



**Water Quality: Numerical Sensor
(AWQ-NTU)**

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1. Introduction

1.1 Description

The measure principle is based on IR nephelometry / 850 nm. The sensor can be calibrated with a formazine standard solution.

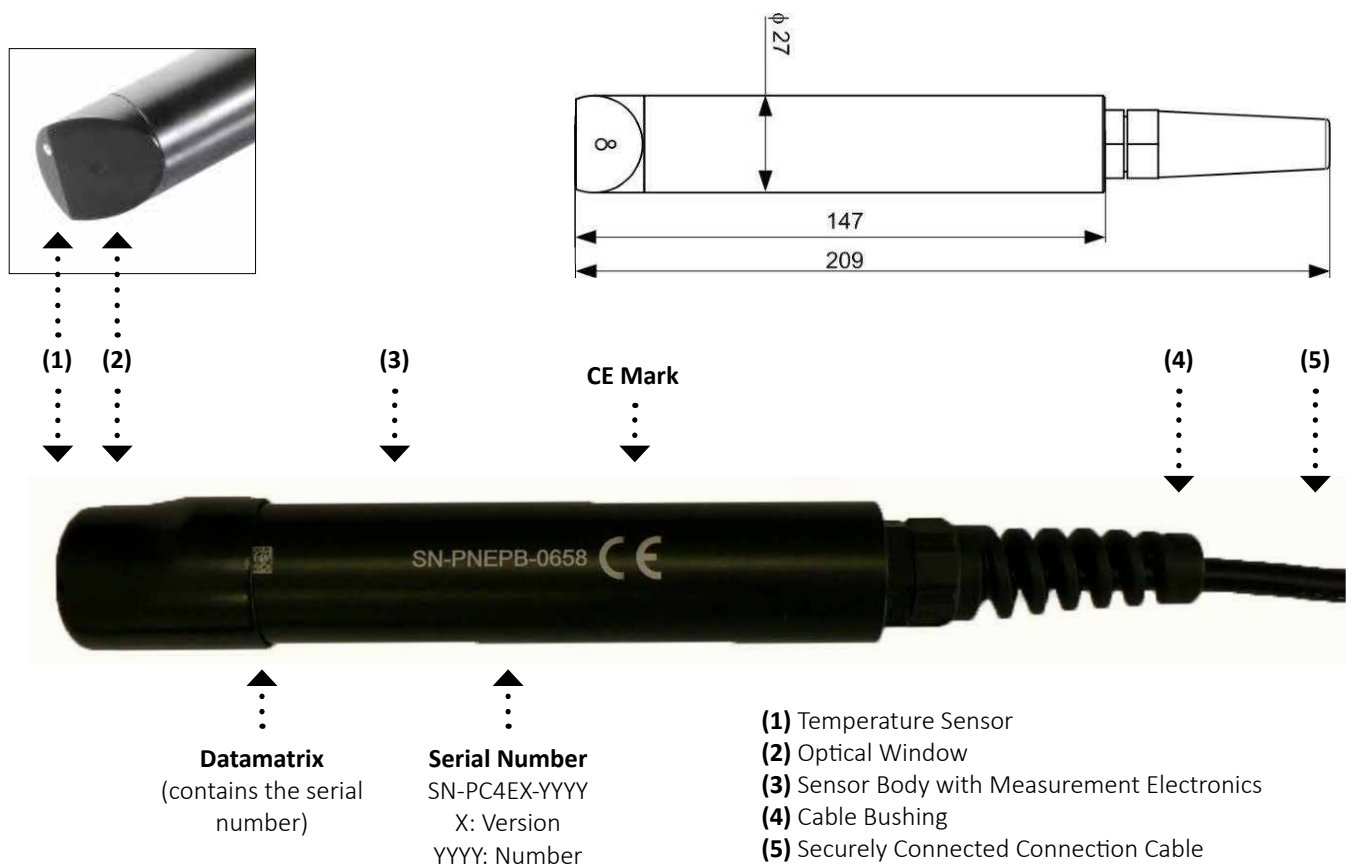
The NTU sensor integrates a low-cost optical technology, with a very few maintenance and no consumables.

