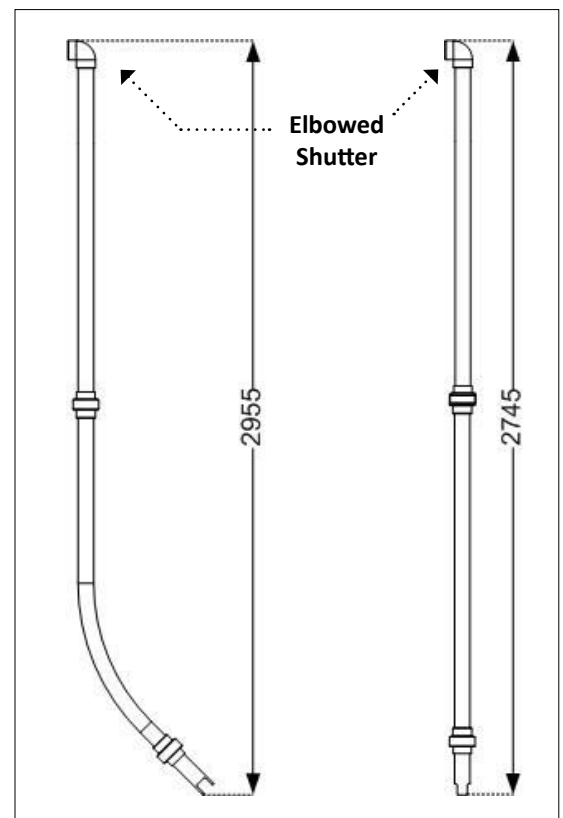
- Version with elbowed shutter. The nozzle of support is included in the offer.
PF-ACC-C-00267: STRAIGHT SHORT POLE FOR AWQ-pH SENSOR (1495 mm, ELBOWED SHUTTER)
- Version with shutter for mounting with chain. The nozzle of support is included in the offer.
PF-ACC-C-00270: STRAIGHT SHORT POLE FOR AWQ-pH SENSOR (1550 mm, RING SHUTTER)



4.4 Long Pole Examples

The long poles are available in elbow version, for installations in aeration basin, and straight, for applications in open channel. Every pole is equipped with an elbowed shutter and with waterproof joints. The lower part includes a nozzle which is adapted to the sensor what assures its mechanical support.

- Elbowed pole with elbowed shutter
PF-ACC-C-00261: 90° ELBOW LONG PERCH FOR AWQ-AWQ-pH SENSOR (2955 mm, ELBOWED SHUTTER)
- Straight long pole with elbowed shutter
PF-ACC-C-00264: STRAIGHT LONG POLE FOR AWQ-pH SENSOR (2745 mm, ELBOWED SHUTTER)



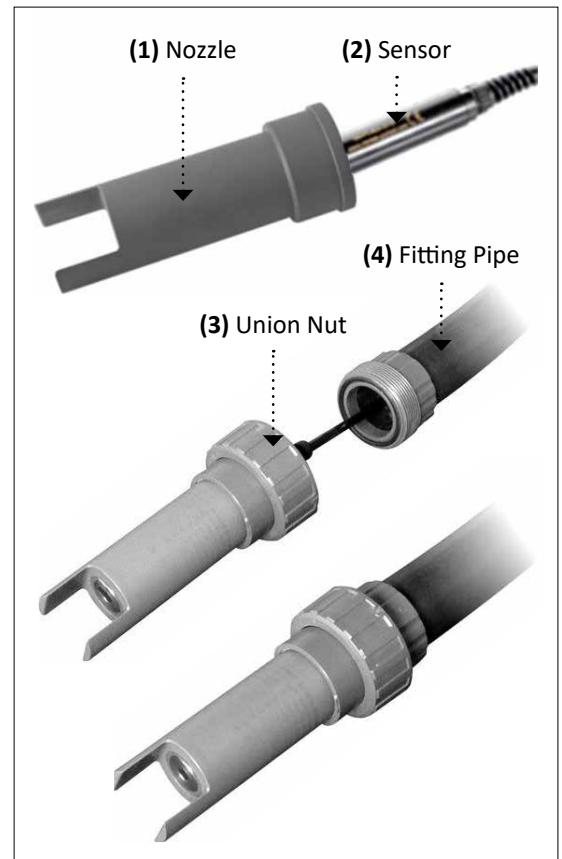
4. Installation Options

4.5 Installation Accessories

Insertion in a pole:

