Aztec ATS430
Turbidity sensor

Measurement made easy

Introduction
The ATS430 sensor is a rugged, reliable instrument designed to measure the turbidity and suspended solids content of water.

The sensor is designed for use with the ABB AWT440 multi-input transmitter featuring EZLink connection. EZLink enables new or replacement sensors to be easily connected without the need to power down the transmitter.

For more information
Publications for the associated Aztec AWT440 transmitter are available for free download from www.abb.com/measurement (see links and reference numbers below) or by scanning this code:

<table>
<thead>
<tr>
<th>search for or click on:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aztec AWT440 multi-input transmitter Commissioning Instruction</td>
<td>CI/AWT440-EN</td>
</tr>
<tr>
<td>Aztec AWT440 multi-input transmitter Data Sheet</td>
<td>DS/AWT440-EN</td>
</tr>
</tbody>
</table>
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1 Health & Safety

1.1 Document symbols
Symbols that appear in this document are explained below:

---

**WARNING – Bodily injury**
This symbol in conjunction with the signal word 'WARNING' indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.

---

**IMPORTANT (NOTE)**
This symbol indicates operator tips, particularly useful information or important information about the product or its further uses. The signal word 'IMPORTANT (NOTE)' does not indicate a dangerous or harmful situation.

---

1.2 Safety precautions
Be sure to read, understand and follow the instructions contained within this manual before and during use of the equipment. Failure to do so could result in bodily harm or damage to the equipment.

---

**WARNING – Bodily injury**
Installation, operation, maintenance and servicing must be performed:
— by suitably trained personnel only
— in accordance with the information provided in this manual
— in accordance with relevant local regulations

---

1.3 Potential safety hazards
1.3.1 Aztec ATS430 sensor – electrical
The sensor operates on 24 V DC.

There are no hazardous voltages present in the sensor.

1.3.2 Aztec ATS430 sensor – formazin used to calibrate the sensor
Sensor calibration (see Section 6.3.1, page 13) may require the use of formazin.

---

**DANGER – Formazin**
Formazin is a polymerisation of 2 hazardous constituents. Please conduct a full risk assessment based on the supplier’s safety datasheet for formazin before use.

---

1.4 Safety standards
This product has been designed to satisfy the requirements of IEC61010-1:2010 3rd edition ‘Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use’ and complies with US NEC 500, NIST and OSHA.

---

1.5 Product symbols
Symbols that may appear on this product are shown below:

---

---

**WARNING – Bodily injury**
This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.

---

**IMPORTANT (NOTE)**
This symbol indicates the need for protective eye wear.

---

**IMPORTANT (NOTE)**
This symbol indicates the need for protective hand wear.

---

Recycle separately from general waste under the WEEE directive.

---

1.6 Product recycling and disposal (Europe only)

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. To conform to European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible.

---

**IMPORTANT (NOTE)**
For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

---

1.7 Restriction of Hazardous Substances (RoHS)

The European Union RoHS Directive and subsequent regulations introduced in member states and other countries limits the use of six hazardous substances used in the manufacturing of electrical and electronic equipment. Currently, monitoring and control monitors do not fall within the scope of the RoHS Directive, however ABB has taken the decision to adopt the recommendations in the Directive as the target for all future product design and component purchasing.
ATS430 sensor components are shown in Fig. 2.1:

![ATS430 sensor components](image)

**Fig. 2.1 ATS430 sensor components**

### System overview

ATS430 sensor components are shown in Fig. 2.1:

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sensor end cap</td>
</tr>
<tr>
<td>B</td>
<td>Sensor body (see Table 2.2 for body and end cap material options)</td>
</tr>
<tr>
<td>C</td>
<td>Sensor cable, 5-way, including M12 connector</td>
</tr>
<tr>
<td>D</td>
<td>EZLink connector</td>
</tr>
</tbody>
</table>

### Table 2.1 Sensor – component descriptions

<table>
<thead>
<tr>
<th>Sensor no.*</th>
<th>Body material</th>
<th>Wiper</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS430/A2A1 (1 m [3.2 ft] cable) or ATS430/A2A2 (10 m [32 ft] cable)</td>
<td>Stainless steel 316</td>
<td>Yes (viton)</td>
<td>0 to 4000 NTU</td>
</tr>
<tr>
<td>ATS430/A1A1 (1 m [3.2 ft] cable) or ATS430/A1A2 (10 m [32 ft] cable)</td>
<td>Stainless steel 316</td>
<td>No</td>
<td>0 to 4000 NTU</td>
</tr>
<tr>
<td>ATS430/A3A1 (1 m [3.2 ft] cable) or ATS430/A3A2 (10 m [32 ft] cable)</td>
<td>Titanium</td>
<td>No</td>
<td>0 to 4000 NTU</td>
</tr>
</tbody>
</table>

*All sensors conform to the ISO 7027 standard.

### Table 2.2 Sensor body options / part numbers

<table>
<thead>
<tr>
<th>Sensor no.*</th>
<th>Body material</th>
<th>Wiper</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS430/A2A1 (1 m [3.2 ft] cable) or ATS430/A2A2 (10 m [32 ft] cable)</td>
<td>Stainless steel 316</td>
<td>Yes (viton)</td>
<td>0 to 4000 NTU</td>
</tr>
<tr>
<td>ATS430/A1A1 (1 m [3.2 ft] cable) or ATS430/A1A2 (10 m [32 ft] cable)</td>
<td>Stainless steel 316</td>
<td>No</td>
<td>0 to 4000 NTU</td>
</tr>
<tr>
<td>ATS430/A3A1 (1 m [3.2 ft] cable) or ATS430/A3A2 (10 m [32 ft] cable)</td>
<td>Titanium</td>
<td>No</td>
<td>0 to 4000 NTU</td>
</tr>
</tbody>
</table>

*All sensors conform to the ISO 7027 standard.
3 Installation

3.1 Siting

**IMPORTANT (NOTE)**
- The sensor is supplied with a protective cover on the end cap. The cover must be removed before the sensor can be operational.
- When installing the sensor, ensure that the front face of the sensor is submerged to at least 30 cm (11.81 in.) and the sensor is at least 5 cm (1.96 in.) away from any surface in all directions.
- When using extension cables, protect the connections using heat shrink (for example, HISA-18/6-PEX-CL or equivalent).

