



**Water Quality: Conductivity / Salinity
(AWQ-C4E)**

Contents

1. Introduction	3
1.1 Description	3
1.2 Dimensions, Construction & Markings	3
2. Maintaining Good Working Order of AWQ-C4E	4
2.1 Authorised Assembly and Activation	4
2.2 Advantages	4
2.3 Hydrology Applications	4
3. AWQ-C4E Specifications	5
3.1 Measurement	5
3.2 Temperature	5
3.3 Sensor & Communication	7
3.4 Modbus RTU registers	7
3.5 SDI12 Frame	7
4. AWQ-C4E Electrical Connections	8
5. Installation Options	9
5.1 Considerations	9
5.2 Short Pole Examples	10
5.3 Long Pole Examples	10
5.4 Pole Mounting	11
5.5 Installation Accessories	12
5.6 PVC Pipe-Mounting	13
5.7 PVC In-Pipe Mounting System	14
5.8 Stainless Steel In-Pipe Mounting System	14

1. Introduction

1.1 Description

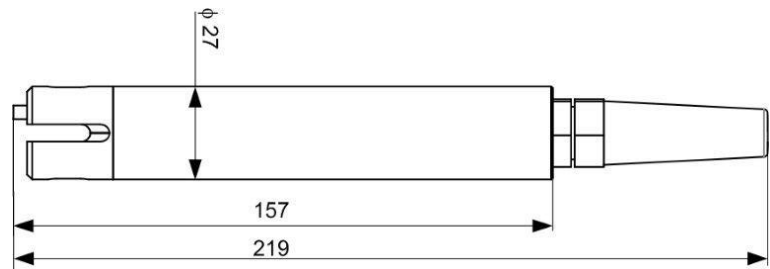
The AWQ-C4E uses 4 electrode technology, where an alternating current of constant-voltage is established between a primary's pair of electrodes in graphite. The secondary's electrodes in platinum allow of regulate the voltage imposed to primary's electrodes to reflect of the fouling.

The voltage measured between the primary's electrodes is in function of the resistance of place and so, of the conductivity.



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) PT100 Temperature Sensor
- (2) PVC Head of body with 4 electrodes inside the slot
- (3) DELRIN Sensor body with measurement electronics
- (4) Cable bushing
- (5) Securely connected connection cable

2. Maintaining Good Working Order of AWQ-C4E

2.1 Authorised Assembly and Activation

In order to maintain and ensure the good working order of the AWQ-C4E 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 Advantages

- Low operating costs due to reduced maintenance work (no electrolyte changes)
- Greater calibration intervals due to low drift behaviour
- No polarization voltage required
- High measuring accuracy, even for low concentrations
- Rapid response times
- No minimum flow (no oxygen consumption)

2.3 Hydrology Applications

- Urban wastewater treatment
- Industrial effluent treatment
- Surface water monitoring
- Sea water
- Drinking water

The sensor features excellent interference immunity thanks to the integrated preamplifier and digital signal processing. The measured value for conductivity is automatically compensated with the temperature and transferred without interference to the connected display unit and controller via a digital interface. The sensor also includes a log book containing the last ten successful calibrations in the form of a ring buffer.

3. AWQ-C4E Specifications

3.1 Measurement

Measurement Principle	Conductivity sensor with 4 electrodes (2 graphite, 2 platinum)
Measurement Range (Conductivity)	0-200 $\mu\text{S}/\text{cm}$ 0-2000 $\mu\text{S}/\text{cm}$ 0-20 mS/cm 0-200 mS/cm
Resolution	0.01 to 1, depending on range
Accuracy	$\pm 1\%$ of the full range
Measurement Range (Salinity)	5-60 g/Kg
Measurement Range (TDS-KCl)	0-133000 ppm