The sensor is mounted on the relevant fitting as described below, using a sensor holder, which can be used both for the short and long pole:

- 1. Remove the protective cap on the sensor and insert the sensor (2) into the nozzle (1) as far as the stop..
- 2. Insert the sensor cable into the fitting pipe (4) and completely feed through.
- 3. Screw the sensor holder with the union nut (3) onto the fitting pipe (4) and tighten until hand-tight.



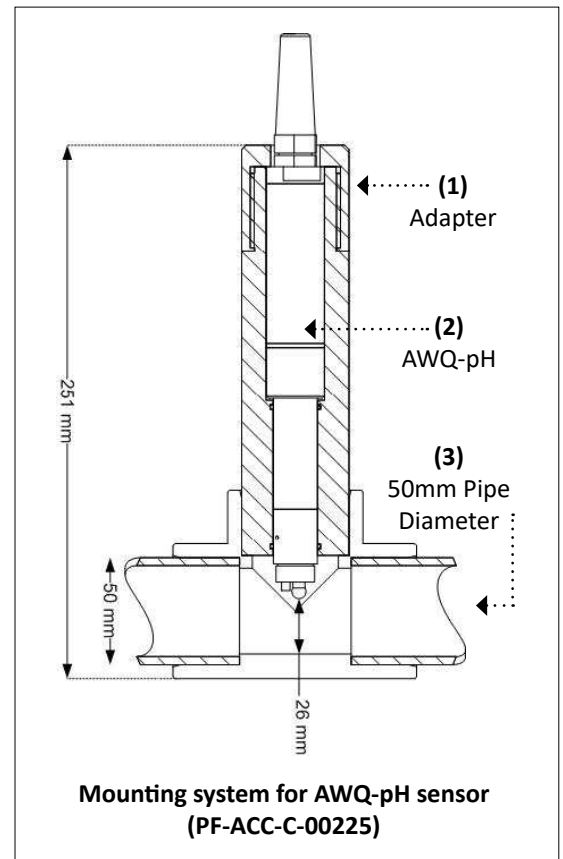
4. Installation Options

4.6 PVC Pipe-Mounting

Every system of assembly is delivered with an adapter (and the appropriate joints) and one T of assembly (90 ° for AWQ-pH sensor) to stick on a 50 mm diameter pipe. Its special design type ensures the correct inflow to the sensor, thus preventing incorrect measurements.

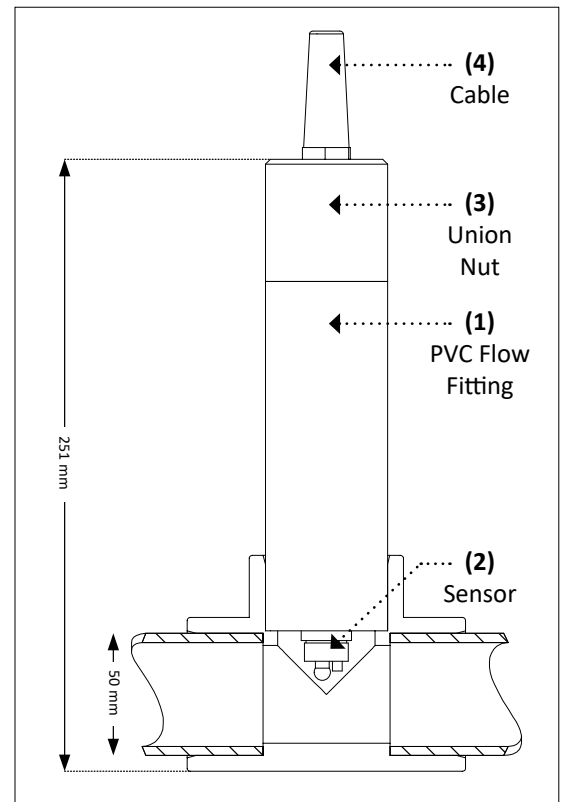
Please note the following when planning your piping set-up:

- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- We recommend bypass measurements. It must be possible to remove the sensor through the use of shut-off valves
- When working with systems involving pressure and/or temperature, ensure that the fitting and sensor meet all relevant requirements
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance).



4.7 PVC In-Pipe Mounting Install

- 1. Unscrew the union nut (3) from the PVC flow fitting (1).
- 2. Guide the sensor cable (4) through the union nut on the fitting.
- 3. Insert the sensor (2) into the fitting as far as the position shown in the image right.
- 4. Screw the union nut onto the fitting as far as the stop.

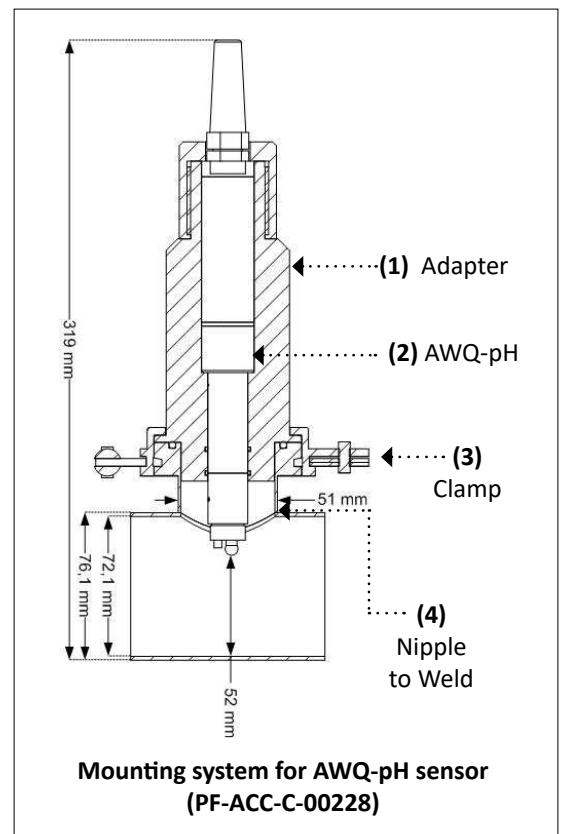


4. Installation Options

4.8 Stainless Steel Pipe-Mounting

The accessories of assembly for stainless pipe are proposed with an adapter and its joints with or without the systems of clamp / Nipple. The acceptable maximum pressure for the sensors is 5 bars.

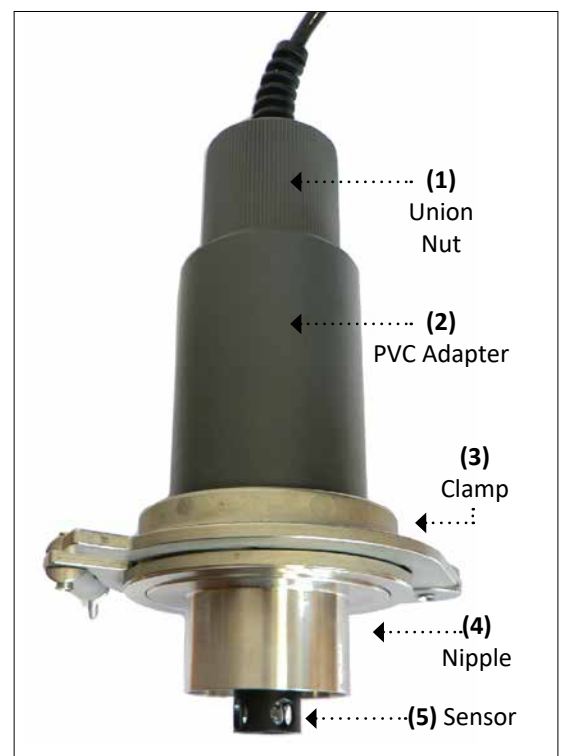
The system of assembly can be delivered with or without stainless steel clamp. The adapter is compatible with a 51 mm diameter external clamp.