Compact, robust and light, the PVC sensor allows a hand-held or fixed unit application.



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.



2. Maintaining Good Working Order of AWQ-NTU

2.1 Authorised Assembly and Activation

In order to maintain and ensure the good working order of the AWQ-NTU 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 turbidity measurement according to DIN EN ISO 7027 is a tried and tested method for monitoring waters with low to strong turbidity. The measuring principle of the NTU turbidity sensor is based on an infrared light measurement according to the 90° scattered light method. Thanks to the light measurement at a wavelength of 880 nm and the wide measuring range of 0 to 4,000 NTU, the sensor can be used in an array of water and wastewater treatment applications, e.g. for monitoring the water quality, detecting filter leaks, and for wastewater final inspection. Apart from the turbidity value, the sensor also measures the medium temperature and Suspended Solid in mg/L (0-4500 mg/L).

The NTU sensor stores its calibration data and history directly in the sensor electronics. This means that it can be used quickly anywhere without the need for constant recalibration. The sensor is characterized by its slim and robust design. Suitable fittings are required for the installation of the sensor, e.g. in order to prevent the influence of extraneous light and any possibly resulting measurement errors. Corresponding immersion, suspended, and flow fittings are available.

2.3 Hydrology Applications

- Drinking water treatment
- Water protection
- Fish farming companies
- Municipal and industrial sewage treatment plants
- Process engineering plants

3. AWQ-NTU Specifications

3.1 pH Measurement

| | | |
|---|---|--|
| Measurement Principle | Turbidity: Diffusion IR at 90° Temperature: NTC | |
| Measurement Range (Conductivity) | 0 to 4000 NTU in 5 ranges: 0 – 50 NTU 0 – 200 NTU 0 – 1000 NTU 0 – 4000 NTU AUTOMATIC | 0 to 4500 mg/L Calibration: Range 0-500 mg/L according to NF EN 872 Range >500 mg/L according to NF T 90 105 2 |
| Resolution | 0.01 to 1 NTU - mg/L | |
| Accuracy | < 5% of the reading | |

3.2 Temperature

| | |
|-------------------------------|--|
| Temperature | NTC |
| Sensor Operating Range | Operating Temperature: 0°C to +50°C Storage Temperature: 0°C to +60°C Maximum Pressure: 5 bar |
| Range | 0,00 °C to + 50,00°C |
| Resolution | 0,01 °C |
| Accuracy | ±0.5°C |
| Response Time | < 5s |

3. AWQ-NTU Specifications

3.3 Sensor & Communication

| | |
|-------------------------------|--|
| Sensor Dimensions | Sensor Size: Diameter: 27 mm; Length: 170 mm Sensor Weight (Including 3 Meter Cable): Approx. 300gms Sensor Protection: IP68 |
| Wetted Material | Head of Sensor: PVC Body: DELRIN Optical Part: Quartz 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 optical windows are vulnerable to: chemicals (organic solvents, acids and strong bases, peroxide, hydrocarbons); mechanical treatments (impact, abrasion). |
| 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 measurements, measurements in progress, etc.)
- Date and name of the operator who performed the calibration etc