3.2 Temperature

Temperature Compensation	NTC Thermistor
Sensor Operating Range	Operating Temperature: 0°C to +50°C Storage Temperature: -10°C to +60°C Maximum Pressure: 5 bar
Resolution	0.01 to 1, depending on range
Accuracy	$\pm 0.5^\circ\text{C}$
Response Time	< 5s
Maximum Refreshing Time	Max < 1 s

3. AWQ-C4E Specifications

The method of temperature correction in the conductivity digital sensor AWQ-C4E is a Non-linear temperature correction. The principal of this correction is that conductivity measured at the sample temperature is corrected to 25°C to give K25.

$$K25 = \underbrace{\left[1 + \alpha \frac{1}{100} (t_{25} - t) \right]}_{f_{25}(t)} K_1$$

f25(T) is the temperature correction factor used for the conversion of conductivity values of natural water from T to 25°C.

With $\alpha = \alpha_{025} \times \alpha_{S25}$ (at 25 °C $\alpha_{025} = 1.9112 \text{ \%}/^\circ\text{C}$) for “normal” water surface.

Standard table at 25°C of coefficients $\alpha_{S25}(t)$

n	t _n °C	$\alpha_{S25}(t_n)$
-5	-5	1,987
-4	-4	1,925
-3	-3	1,867
-2	-2	1,813
-1	-1	1,761
0	0	1,708
1	1	1,667
2	2	1,623
3	3	1,582
4	4	1,543
5	5	1,519
6	6	1,470
7	7	1,436
8	8	1,404
9	9	1,373
10	10	1,344
11	11	1,316
12	12	1,290
13	13	1,266
14	14	1,239
15	15	1,213
16	16	1,190
17	17	1,167
18	18	1,147
19	19	1,129
20	20	1,105
21	21	1,083
22	22	1,061
23	23	1,040
24	24	1,019
25	25	1,000
26	26	0,981
27	27	0,963
28	28	0,946
29	29	0,929

n	t _n °C	$\alpha_{S25}(t_n)$
30	30	0,913
31	31	0,897
32	32	0,884
33	33	0,872
34	34	0,861
35	35	0,851
36	36	0,842
37	37	0,834
38	38	0,827
39	39	0,820
40	40	0,812
41	41	0,800
42	42	0,789
43	43	0,779
44	44	0,769
45	45	0,760
46	46	0,751
47	47	0,742
48	48	0,733
49	49	0,724
50	50	0,716
51	51	0,708
52	52	0,700
53	53	0,692
54	54	0,684
55	55	0,676
56	56	0,669
57	57	0,662
58	58	0,655
59	59	0,648
60	60	0,641
61	61	0,635
62	62	0,628
63	63	0,622
64	64	0,615



3. AWQ-C4E Specifications

3.3 Sensor & Communication

Sensor Dimensions	Sensor Size: Diameter: 27 mm; Length: 177 mm Sensor Weight (Including 3 Meter Cable): Approx. 300gms Sensor Material: PVC, DELRIN, stainless steel Sensor Protection: IP68
Wetted Material	Body: PVC body + DELRIN NTC: stainless steel Electrodes: platinum, graphic Cable: polyurethane jacket Steam gland: Polyamide
Sensor Operating Range	Operating Temperature: 0°C to +50°C Storage Temperature: -10°C to +60°C Maximum Pressure: 5 bar
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 4 electrodes are sensitive to deposits (some fat, hydrocarbons, biofilm, mud)
Sensor Interface	Modbus RS-485 (standard); SDI-12 (optional)

3.4 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:

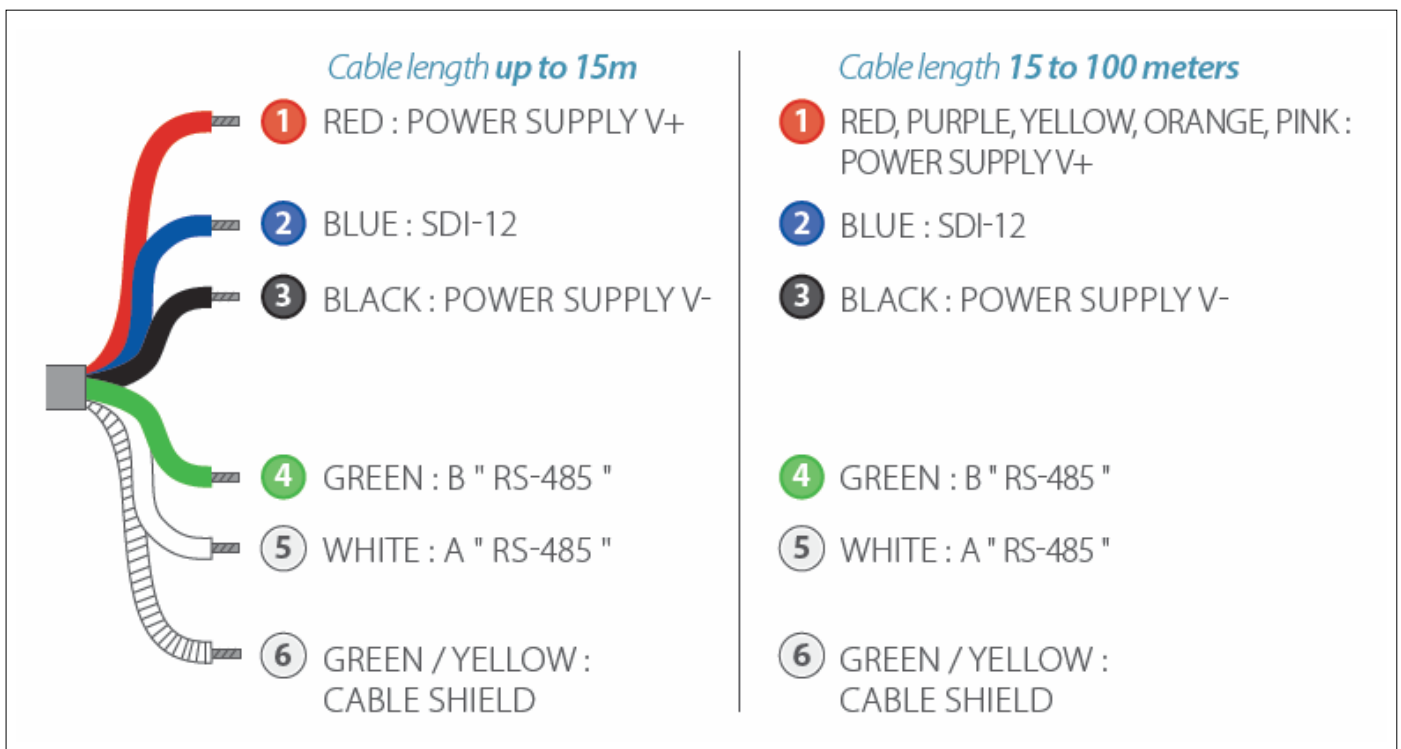
- Select the averaging value
- Read the Sensor description
- Return to default coefficients
- Modify the Sensor address
- Information on measures conducted (Out Of Specification measures, measures in progress, etc.)
- Date and name of the operator who performed the calibration etc

3.5 SDI12 Frame

A list of SDI12 registers is available for network communication.

4. AWQ-C4E 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): 6.3 mA Average SDI-12 (1 measurement/second): 9.2 mA Current pulse: 500 mA Protection against the inversions of polarity



5. Installation Options

5.1 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:

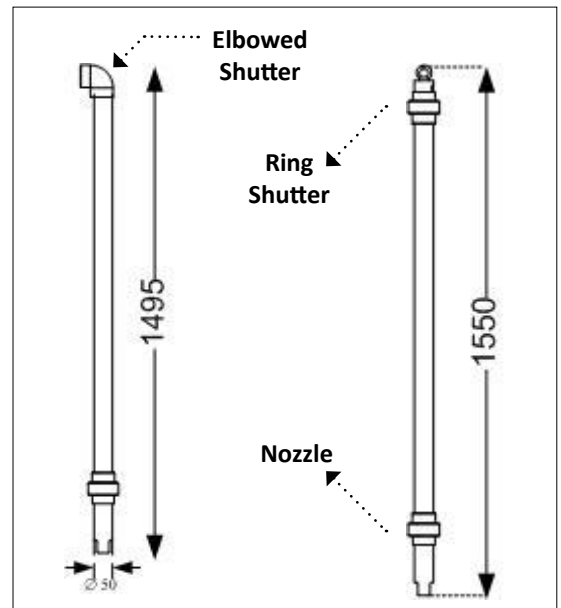
- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- Do not allow the fitting (and thus also the sensor) to swing against and hit the basin edge
- When working with systems involving pressure and/or temperature, ensure that the fitting 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)

5. Installation Options

5.2 Short Pole Examples

The short pole is available in 2 versions:

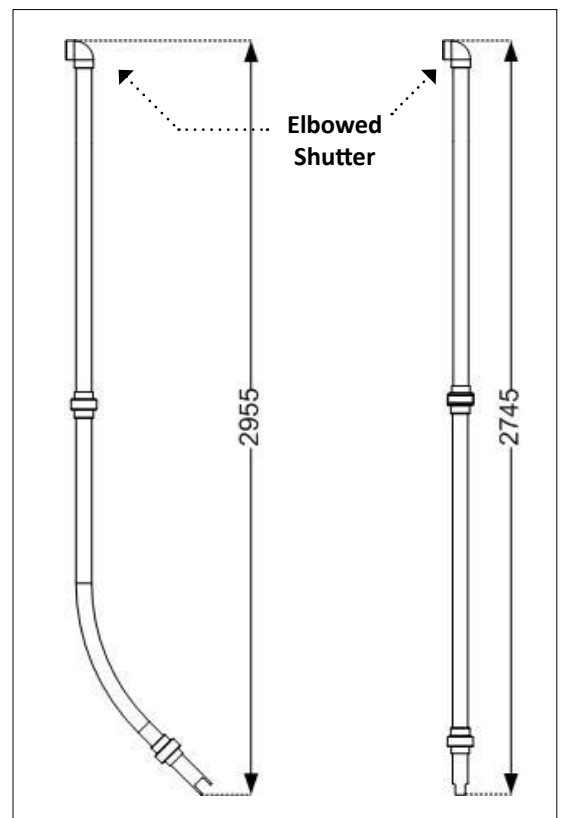
- version with elbowed shutter. The nozzle of support is included in the offer.
PF-ACC-C-00268: STRAIGHT SHORT POLE FOR AWQ-C4E/NTU SENSOR (1495 mm, ELBOWED SHUTTER)
- version with shutter for mounting with chain. The nozzle of support is included in the offer.
PF-ACC-C-00271: STRAIGHT SHORT POLE FOR AWQ-C4E/NTU SENSOR (1550 mm, RING SHUTTER)