![Fig. 3.1 Siting the sensor](image)

**Fig. 3.1 Siting the sensor**

3.2 Sensor dimensions

Dimensions in mm (in.).

![Fig. 3.2 Sensor dimensions](image)

**Fig. 3.2 Sensor dimensions**
3.3 Mounting / Cleaning options

Sensor mounting / cleaning options are shown in Table 3.1 / Fig. 3.3:

<table>
<thead>
<tr>
<th>Item</th>
<th>Mounting option</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Open channel mounting kit:</td>
</tr>
<tr>
<td></td>
<td>— ATS4000768, suitable for floor/wall (surface) mounting (ATS4000720 chain mounting kit available separately)</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Wall mounting accessory:</td>
</tr>
<tr>
<td></td>
<td>— ATS4000700, suitable for 40 mm / 1.25 in dia dip pole</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Dip pole assembly (supplied with 40 mm dia pole):</td>
</tr>
<tr>
<td></td>
<td>— ATS4000750: 2.5 m (8.2 ft) straight</td>
</tr>
<tr>
<td></td>
<td>— ATS4000716: 2.5 m (8.2 ft) 90° bend</td>
</tr>
<tr>
<td></td>
<td>— ATS4000719: 2.5 m (8.2 ft) 45° bend</td>
</tr>
<tr>
<td>Dip pole mounting adaptor kits (to attach to user-supplied pole)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— ATS4000751: for attachment to 40 mm dia or 1.25 in NB pole (straight)</td>
</tr>
<tr>
<td></td>
<td>— ATS4000710: for attachment to 1.25 in NB pole (90° bend)</td>
</tr>
<tr>
<td></td>
<td>— ATS4000711: for attachment to 1.25 in NB pole (45° bend)</td>
</tr>
<tr>
<td></td>
<td>— ATS4000714: for attachment to 40 mm dia. pole (90° bend)</td>
</tr>
<tr>
<td></td>
<td>— ATS4000715: for attachment to 40 mm dia. pole (45° bend)</td>
</tr>
</tbody>
</table>

**Note.** Handrail mounting brackets are not supplied with this kit and must be purchased separately.

| **D** | Open tank flanged dip mount: |
| | — ATS4000785, for mounting on user-supplied mounting bracket |
| **E** | Wiper arm protective shroud assembly: |
| | — ATS4000725 |
| **F** | Flow cell pipeline mount: |
| | — ATS4000741, suitable for wall / surface mounting (includes wall mounting clip) |
| **G** | Handrail mounting bracket – swivel / tilt action: |
| | — ATS4000762 for 1.25 in NB dip pole, suitable for 42 or 51 mm (1.7 or 2.0 in) dia. handrail |
| | — ATS4000763 for 40 mm dia dip pole, suitable for 42 or 51 mm (1.7 or 2.0 in) dia. handrail |
| **H** | Handrail mounting bracket – tilt action: |
| | — ATS4000760 for 40 mm or 1.25 in dia dip pole, suitable for 42 or 51 mm (1.7 or 2.0 in) dia handrail |
| **I** | Retractable insertion assembly: |
| | — ATS4000780, maximum pressure 10 bar (145 psi), for mounting on user-supplied flange: BS EN 1092-1, Type 01B, DN50, PN16, stainless steel 316L or similar. Maximum distance from flange sealing face to pipe I/D must not exceed 70 mm (2.75 in.). |

Table 3.1 ATS430 sensor mounting / cleaning options

Fig. 3.3 ATS430 sensor mounting / cleaning options
4 Sensor setup – first-time installation

**IMPORTANT (NOTE)**
Perform this procedure when a new / replacement sensor is connected to the transmitter for the first time only. For existing sensors, see Section 5, page 8.

To perform a first-time installation (Easy Setup menu):

1. Connect a new or replacement sensor to the transmitter’s EZLink connector – see transmitter Operating instructions OI/AWT40-EN.

   The following prompt is displayed identifying the new / replacement sensor (S1 to S4):

   ![ATS400 New Sensor $x $x Detected Start Easy Setup ?](image)

2. To enter Easy Setup level, press the key (below the icon).

   The Easy Setup start screen is displayed:

   ![Menu Easy Setup Exit Select](image)

   Press the key (below the Select prompt).

3. To enter Easy Setup level, press the key (below the Select icon).

4. Press the key (below the Edit prompt) to change the default value to the required value / selection.

5. Press the key (below the Next prompt) to accept the value / selection displayed and advance to the next configuration parameter.

   The following Configuration parameters are set at Easy Setup level:

   - Tag
   - PV Type
   - Units
   - Range High
   - Range Low
   - Clean Interval
   - Filter Type
   - Analogue outputs and alarms

**IMPORTANT (NOTE)**
Refer to Section 5.1, page 9, for parameter details – not all parameters in Section 5.1 are displayed at Easy Setup level.

6. Continue with configuration of the required parameters.

   On completion the Easy Setup start screen is displayed:

   ![Menu Easy Setup Exit Select](image)

7. To exit Easy Setup, press the key (below the Exit prompt) to display the Operator Page.

   Pressing the key (below the Select prompt) re-enters the Easy Setup level where parameters can be reviewed or modified after 1st time connection.