3.5 SDI12 Frame

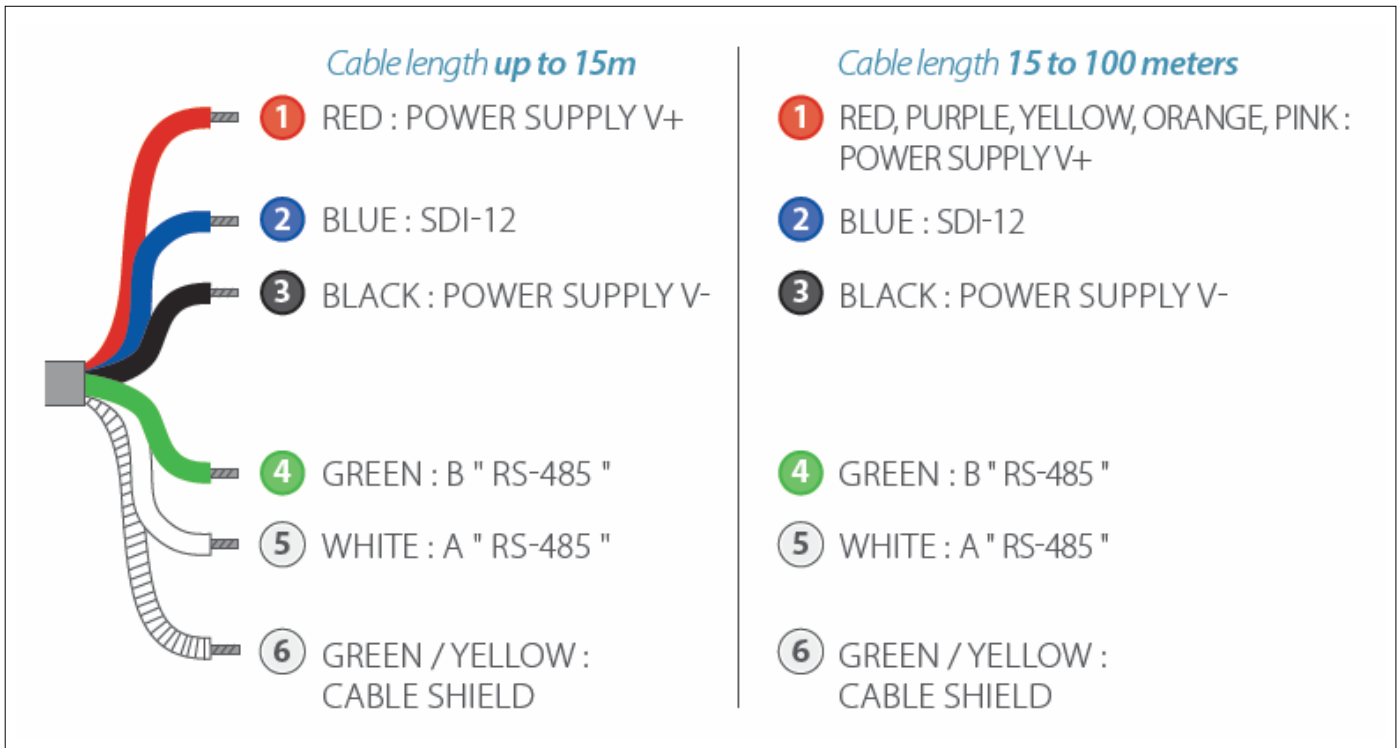
A list of SDI12 registers is available for network communication.



3. AWQ-NTU Specifications

3.6 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: 40 μ A Average RS485 (1 measurement/second): 820 μ A Average SDI12 (1 measurement/second): 4,2 mA Current pulse: 500 mA Heating time: 100 mS Protection against the inversions of polarity |



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)

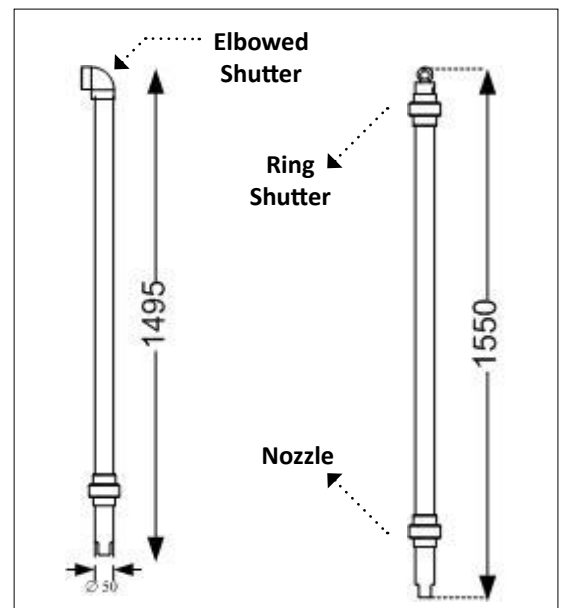
| | |
|-------------------------------|--------------|
| Material | PVC |
| Admissible Temperature | 0°C to +60°C |
| Maximum Pressure: | 5 bar |