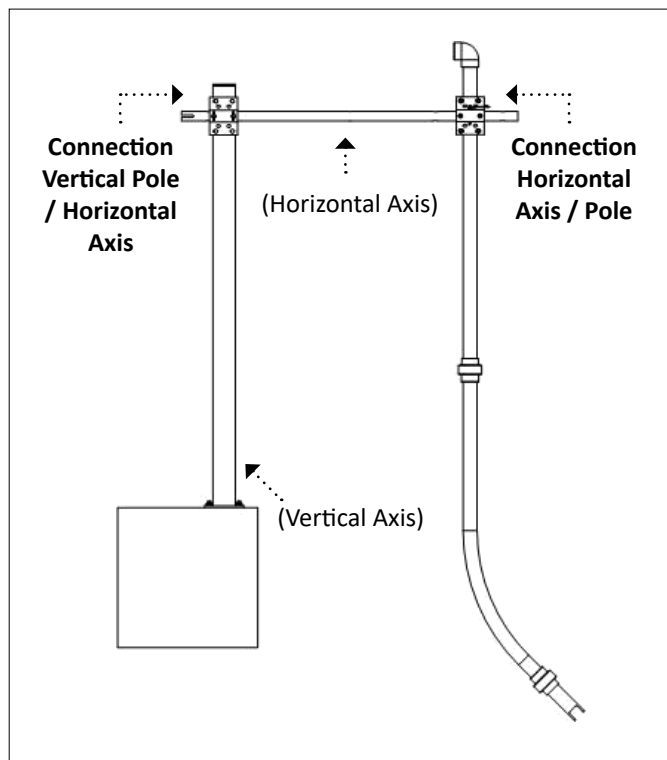
5.3 Long Pole Examples

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 waterproofness 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-00262: 90° ELBOW LONG PERCH FOR AWQ-AWQ-C4E/NTU SENSOR (2955 mm, ELBOWED SHUTTER)
- Straight long pole with elbowed shutter
PF-ACC-C-00265: STRAIGHT LONG POLE FOR AWQ-C4E/NTU SENSOR (2745 mm, ELBOWED SHUTTER)



5. Installation Options



5.4 Pole Mounting

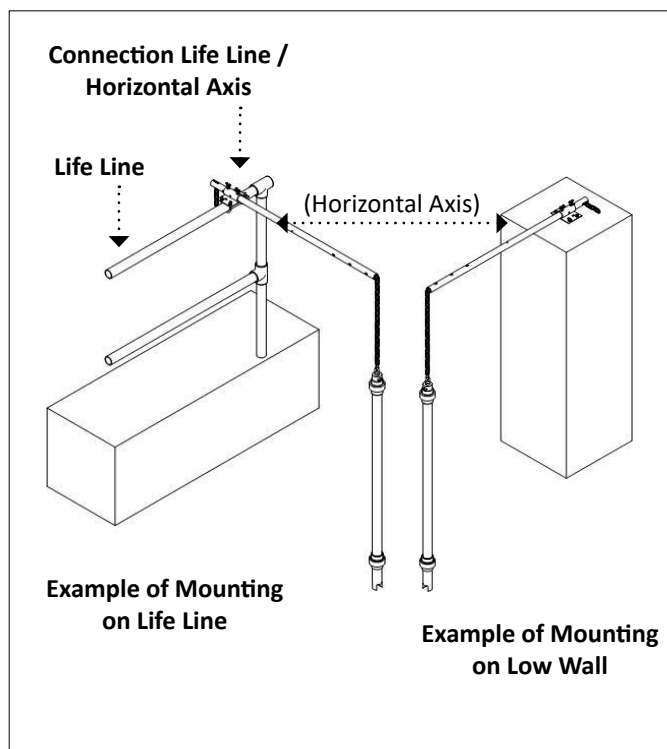
The elements of fixation for the poles are flexible and specially studied to adapt themselves to the different configurations of assembly.

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)