   After completing the Easy Setup level, pressing the or key enters the Advanced Configuration level, where all available sensor and transmitter parameters can be reviewed or modified.

**IMPORTANT (NOTE)**
To re-configure an existing sensor (after first-time installation), enter the Configuration level (see Section 5.1, page 9) via the Operator Page – refer to transmitter Operating instructions OI/AWT440-EN for Operator Page details and navigation.
5 Sensor setup

**IMPORTANT (NOTE)**

Perform this procedure on existing sensor(s) only. Sensors are setup / configured individually. If installing a new / replacement sensor, refer to Section 4, page 7.

1. Connect the ATS430 sensor to the transmitter’s EZLink connector – see transmitter Operating instruction OI/AWT440-EN.

2. At the AWT440 transmitter, press the key to display the Operator Page menu, then select Enter Configuration to display the Access Level page.

   Use the key to select the Advanced menu item and press the key (below the Select prompt).

   If the Sensor Setup menu is not displayed use the / keys to scroll to it:

   ![Sensor Setup Menu]

   Press the key (below the Select prompt).

3. The Sensor Setup page is displayed:

   ![Sensor Setup Page]

   Ensure Sx:Turb TSS is highlighted and press the key (below the Select prompt).

   The Sx:Turb TSS: Turbidity menu page is displayed:

   ![Sx:Turb TSS: Turbidity Page]

4. Proceed with sensor setup – see Section 6.1, page 10 for parameter options.
5.1 Sensor Setup

Used to set the sensor tag, operational range, filtering parameters and clean interval.

<table>
<thead>
<tr>
<th>Menu</th>
<th>Comment</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Setup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tag</td>
<td>Enter an alphanumeric sensor tag (16 characters maximum) to identify the sensor on the Operator Pages.</td>
<td>TAG1</td>
</tr>
<tr>
<td>PV Type</td>
<td>Select measurement type.</td>
<td>Turbidity</td>
</tr>
<tr>
<td>Turb Units</td>
<td>Select the turbidity units: NTU / FNU</td>
<td>NTU</td>
</tr>
<tr>
<td>SS Units</td>
<td>Select the units for suspended solids: mg/l / ppm</td>
<td>mg/l</td>
</tr>
<tr>
<td>Range High</td>
<td>Set the span value in Chart and Bargraph views.</td>
<td>4000 NTU (turbidity)</td>
</tr>
<tr>
<td>Range Low</td>
<td>Set the zero value in Chart and Bargraph views.</td>
<td>0 NTU (turbidity)</td>
</tr>
<tr>
<td>Filter Type</td>
<td>Select the signal filtering type: Off / Low / Medium / High / Bubble Reject</td>
<td>Off</td>
</tr>
<tr>
<td>Clean Interval</td>
<td>Set the interval between cleans: Off / 15 mins / 30 mins / 45 mins / 1 to 24 Hours</td>
<td>Off</td>
</tr>
<tr>
<td>Clean Mechanism</td>
<td>None (for non wiper versions), Wiper (for wiper versions) or External. The external option allows the transmitter to control an external cleaning device through the digital I/O lines. Note. Refer to the Aztec ADS430 EZCLEAN operating instructions (OI/ADS430/EZCLN-EN) for an example of the use of this facility.</td>
<td></td>
</tr>
<tr>
<td>Clean Type*</td>
<td>Set the clean type: Continuous / Pulsed.</td>
<td>Continuous</td>
</tr>
<tr>
<td>Clean On Time*</td>
<td>Set the duration of the clean: 1 to 60 s</td>
<td>30 secs</td>
</tr>
<tr>
<td>Clean Off Time*</td>
<td>Set the duration between cleans: 1 to 60 s</td>
<td>30 secs</td>
</tr>
<tr>
<td>Recovery Time*</td>
<td>Set the time delay between the completion of cleaning and the display of a new reading on the operator page: 1 to 10 min</td>
<td>1 min</td>
</tr>
<tr>
<td>Clean Duration*</td>
<td>Displays the total duration of the clean: Clean Type set to Continuous = Clean on Time + Recovery Time Clean Type set to Pulsed = (Clean on Time + Clean Off Time) x Number of Pulses + Recovery Time</td>
<td></td>
</tr>
<tr>
<td>Clean Output*</td>
<td>Displays the output signal the clean is assigned to.</td>
<td>No Assignment</td>
</tr>
<tr>
<td>Reset Wiper Lifetime</td>
<td>Available only for sensors with wipers. Use to restart the wiper lifetime counter after wiper replacement.</td>
<td></td>
</tr>
<tr>
<td>Restore Defaults</td>
<td>Returns all settings back to default values.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Displayed only if Clean Interval is NOT set to Off AND Clean Mechanism is set to External.

**Displayed only if Clean Type is set to Pulsed.
6 Calibration

This section describes how to calibrate the sensor and involves measuring the sensor’s sensitivity to turbidity and/or suspended solids by exposing the sensor to samples of known turbidity or suspended solids content.

Calibrations are initiated via the Cal prompt displayed on the main page or via the Operator pages or Calibrate and Advanced menu items on the Access Level page – refer to transmitter Operating instructions OI/AWT440-EN for all transmitter menu options.

6.1 Calibrate menu

IMPORTANT (NOTE) — Do not perform a calibration until the sensor and transmitter are installed and ready for operation.
— Before removing the sensor for calibration purposes, set the currents outputs and alarms to Hold (enabled via the Operator Menu / Manual Hold function).

Used to calibrate the sensor. Access to the Calibrate menu is via the Calibrate and Advanced levels only.

Note. During calibration, current outputs and alarms are set to Hold automatically if Hold Outputs is enabled (see below).

– Refer to Section 6.2, page 11 to perform a sensor verification.
– Refer to Section 6.3, page 13 to perform a turbidity calibration.
– Refer to Section 6.4, page 17 to perform a suspended solids calibration.