4. Installation Options

4.2 Short Pole Examples

The short pole is available in 2 versions:

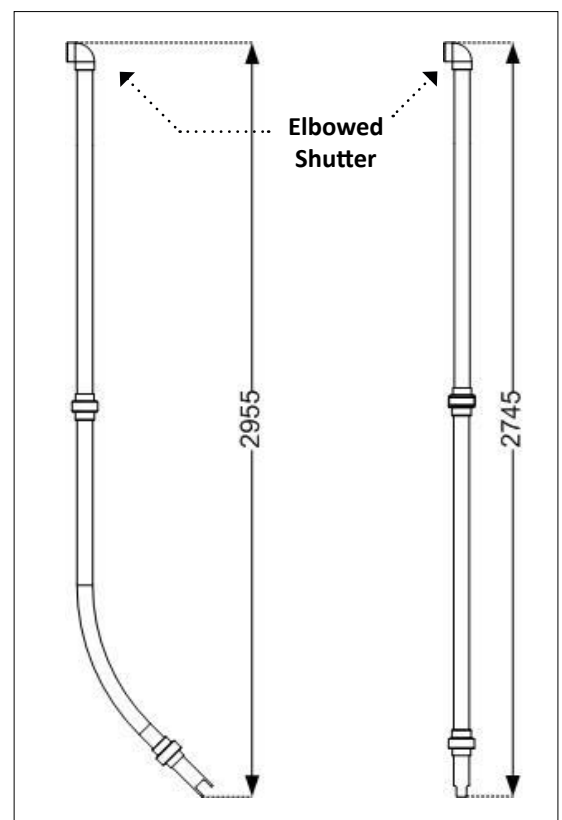
- Version with elbowed shutter. The nozzle of support is included in the offer.
PF-ACC-C-00268: STRAIGHT SHORT POLE FOR AWQ-NTU SENSOR (1495 mm, ELBOWED SHUTTER)
- Version with shutter for mounting with chain. The nozzle of support is included in the offer.
PF-ACC-C-00271: STRAIGHT SHORT POLE FOR AWQ-NTU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