4.9 Stainless Steel In-Pipe Mounting Install

The sensor is mounted on the relevant fitting as described below, using a sensor holder, which can be used both for the short and long pole:

- 1. After welding the clamp (3) on the stainless steel pipe, remove the clamp from the system and remove the PVC adapter (2).
- 2. Unscrew the union nut (1) from the adapter.
- 3. Guide the sensor cable through the union nut on the adapter and insert the sensor (5) with the mounted locking ring into the flow fitting as far as the stop.
- 4. Reposition the adapter in the nipple (4), and re-screw the union nut.



5. Startup and Maintenance

5.1 Initial Startup

Once the sensor is connected to your terminal, the sensor is settled in its accessory of assembly and the parameterization has been carried out on the display unit, the sensor is ready for initial startup.

Please note:

- For measurement, you must eliminate bubbles trapped under the pH glass bulb. During the introduction of the sensor in measurement environment, wait for sensor's temperature stabilization before measure processing.
- The glass electrode is vulnerable to chemicals (organic solvents, acids and strong bases, peroxide, hydrocarbons), and mechanical treatments (impacts).
- The redox potential electrode is sensitive to sulphide adsorption on platinum.

5.2 Preparation of Sensor

Remove the black cap of protection (by holding the sensor head downward and by unscrewing the hood towards the right). The sensor is delivered dry and the pH glass must be rehydrated so that the measures are optimized.

After dry storage, rehydrate the pH bulb for a 12 hours period (one night) in a standard solution pH4 or in the cleaning solution delivered (PF-CSO-C-00010).

5.3 Calibration Considerations

The sensor is calibrated to specification at the factory. The frequency of calibration depends of the application (depends on the fouling of the sensor, on the conductivity of the environment..). If calibration is required, let the sensor come to equilibrium with the process before calibration.

Do not calibrate the sensor at setup. After the cartridge is replaced, calibration should be carried out. It is also advisable to regularly clean the sensor in a cleaning solution (PF-CSO-C-00010). With two-point calibration, the zero point (offset with standard solution) and slope (second standard solution) of the sensor are calibrated.

This calibration method offers the greatest possible level of accuracy and is particularly recommended.

5. Startup and Maintenance

5.4 pH Calibration - Offset

- The sensor beforehand cleaned is immersed in a first standard solution (PH 7.01 at 25 °C for example) in order to determine the zero point (offset). Maintain the standard solution under agitation and wait that the sensor puts itself in equilibrium with the temperature of the standard solution.
- The pH of the standard solution varies with the temperature, note the temperature of the solution and refer to the board of variation of the pH according to the temperature to fix the pH value to be calibrated.
- For example, for a standard solution pH 7.01 at 25 °C if the temperature of the standard solution is 20°C the value of the pH is 7.03.
- Washing (with clear water) and drying the sensor with a soft cloth or an absorbent paper.

Standard PH 7.01 at 25°C

°C	°F	pH
0	32	7.13
5	41	7.10
10	50	7.07
15	59	7.04
20	68	7.03
25	77	7.01
30	86	7.00
35	95	6.99
40	104	6.98
45	113	6.98

5.5 pH Calibration - Slope

Sensor slope is determined by positioning in a second pH buffer solution. Immerse the sensor in the selected standard solution, maintain the standard solution under agitation and wait that the sensor puts itself in equilibrium with the temperature of the standard solution.

The pH of the standard solution varies with the temperature, note the temperature of the solution and refer to the board of variation of the pH according to the temperature to fix the pH value to be calibrated. For example, for a standard solution pH 4.01 at 25 °C if the temperature of the standard solution is 20°C the value of the pH is 4.00.