<table>
<thead>
<tr>
<th>Menu</th>
<th>Comment</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1(to 4) : TURB TSS</td>
<td>Select the turbidity sensor to calibrate.</td>
<td></td>
</tr>
<tr>
<td>Sensor Verification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbidity Calibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Point Cal</td>
<td>General purpose span calibration.</td>
<td></td>
</tr>
<tr>
<td>2-Point Cal</td>
<td>Calibration for better accuracy.</td>
<td></td>
</tr>
<tr>
<td>Suspended Solids Cal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Point Cal</td>
<td>General purpose span calibration.</td>
<td></td>
</tr>
<tr>
<td>2-Point Cal</td>
<td>Calibration for better accuracy.</td>
<td></td>
</tr>
<tr>
<td>Sample Collection</td>
<td>Sample collection in progress.</td>
<td></td>
</tr>
<tr>
<td>Collection Complete</td>
<td>Sample collection completed.</td>
<td></td>
</tr>
<tr>
<td>Manual Coefficient</td>
<td>Enter the coefficient that relates the turbidity of the sample to its suspended solids content.</td>
<td></td>
</tr>
<tr>
<td>Restore Defaults</td>
<td>Restores default values to their factory settings.</td>
<td></td>
</tr>
<tr>
<td>Hold Outputs</td>
<td>Enable / disable the Hold Outputs function. If enabled, the current outputs and alarm functions are held during calibrations.</td>
<td>Enabled</td>
</tr>
</tbody>
</table>
6.2 Sensor verification

6.2.1 Preparing the verification tool and locking the sensor in place
The verification tool can be used to verify sensor operation as an alternative to using formazin. Using the verification tool eliminates the need to handle potentially hazardous chemicals (formazin) during routine verification.

**IMPORTANT (NOTE)**

- Ensure the verification tool carrier is kept clean and any dirt is removed after each use.
- Ensure the sensor is clean of dirt and fouling prior to insertion into the verification tool (step 7).
- Take care not to damage the surface of verification pucks. When using the puck in locations where grit or sand may be present, ensure the sensor is thoroughly clean before inserting it into the verification tool. Any debris on the front face of the sensor will prevent the puck making full contact with the sensing area and result in a reading error as well as possible damage to the puck.

Referring to Fig. 6.1:

1. Select a verification puck with the NTU value suitable for the application – the NTU value is printed on puck label A.
2. Remove protective cap B from puck C.
3. Align slot D (opposite puck label A) with sprung ball screw E located within the bore of the lower section of verification tool F.
4. Press puck C into place taking care not to touch the upper surface and confirm a puck of the correct NTU value has been fitted – the NTU value of the puck is visible through front aperture G.
5. Pour a few drops of coupling agent H onto the puck surface, near the centre of the circle.
6. Ensure slider I is in the unlocked position.
7. Insert sensor J into verification tool F and align the (2 opposing) holes K with notch L on the verification tool top cap.

**IMPORTANT (NOTE)**

- Sensors with accessories connected:
  - sensor J is shown with a standard cable attached. If accessories (such as dip pole, chain adaptor) are connected there is no need to disconnect them. Verification can be performed with accessories in place. For flow cell mounted sensors, unscrew the flow cell adaptor from the sensor then slide it up the cable.
- Aligning sensors fitted with wiper:
  - orientate the sensor with the wiper blade to the front (open cut-out) to ensure correct alignment with the puck. This also ensures correct alignment with the locking plate peg. To avoid damage to the wiper arm, wiping is disabled automatically while the sensor is inserted in the verification tool.

8. Push sensor J down until the holes K in the sensor body are within the top cap, then push slider I to the locked position to lock sensor J in place.
9. Refer to Operating instruction OI/AWT440-EN and initiate a verification routine.
10. When the verification routine is complete, carefully wipe puck C and verification tool F clean, refit puck cap B and store all items into the case supplied with the kit.

**IMPORTANT (NOTE)** When pushing the sensor into the verification tool body (step 8), ensure the sensor is inserted straight so that the sensor face is placed directly onto the puck surface.

Fig. 6.1 Using the verification tool
6.2.2 Initiating the verification at the transmitter

1. At the Calibrate level, press the Calibrate key (below the Select prompt):

   The sensor selector menu is displayed:
   
   ![Sensor selector menu]

   Highlight the sensor to be verified (for example S1:Turb TSS) and press the Select key (below the Select prompt).

2. The menu options for S1:Turb TSS are displayed:

   ![Menu options for S1:Turb TSS]

3. Use the \( \uparrow \) / \( \downarrow \) keys to select Sensor Verification and press the Select key (below the Select prompt).

   The Sensor Verification screen is displayed:
   
   ![Sensor Verification screen]

4. Press the \( \uparrow \) key (below the Edit prompt) to enter the value of the verification puck.

5. Enter the turbidity value printed on the puck label and press the Select key (below the OK prompt).

   The Start Verification screen is displayed:
   
   ![Start Verification screen]

   Ensure the sensor is inserted in the verification tool (see Section 6.2.1, page 11) and press the Select key (below the Continue prompt) to start the verification routine. (To Abort verification, press the \( \uparrow \) key).

6. The Verification progress screen is displayed:

   ![Verification progress screen]

   If the verification process completes successfully, a verification successful message (Procedure Pass) is displayed:
   
   ![Verification successful message]

---

12 OI/ATS430–EN Rev. H | Aztec ATS430 | Turbidity sensor
7. If the verification fails, a verification failure message (Procedure Failed) is displayed:

<table>
<thead>
<tr>
<th>Verification</th>
<th>PV 1400 NTU</th>
<th>STD 1000 NTU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Procedure Failed</td>
<td></td>
</tr>
</tbody>
</table>

This may indicate that the sensor requires calibration.