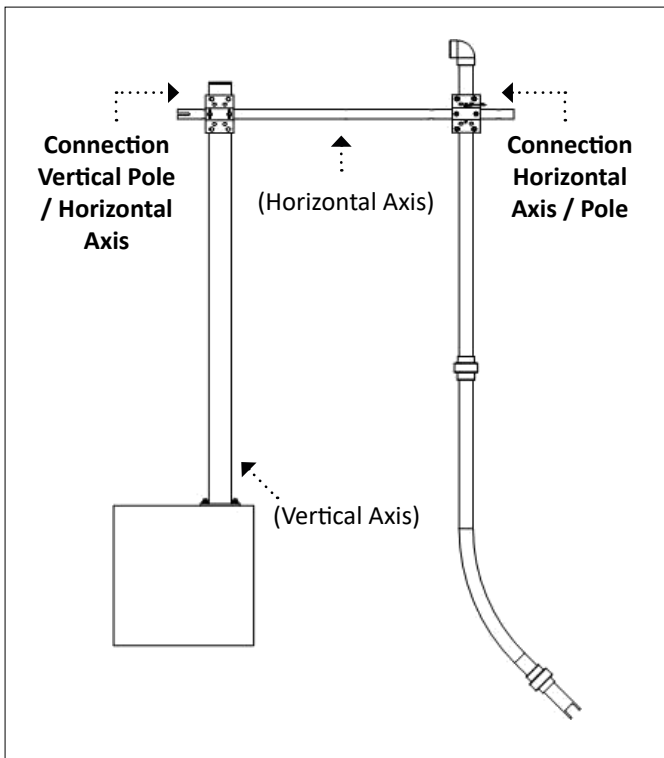
4.3 Long Pole Examples

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



4. Installation Options



4.4 Pole Mounting

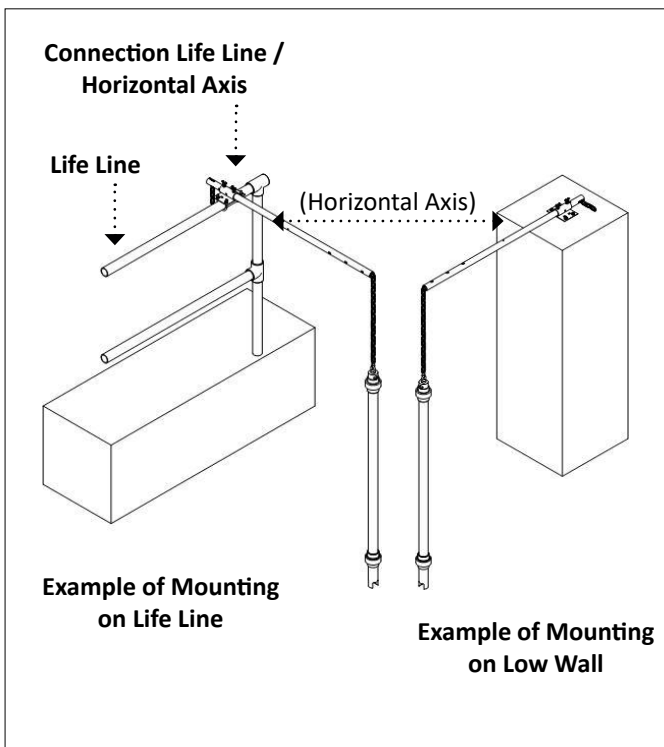