Standard PH 4.01 at 25°C

°C	°F	pH
0	32	4.01
5	41	4.00
10	50	4.00
15	59	4.00
20	68	4.00
25	77	4.01
30	86	4.02
35	95	4.03
40	104	4.04
45	113	4.05

5.6 Check of the Redox potential

Wedging of the offset.

- The first step in the calibration is to set the offset by exposing the sensor to air. The default value of this calibration standard is set at 0 mV and cannot be changed. Wait for the stabilization of the measure and validate the point of calibration.

Validation of the slope.

- Immerse the sensor in the selected standard solution (240 mV for example), maintain the standard solution under agitation and wait that the sensor puts itself in equilibrium with the temperature of the standard solution. Washing (with clear water) and drying the sensor with a soft cloth or an absorbent paper.

5. Startup and Maintenance

5.7 Maintenance

The maintenance schedule shows minimum intervals for regular maintenance tasks. Perform maintenance tasks more frequently for applications that cause electrode fouling.

Note: Do not disassemble the probe for maintenance or cleaning.

- The sensor must always be kept clean, particularly in the area around the pH bulb and the platinum disk (Redox measurement).
- The presence of a biofilm on the pH bulb can lead to measuring errors. For pH bulb, A dirty bulb should be cleaned with warm, soapy water. For the redox measurement, clean the platinum disk to optimize the measures of redox potential.
- If the sensor is put out of operation, it should be rinsed prior to being stored, and the protective cap should be fitted with the protective case and a moist absorbent surface (like cotton)..

5.8 Cleaning

Rinse meticulously the sensor and the bulb with clear water. For pH glass: if deposits like biofilm or mud persist, put the sensor in a cleaning solution (PF-CSO-C-00010) for a few hours and rinse profusely before use. Avoid using a soft cloth or an absorbent paper because the glass ball is extremely vulnerable to frictions.

For the Redox part, clean the platinum disk with an abrasive moist paper (type P1200 or P220) and rinse the electrode with clean water.

5.9 Change of the AWQ-pH Cartridge

The principle of measure integrates a reference electrode type Ag/AgCl, used for the measures of pH and ORP, into plasticized electrolyte saturated in KCl PLASTOGEL®

The electrolyte PLASTOGEL® communicates directly with the outside environment without interposition of capillary or porous. There is thus no risk of closing or dismantling of the reference.

Plastogel tends to become impoverished in KCl according to the use of the sensor AWQ-pH. When the Plastogel® is exhausted, the probe does not answer any more the variations of pH and/or is very slow to stabilize. In that case, it is necessary to proceed to the change of the cartridge.

5. Startup and Maintenance

The electronic part contains the cable of connection with standard measurement of 3, 7 or 15 meters (other lengths can be realized on inquiry). The cartridge which is the replaceable element contains the special pH glass, the ORP and the Temperature. Protect the sensor when it is not used by means of the case of protection (d).

The clamp (b) is positioned between the electronics and the cartridge parts to make a united and waterproof system.