6.3 Turbidity calibration
Used to calibrate the sensor to measure turbidity. There are two possible calibration modes:

— 1-Point calibration, refer to Section 6.3.2, page 15
— 2-Point calibration, refer to Section 6.3.3, page 16

A 1-point calibration adjusts the Calibration Slope and is suitable for general operation.

A 2-point calibration is recommended when measuring low turbidity values (below 50 NTU). The Offset and Slope are adjusted resulting in improved accuracy at low turbidity concentrations.

When performing calibrations for measuring low turbidity values (below 50 NTU), ensure the sensor reading is not affected by light scattered by the calibration solution container. Use a large container (minimum 1 litre) and ensure that the sensor is immersed by no more than 5 cm below the solution surface and is at least 5 cm from the container walls.

For low level applications that use the ABB Flowcell (ATS4000741), use the Calibration Pot (part no. ATS4000740) to calibrate the sensor. See Section 6.3.1.

6.3.1 Calibration using optional calibration pot ATS4000740
The calibration pot (part no. ATS4000740) is recommended for use in the following situations:

— When performing a calibration in direct sunlight. The calibration pot excludes ambient light that can affect the measurement.

— For low level applications (less than 50 NTU) that use the ABB Flowcell (ATS4000741). The interior properties (dimensions and surface finish) of the flowcell and calibration pot are comparable, resulting in a matched calibration.

— For high concentration calibrations, when the use of large quantities of formazin solution is not desirable. The calibration pot requires only 200 ml of calibration solution.

Do not use the calibration pot in low level applications (less than 50 NTU) that either do not use the flowcell or where the sensor is mounted more than 5 cm away from any surface, as the surface light scattering in the calibration pot could result in an offset in the reading.

**IMPORTANT (NOTE)**

— When inserting the sensor into the calibration solution take care not to trap air bubbles in the front face of the sensor. For sensors with wiper, perform a wipe before proceeding with calibration.

— Sensors with accessories connected:

  — sensor B (Fig. 6.2, page 14:) is shown with a standard cable attached. If accessories (such as dip pole, chain adaptor) are connected the calibration can still be performed with them in place.

Refering to Fig. 6.2, page 14:

1. Slide cap A onto sensor B until the cap is close to the top of the sensor.

**IMPORTANT (NOTE)**

Cap A has 2 sprung-loaded ball screws C that engage with 2 holes D in the top ring of sensor B. Confirm correct alignment by checking that 2 grooves E on the top face of cap A align with holes D / ball screws C when cap is connected.

For sensors installed in a flow cell, the flow cell thread adaptor can be used instead of the calibration pot cap. Alternatively, unscrew the adaptor and slide back to allow the cap to fit onto the sensor.

3. Carefully pour 200 ml (6.76 ounce [US, liquid]) of formazin F into calibration pot G.
4. Carefully slide sensor / cap assembly H into calibration pot G until fully inserted.
5. Perform a sensor calibration at the transmitter:
   — see Section 6.3.2, page 15 for a 1-point calibration
   — see Section 6.3.3, page 16 for a 2-point calibration.

6. When the calibration is complete, withdraw sensor / cap assembly \( H \) from calibration pot \( G \). Remove cap \( A \) from sensor \( B \) (a combined pull and twist action is the easiest withdrawal method). Rinse all items with water and dry thoroughly with tissue (not supplied).

7. Dispose of formazin solution safely in accordance with local regulations.

Fig. 6.2 Calibration using the optional calibration pot

---

200 ml (6.76 fl. oz) formazin
6.3.2 1-Point calibration
For the 1-point calibration only a span value is used. The span value can be provided by a verification puck, a formazin solution or an AMCO standard.

1. At the Calibrate level, press the \textarrow{left} key (below the \textit{Select} prompt):

   The sensor selector menu is displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{sensor_selector}
   \end{center}

   Highlight the sensor to be calibrated (for example \texttt{S1:Turbidity TSS}) and press the \textarrow{left} key (below the \textit{Select} prompt).

2. The menu options for \texttt{S1:Turbidity TSS} are displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{menu_options}
   \end{center}

3. Use the \textarrow{up} / \textarrow{down} keys to select \texttt{Turbidity Cal} and press the \textarrow{left} key (below the \textit{Select} prompt).

   The \texttt{Turbidity Cal} screen is displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{turbidity_cal}
   \end{center}

4. Press the \textarrow{left} key (below the \textit{Edit} prompt).

   The \texttt{Calibration Type} screen is displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{calibration_type}
   \end{center}

5. Use the \textarrow{up} / \textarrow{down} keys to select \texttt{1-Point Cal} and press the \textarrow{left} key (below the \textit{OK} prompt).

   Press the \textarrow{left} key (below the \textit{Next} prompt).

   The \texttt{Turbidity / Offset} screen is displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{turbidity_offset}
   \end{center}

   For most cases a zero offset is suitable. However, in situations where an offset was previously determined during a 2-point calibration, it is possible to retain the previously measured offset during the 1-point calibration.

6. To select the required offset press the \textarrow{left} key (below the \textit{Edit} prompt).

   The \texttt{Offset / Remove Offset | Retain Offset} screen is displayed:

   \begin{center}
   \includegraphics[width=0.4\textwidth]{offset_remove Offset}
   \end{center}

7. Use the \textarrow{up} / \textarrow{down} keys to select \texttt{Retain Offset} and press the \textarrow{left} key (below the \textit{OK} prompt) to confirm the selection and use the existing offset, or select \texttt{Remove Offset} to remove the offset (an offset of 0 NTU is assumed).
The Turbidity | Calibration Value screen is displayed where the calibration value can be modified by pressing the Edit key (below the Edit prompt).

When the required value is set, press the Next key (below the Next prompt).