The elements of fixation for the poles are flexible and specially studied to adapt themselves to the different configurations of assembly.

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)

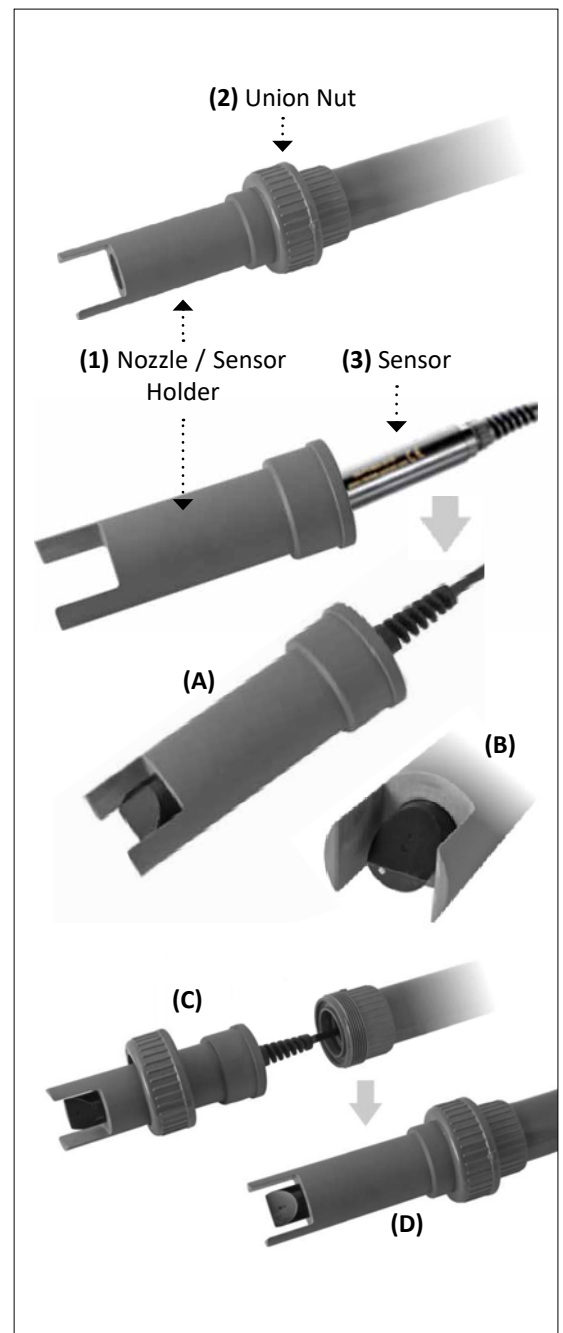
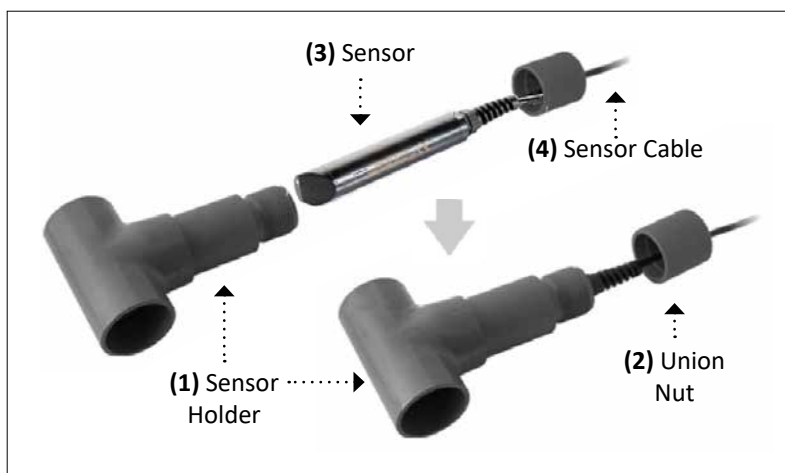