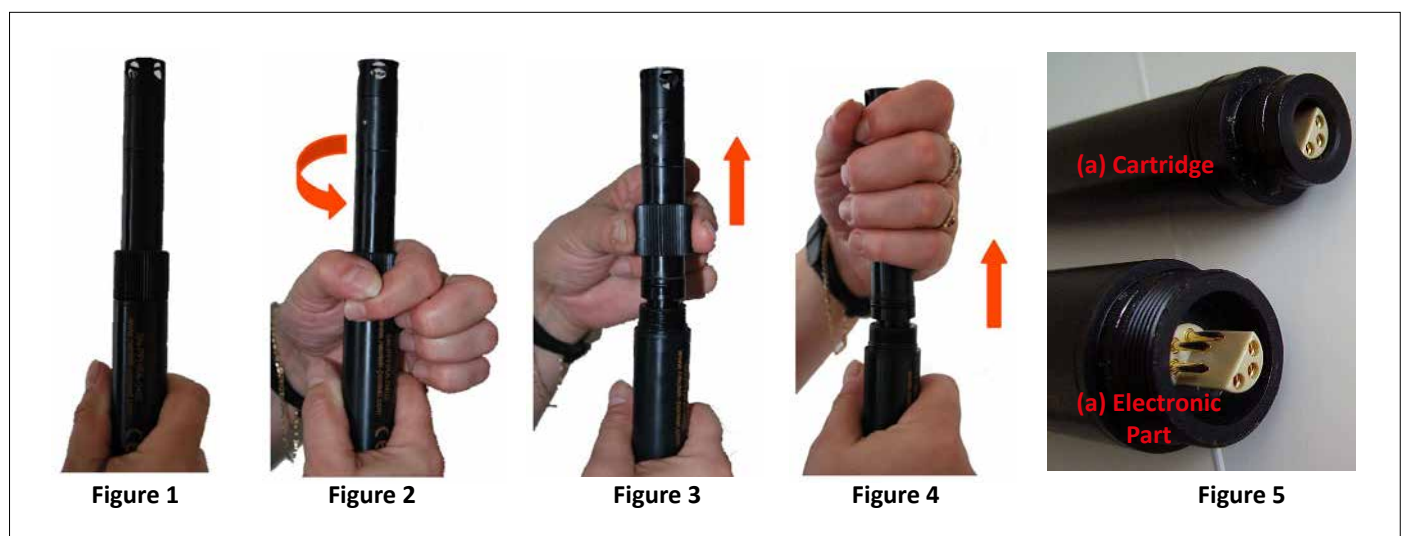
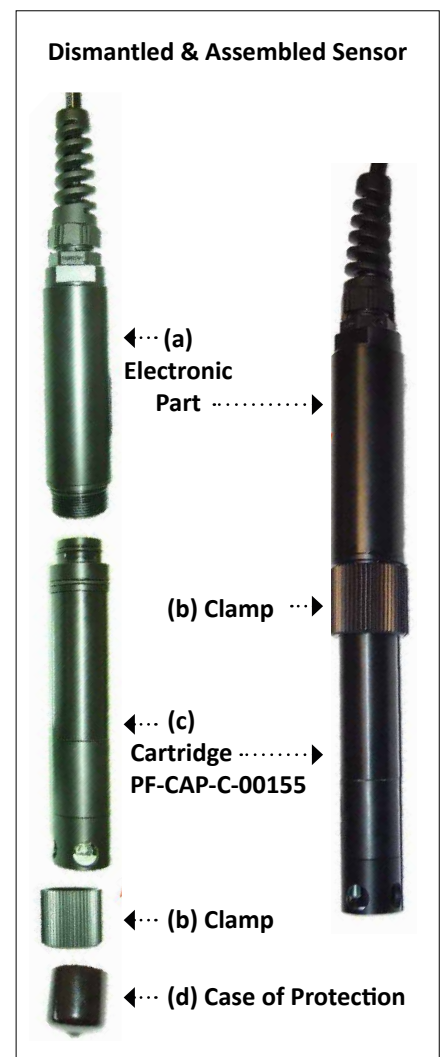
5.9.1 Dismantling the AWQ-pH Sensor

Remove the protective cap (d) from the probe AWQ-pH. Maintain the electronic part (a) in a hand and undo the clamp (b) with the other hand (Figure 2). Remove the clamp (Figure 3) may hold the electronic part (a) in a hand and remove the cartridge with the other hand (Figure 4).

5.9.2 Reassembly of the AWQ-pH Sensor

Hold the electronic part in one hand, place the connector in the shape of half-moon of the new cartridge AWQ-pH (Figure 5) in front of the connector of the electronic part and fit both parts (Figure 5).

Remove the case of protection then replace the clamp on the sensor by maintaining the sensor by the electronic part. End by tightening clamp. Proceed to a complete calibration to configure the sensor with his new cartridge.





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