8. Once the value shown on screen matches the span value, insert the sensor in the verification tool or solution and press the Next key (below the Next prompt).

6.3.3 2-Point calibration

2 Solutions are used for a 2-point calibration. This calibration is used when more accuracy is needed over a given range, using calibration solutions at either end of the desired range.

1. At the Calibrate level, press the Select key (below the Select prompt):

The sensor selector menu is displayed:

2. Highlight the sensor to be calibrated and press the Select key (below the Select prompt).

The menu options for S1: Turb TSS are displayed:

3. Use the keys to select Turbidity Cal and press the Select key (below the Select prompt).

The Turbidity screen is displayed:

9. If the calibration is successful the final screen displays the new slope. Press the Exit key (below the Exit prompt) to return to the main menu.

The 1-point calibration is now complete.
4. Press the \( \text{ } \) key (below the Edit prompt).

The Calibration Type screen is displayed:

5. Use the \( \text{ } \) / \( \text{ } \) keys to select 2-Point Cal and press the \( \text{ } \) key (below the OK prompt) to start the 2-point calibration. The Turbidity / Low Solution Value screen is displayed where the first point value can be entered:

Press the \( \text{ } \) key (below the Next prompt).

Press the \( \text{ } \) key (below the Edit prompt) to enter the value of the lower calibration point. Press the \( \text{ } \) key (below the OK prompt). Press the \( \text{ } \) key (below the Next prompt) to set the value and display the Second Point Value screen.

6. On the Turbidity / High Solution Value screen press the \( \text{ } \) key (below the Edit prompt) to enter the value of the higher calibration point.

7. Place the sensor in the lower calibration solution, press the \( \text{ } \) key (below the OK prompt), press the \( \text{ } \) key (below the Next and press the \( \text{ } \) key (below the Continue prompt).

8. When acquisition is complete remove the sensor from the first calibration point, clean and insert the sensor into the second calibration point. Clean and dry the sensor thoroughly, to avoid cross contamination of the calibration solutions. Press the \( \text{ } \) key (below the Continue prompt) to start data acquisition.

9. If the calibration fails a message is displayed indicating the reason for failure. If the calibration is successful the final screen displays the new slope. Press the \( \text{ } \) key (below the Exit prompt) to return to the main menu.

The 2-point calibration is now complete.

6.4 Suspended solids

There are 4 possible calibration modes for suspended solids:

— 1-Point calibration: assumes that there is no zero offset, so a single point is used to calculate the linear relation between turbidity and suspended solids – refer to Section 6.4.2, page 18

— 2-Point calibration: two solutions of known suspended solids concentrations are used to determine the linear relation between turbidity and suspended solids – refer to Section 6.4.3, page 19

In-Process calibration: used in situations where it is not possible to remove the sensor from the process. A grab sample is taken from the process for laboratory determination of the suspended solids content, and the sensor stores the turbidity value being read at the time the sample was taken – refer to Sections 6.4.4, page 20 to 6.4.6, page 21

— Manual coefficient: allows the user to input a coefficient obtained from data analyzed in the lab – refer to Section 6.4.7, page 22.
6.4.1 Suspended solids calibration
To perform a suspended solids calibration:

1. At the Calibrate level, press the \( \uparrow \) key (below the Select prompt):

   ![Sensor selector menu](image)

   The sensor selector menu is displayed:

2. Highlight the sensor to be calibrated and press the \( \uparrow \) key (below the Select prompt). The menu options for calibration are displayed:

   ![Sensor verification menu](image)

3. Use the \( \leftarrow / \rightarrow \) keys to select TSS Cal and press the \( \uparrow \) key (below the Select prompt) to enter the calibration menus.

6.4.2 1-Point calibration
A solution of a known turbidity and suspended solids content is used to calibrate the sample.

1. At the Calibration Type screen, press the \( \uparrow \) key (below the Edit prompt), use the \( \leftarrow / \rightarrow \) keys to select 1-Point Cal and press the \( \uparrow \) key (below the OK prompt):

   ![Calibration type menu](image)

   The Suspended Solids / High Solution Value screen is displayed. Press Next:

   ![Suspension solids menu](image)

2. Press the \( \uparrow \) key (below the Next prompt) to start the calibration.

3. In the following screen, press the \( \uparrow \) key (below the Edit prompt) to enter the suspended solids content of the calibration sample.

   ![Span solution value menu](image)

4. Press the \( \uparrow \) key (below the OK prompt) once the value has been entered.
5. Place the sensor in the sample when prompted and press the key (below the Continue prompt) to start the calibration:

The calibration progress window is displayed. When acquisition is complete a screen displays the calibration coefficient. Press the key (below the Exit prompt) to return to the main menu.

The calibration is now complete.

6.4.3 2-Point calibration
Two solutions are used for a 2-point calibration. This calibration is used when more accuracy is needed over a given range, using calibration solutions at either end of the required range.

1. At the Calibration Type screen, use the / keys to select 2-Point Cal and press the key (below the OK prompt):

2. On the next screen, press the key (below the Next prompt).

3. On the Low Solution Value screen press the key (below the Edit prompt) to enter the value of the lower calibration point. Press the key (below the Next prompt) once the value is entered.

4. On the 2nd Point Value screen press the key (below the Edit prompt) to enter the value of the higher calibration point. Press the key (below the Next prompt) once the value is entered.

5. Place the sensor in the lower calibration point and press the key (below the Continue prompt).

The calibration process screen is displayed – the calibration can be cancelled at any time during the process by pressing the key (below the Abort prompt):

6. On completion, remove the sensor from the first calibration point, clean and insert the sensor into the second calibration point. Press the key (below the Continue prompt) to start data acquisition.

7. If the calibration fails a message is displayed indicating the reason for failure. If the calibration is successful the next screen displays the new slope. Press the key (below the Exit prompt) to return to the main menu.