4. Installation Options

4.5 Installation 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. Unscrew the union nut (2) of the sensor holder (1) and remove the sensor holder.
- 2. Insert the sensor with locking ring (3) into the sensor holder (1) as far as the stop; See (A).
- 3. Align the surface of the optical windows in the sensor holder by turning the sensor; See (B).
- 4. Push the connecting cable of the sensor (3) through the fitting (4); See (C).
- 5. Fasten the sensor holder with the sensor (2), as shown in the figure above, to the fitting with the help of the union nut; See (D). The fitting can now be suspended or mounted at the operating location.



4.5 Installation in PVC In-Pipe Mounting:

- 1. Guide the sensor cable (4) through the union nut on the fitting.
- 2. Push the sensor with the mounted locking ring into the flow fitting as far as the stop. **Pay attention to the alignment of the sensor with regard to the flow.** For operation in media with low turbidity, it is recommended to align the optical windows of the sensor perpendicular to the flow (arrow). For operation in media with relatively high turbidity, the optical windows of the sensors should be turned away from the flow (arrow).
- 3. Screw the union nut onto the fitting as far as the stop.

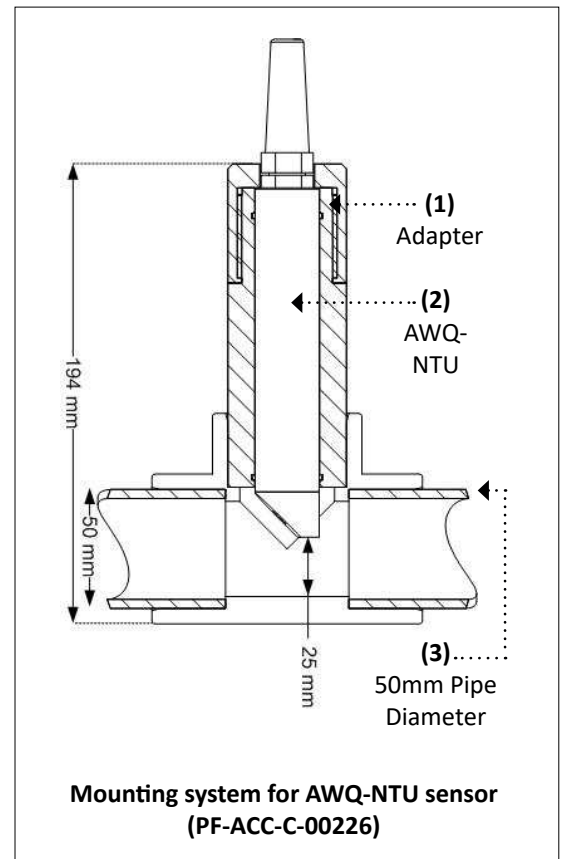
4. Installation Options

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-NTU 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 |

4. Installation Options

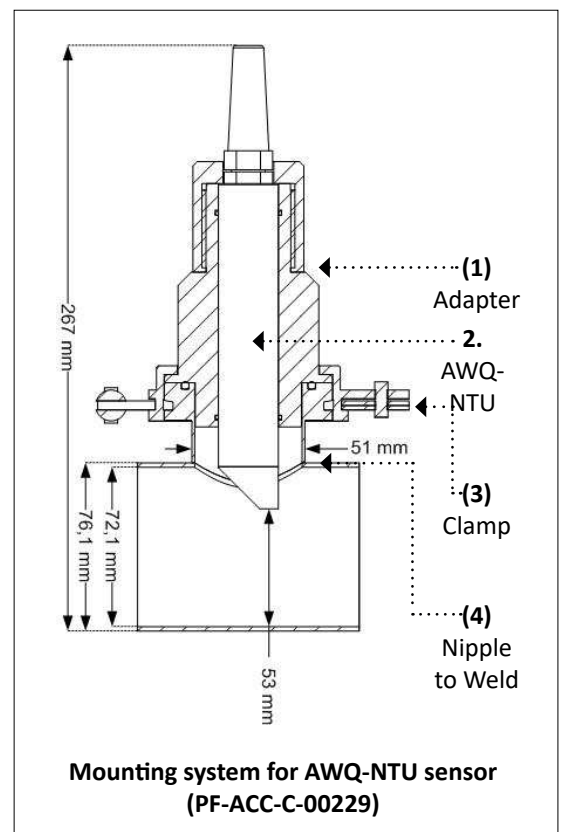
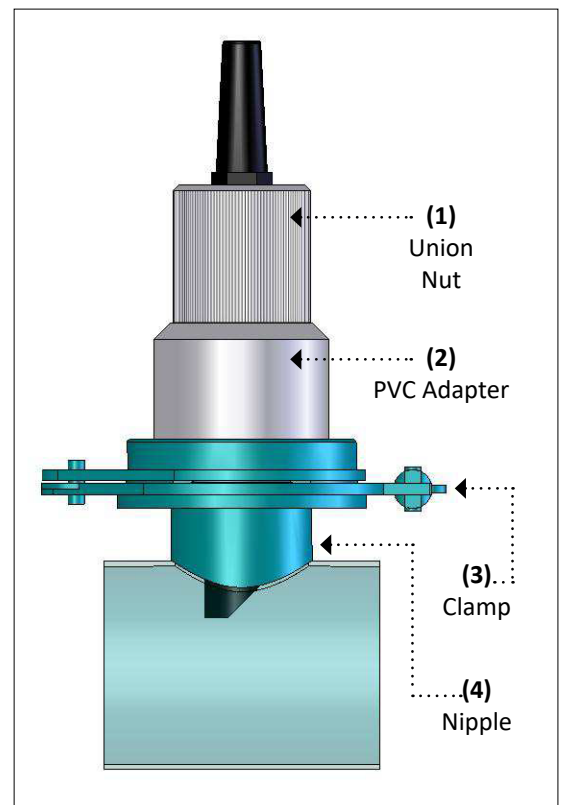
4.8 Stainless Steel In-Pipe Mounting System

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 .