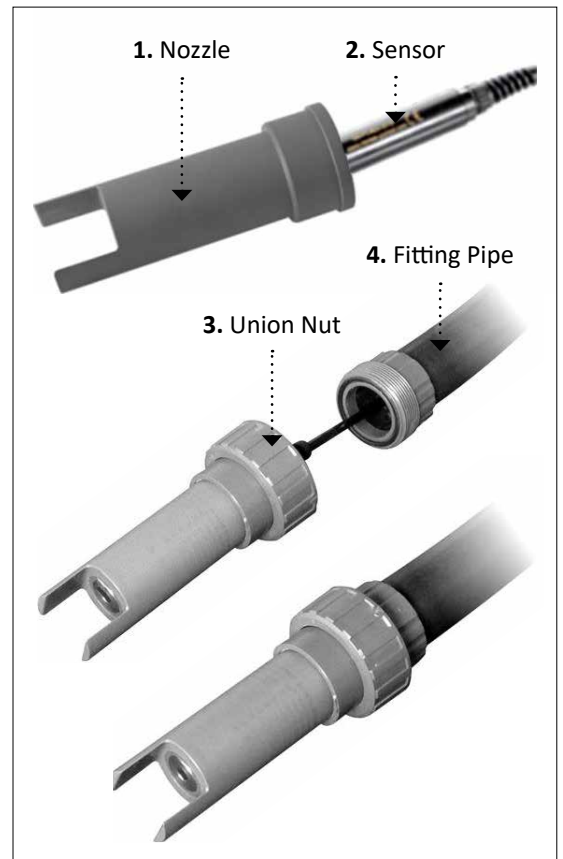
5. Installation Options

5.5 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 handtight.



5. Installation Options

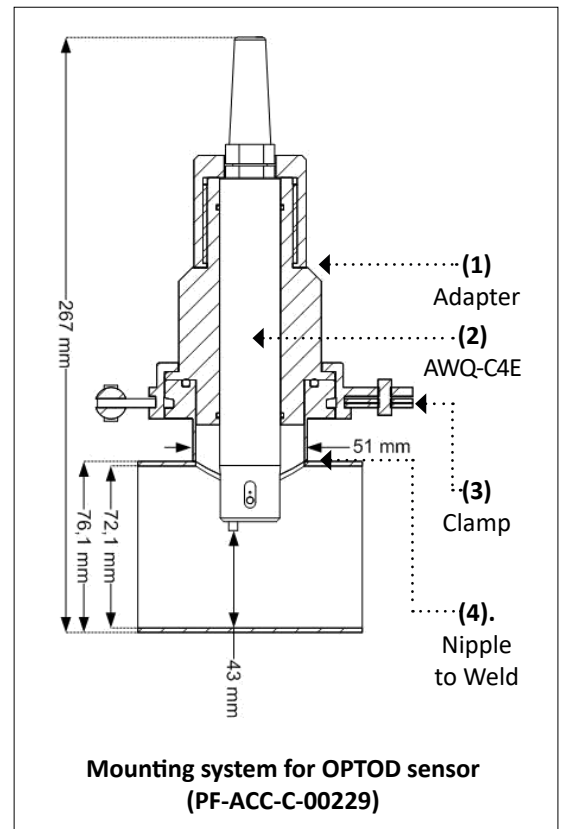
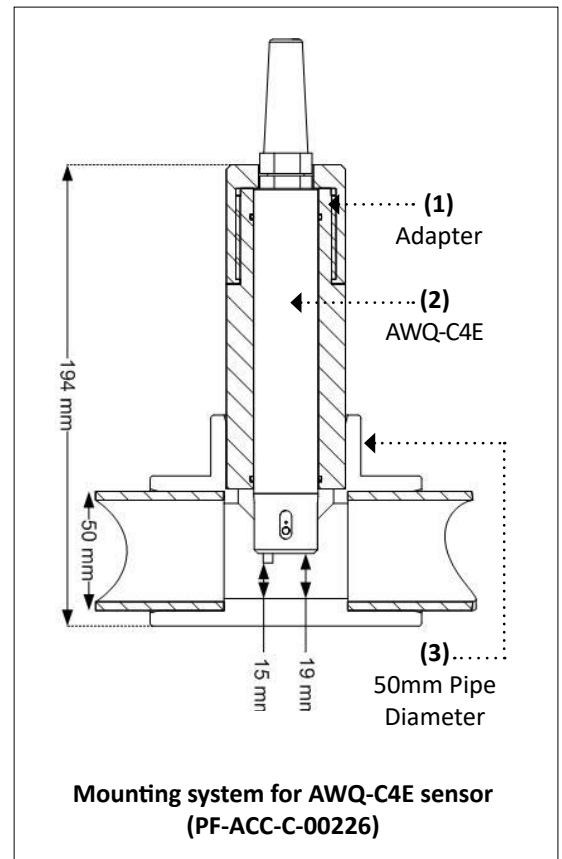
5.6 PVC Pipe-Mounting

Every system of assembly is delivered with an adapter (and the appropriate joints) and one T of assembly (90 ° for AWQ-C4E 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).