The 2-point calibration is now complete.
6.4.4 In process calibration
In process calibration is used when it is not possible to remove
the sensor from the process to perform the calibration. In this
calibration mode the actual sample is used to calibrate the
sensor.

The in process calibration takes place in two steps. During the
first step a grab sample is taken from the process, and the
sensor records the turbidity of the sample at that time. The
suspended solids content of the grab sample is then measured
in the laboratory and entered into the transmitter during the
second step.

Due to the inherent variability of both the turbidity and
suspended solids measurements, using a single point to
calibrate the suspended solids measurement can lead to sudden
jumps in the suspended solids value reported by the sensor.
(The ATS430 sensor supports an adaptive calibration mode,
which mitigates the occurrence of such jumps.) – refer to
AN/ANAINST/021-EN for details of adaptive calibration.

1. At the Calibration Type screen, use the a / v keys to
select Sample Collection and press the p key (below the
OK prompt):

2. Proceed to Section 6.4.5 (Sample collection) to start the
first part of the calibration.

6.4.5 Sample collection
1. This is the first step of the calibration. On the next screen,
press the p key (below the Next prompt).

Performing this step erases any sample collection
performed previously. Only the last sample collection
performed is stored in the sensor.

2. On the following screen press the p key (below the
Continue prompt) to start the data collection. The grab
sample should be taken as close to the sensor as possible
during this period.

The calibration process screen is displayed – the acquisition
can be cancelled at any time during the process by pressing
the p key (below the Abort prompt):

3. Once the acquisition is complete, Press the p key (below
the Exit prompt) to return to the main menu.

The value of the sample turbidity is now stored.

4. Proceed to Section 6.4.6 (Sample collection) to start the
second part of the calibration once the suspended solids
value has been determined.
6.4.6 Collection complete

This is the second step of the calibration. Once the suspended solids content of the sample has been measured in the laboratory, the value can be entered into the transmitter. Note that this sample must correspond to the last sample collection step performed, otherwise the calibration may not be correct.

1. To start the Collection Complete procedure from the Calibration Type screen, use the ↑ / ↓ keys to select Collection Complete and press the key (below the Edit prompt).

2. Press the key (below the Edit prompt).

The Suspended Solids / New Process screen is displayed:

3. To start collection for a new process (when the sensor is installed for the first time in a new process or when the calibration needs to be reset) use the ↑ / ↓ keys to select Yes.

To retain the memory of the previous calibrations (adaptive calibration to fine tune the existing suspended solids calibration) select No.

4. Press the key (below the OK prompt).

5. Press key (below the Next prompt).

The Collection Complete screen is displayed:

6. Use the ↑ / ↓ keys to enter the suspended solids value (ensure the value entered is in the same units as those displayed in the screen) and press the key (below the Continue prompt) when complete.

A new calibration coefficient based on the value entered, and the previous values if using adaptive calibration, is calculated.

The calibration is now complete.

7. Press the key (below the Exit prompt) to return to the main menu.
6.4.7 Manual coefficient
This calibration mode enables the user to enter directly the coefficient that relates the turbidity of the sample to its suspended solids content. The sensor uses the following equation to calculate suspended solids content from turbidity (see Fig. A.2, page 27):

\[ SS = \frac{T}{a} \]

Where:
- \( SS \) is the suspended solids content in the required units (mg/l or ppm),
- \( T \) is the turbidity in NTU
- \( a \) is the coefficient.

If a set of data points of turbidity and suspended solids, the coefficient can be calculated by plotting the suspended solids (y-axis) against turbidity (x-axis) and fitting a straight line with an intercept of 0. The calibration coefficient is the slope from the linear fit of the data.

1. To enter a coefficient, select Manual Coefficient from the Calibration Type screen and press the key (below the Next prompt).

2. Press the key (below the Edit prompt) to enter the value of the coefficient and press the key (below the OK prompt) when complete.

3. The Calibration Complete screen is displayed. Press the key (below the Next prompt) to return to the main menu.

The calibration is now complete.

6.5 Calibration log
The calibration log stored in the sensor holds a record of the last 15 calibration operations undertaken on the sensor. To view the calibration log in the transmitter, logs must be enabled first. Refer to the AWT440 transmitter manual (OI/AWT440-EN) for details of how to enable logs.

Once logs are enabled, a calibration log page exists for each of the sensors connected to the transmitter. To access the calibration log, press the View key on the transmitter keypad (the first calibration log is displayed):

![Calibration Log S1]

Fig. 6.3 Calibration log for Sensor 1, showing the result of different calibration and verification operations

Use the group key in the keypad to cycle through the calibration logs for each of the sensors. The log shows the result of the last 15 calibration operations undertaken. The result can be:

- **Calibration aborted**: if calibration is stopped (by the user) part of the way through
- **Calibration failed**: the log entry displays the reason for the calibration failure
- **Verification successful**: if the sensor passes verification
- **Verification failed**: if the sensor failed verification
- **Calibration successful**: the log entry displays the new calibration parameters

Each entry displays the date and time the operation was performed. Note that the date and time are taken from the transmitter. To ensure the date and time stored in the log are accurate, ensure the date and time set in the transmitter are correct.
7 Maintenance

7.1 Fitting and replacing the wiper blade
Referring to Fig. 7.1:

1. Refer to the AWT440 transmitter operating instruction (OI/AT440-EN) and stop wiper operation.

2. Remove sensor from sample and clean the sensor.

3. Using a 5.5 mm spanner or hex nut driver, remove nyloc retaining nut A.

4. Remove wiper arm B complete with blade and captive O-ring.

5. Thoroughly clean wiper motor shaft C and sensor end face and check condition. If the shaft is damaged, consult the factory.