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 with the mounted locking ring into the flow fitting as far as the stop.
- **Pay attention to the alignment of the sensor with regard to the flow.** For operation in media with low turbidity, it is recommended to align the optical windows of the sensor perpendicular to the flow (arrow). For operation in media with relatively high turbidity, the optical windows of the sensors should be turned away from the flow.
- 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 optical window.
- During the introduction of the sensor in measurement environment, wait for sensor's temperature stabilization before measure processing.
- **The optical windows are vulnerable to: chemicals (organic solvents, acids and strong bases, peroxide, hydrocarbons); mechanical treatments (impact, abrasion).**

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).

5.3 Calibration Considerations

The method of **two-point calibration for each of the four measuring ranges** is available for calibrating the sensor. The sensor should be rinsed with clean water before each calibration. Organic deposits left on the sensor lens, such as a biofilm or silt, may cause measurement errors. These deposits should be removed carefully with warm soapy water and a soft sponge. Never use abrasive agents (e.g. scouring sponge).

Calcium deposits can be removed by submersing the sensors in a diluted hydrochloric acid solution (**concentration max. 5 %**) for several minutes.

5.4 Maintenance

The following points should be taken into account during ongoing operation of the sensor:

- The sensor must always be kept clean, particularly in the area around the optical windows. The presence of deposits on the optical windows may lead to measurement errors.
- Deposits such as a biofilm or silt should be removed carefully with warm soapy water and a soft sponge. Never use abrasive agents (e.g. scouring sponge).
- If the sensor is put out of operation, it should be rinsed ready for storage, and the provided protective cap should be fitted.

5. Startup and Maintenance

5.5 NTU Calibration 2-Point - Offset

The sensor is calibrated ex works, meaning that no calibration is required before initial startup. During operation, the sensor should be calibrated if the measured values begin to drift. If the zero point is moved, a complete two-point calibration must be carried out. The NTU sensor is an optical sensor which just need of a few calibration. On a clean sensor, check once in a while the 0 NTU value by dipping sensor in bubble free clear water. If the 0 point is shifted, proceed with the complete sensor calibration (on 1 or 4 ranges). It is carried out as follows:

- Immerse the sensor in distilled water (Attention on side effects, sensor has to be for a distance > 5 cm with regard to walls) in order to determine the zero point (offset). Wait that the sensor puts itself in equilibrium with the temperature of the standard solution.
- Drying the sensor with a soft cloth or an absorbent paper.

5.6 NTU Calibration 2-Point - Slope

Sensor slope is determined by positioning the sensor in a Formazine solution which depends of the calibrated range. For this procedure, a Formazin solution, with concentration matching the middle of the measurement range, will be necessary. This solution will be prepared from a 4000 NTU main solution.

- For the preparation of solutions, take a flask of 200 mL. Introduce the necessary volume of Formazin (cf. table below) and fill up to 200 mL with distilled water. The formazin solutions of concentrations lower at 1000 NTU deteriorate quickly, so do not preserve a solution during several days. The solution at 2000 NTU can be preserve in the refrigerator for 2 or 3 weeks in a opaque flask.
- 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.
- Rinse the sensor in clean water and drying the sensor with a soft cloth or an absorbent paper.

5.7 Calibration in mg/L - Offset

It is carried out as follows:

- Immerse the sensor in distilled water (Attention on side effects, sensor has to be for a distance > 5 cm with regard to walls) in order to determine the zero point (offset). Wait that the sensor puts itself in equilibrium with the temperature of the standard solution.
- Drying the sensor with a soft cloth or an absorbent paper.

5.8 Calibration in mg/L - Slope

Turbidity in mg / L, it is necessary to calibrate the sensor on a real sample.

- Immerse the sensor into a sample of sludge, maintained under agitation, and validate the theoretical value measured by the sensor. Analysis the sample dry weight in the laboratory according to the NF standard IN 872 for a range of 0-500 mg / L and according to the NF standard T 90 105 2 for a concentration > 500 mg / L.



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