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

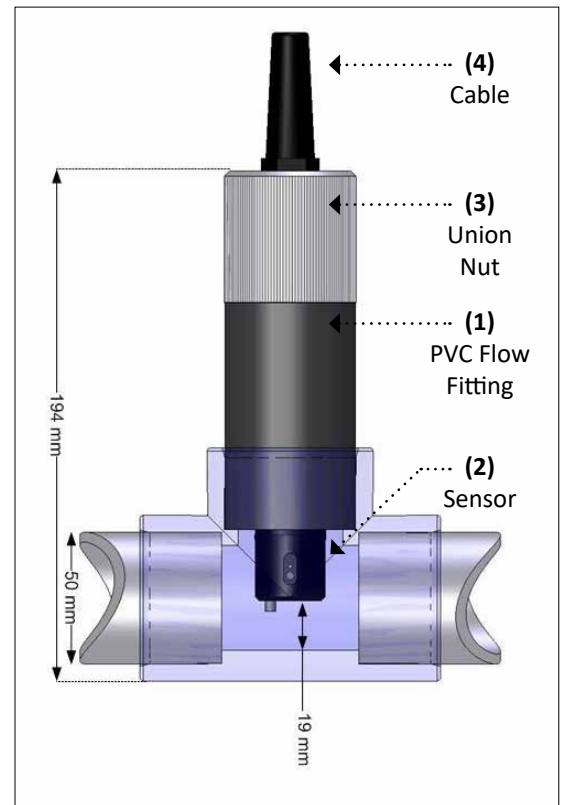


5. Installation Options

5.7 PVC In-Pipe Mounting System

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:

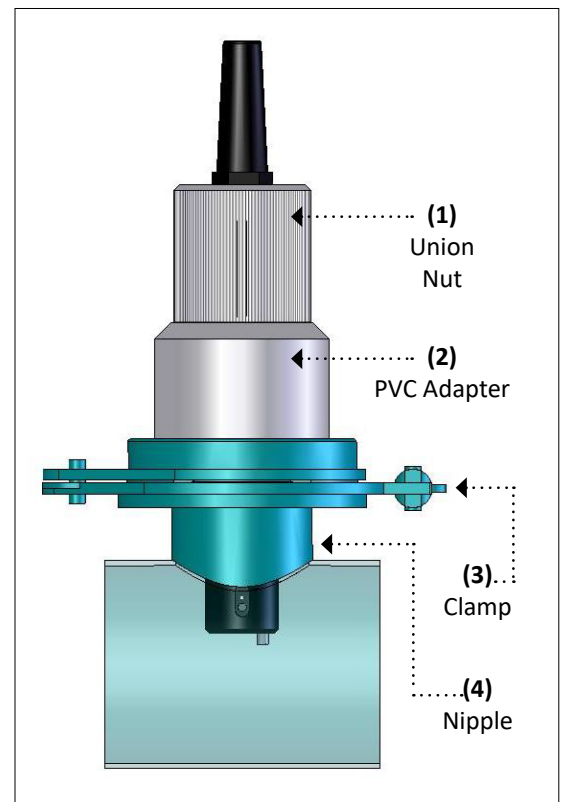
- 1. Unscrew the union nut (3) from the PVC flow fitting (1).
- 2. Guide the sensor cable (4) through the union nut on the fitting.
- 3. Insert the sensor (2) into the fitting as far as the position shown in the middle image above.
- 4. Screw the union nut onto the fitting as far as the stop.



5.8 Stainless Steel In-Pipe Mounting System

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.
- 4. Reposition the adapter in the nipple (4), and re-screw the union nut.





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plant & environmental monitoring.*