6. Lightly grease captive O-ring within the new wiper arm assembly.

7. Align the flat in the new wiper arm assembly with the flat on wiper motor shaft C and fit the arm to the shaft, ensuring the wiper blade faces the sensor end cap.

8. Insert supplied feeler gauge D between the wiper arm captive O-ring and the sensor end cap.

9. Fit a new nyloc M3 nut and tighten until feeler gauge D is lightly pinched but can be removed without excessive force. Remove the feeler gauge.

10. Refer to the AWT440 transmitter Operating instruction (OI/AT440-EN) and re-start the wiper operation. Ensure the wiper arm functions correctly by issuing a manual clean request from the transmitter.

11. Replace the sensor in the sample.

12. Refer to Section 5.1, page 9 to reset the wiper lifetime.
### 7.2 Diagnostic messages
The table below shows sensor-specific icon types, diagnostic messages and possible causes / suggested remedial action.

**IMPORTANT (NOTE)**
- The diagnostic icons in the following tables conform to NAMUR 107.
- For transmitter-specific diagnostics messages, refer to AWT440-EN.

<table>
<thead>
<tr>
<th>Diagnostic Icon</th>
<th>NAMUR Status</th>
<th>Icon Message</th>
<th>Possible cause / suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Error / Failure" /></td>
<td>Error / Failure</td>
<td>PV failure</td>
<td>The LED is not illuminating the sample. Cycle power to sensor.</td>
</tr>
<tr>
<td><img src="image" alt="Out of specification" /></td>
<td>Out of specification</td>
<td>ADC Failure</td>
<td>An error has been reported by the on board ADC. Cycle power to sensor.</td>
</tr>
<tr>
<td><img src="image" alt="Maintenance required" /></td>
<td>Maintenance required</td>
<td>NV Failure</td>
<td>Failure of non-volatile memory on sensor board. Cycle power to sensor. If power cycling fails, reset the sensor configuration to default and reconfigure as needed.</td>
</tr>
<tr>
<td><img src="image" alt="Check function" /></td>
<td>Check function</td>
<td>Cal. Failed</td>
<td>The last calibration failed. Repeat calibration procedure.</td>
</tr>
<tr>
<td><img src="image" alt="Out of Range" /></td>
<td>Out of Range</td>
<td>Out of Range</td>
<td>The measured turbidity is outside the specified range.</td>
</tr>
<tr>
<td><img src="image" alt="Wiper Expired" /></td>
<td>Wiper Expired</td>
<td>Wiper Expired</td>
<td>The wiper blade is overdue for replacement. Replace the wiper blade and issue wiper blade replaced command.</td>
</tr>
<tr>
<td><img src="image" alt="Temperature Out of Range" /></td>
<td>Temperature Out of Range</td>
<td>Temperature Out of Range</td>
<td>The internal sensor temperature is outside operating limits. Verify that the sample temperature is within the operating range of the sensor (0 to 60 °C [32 to 140 °F])</td>
</tr>
<tr>
<td><img src="image" alt="Excess Light" /></td>
<td>Excess Light</td>
<td>Excess Light</td>
<td>Excess ambient light is present stopping sensor from operating. Shade the sensor, or move to an area where the sunlight is excluded.</td>
</tr>
<tr>
<td><img src="image" alt="Wiper Failed" /></td>
<td>Wiper Failed</td>
<td>Wiper Failed</td>
<td>The wiper has failed to wipe. Check wiper for blockage.</td>
</tr>
<tr>
<td><img src="image" alt="Replace Wiper" /></td>
<td>Replace Wiper</td>
<td>Replace Wiper</td>
<td>The wiper blade is due for replacement. Replace wiper blade and issue wiper blade replaced command.</td>
</tr>
<tr>
<td><img src="image" alt="LED Expired" /></td>
<td>LED Expired</td>
<td>LED Expired</td>
<td>The LED is going to fail shortly.</td>
</tr>
<tr>
<td><img src="image" alt="Cal In Progress" /></td>
<td>Cal In Progress</td>
<td>Cal In Progress</td>
<td>A calibration is in progress.</td>
</tr>
<tr>
<td><img src="image" alt="In Recovery" /></td>
<td>In Recovery</td>
<td>In Recovery</td>
<td>The sensor is in recovery mode after performing a calibration.</td>
</tr>
<tr>
<td><img src="image" alt="Clean Progress" /></td>
<td>Clean Progress</td>
<td>Clean Progress</td>
<td>The wiper is currently cleaning.</td>
</tr>
<tr>
<td><img src="image" alt="Clean Inhibited" /></td>
<td>Clean Inhibited</td>
<td>Clean Inhibited</td>
<td>Wiping is inhibited.</td>
</tr>
</tbody>
</table>
8 Specification

Sensor type
Optical nephelometric turbidity and suspended solids sensor

Sensor
IP rating
IP68

Range
Turbidity: 0 to 4000 NTU
Suspended solids: dependent on sample:
– up to 5000 mg/l kaolin
– up to 15000 mg/l Fullers earth
– up to 100,000 mg/l SiO2

Accuracy1,2
Turbidity: <±2 % measured value
Suspended solids: dependent on sample

Repeatability & Limit of Detection
Repeatability1: <1 %
Limit of detection1: 0.006 NTU

Display resolution
Turbidity: 0.001 NTU
Suspended solids: 0.001 mg/l

Response time
T90 < 30 s with filtering disabled

Storage conditions
–5 to 70 °C (23 to 158 °F)

Operating temperature
0 to 60 °C (32 to 140 °F)

Operating pressure
Up to 10 bar (145 psi) for metal versions

Dimensions
40 mm (1.57 in.) diameter
180 mm (7.08 in.) length

Weight
Stainless steel: approx. 0.65 kg (1.43 lb) without cable
Titanium: approx. 0.4 kg (0.88 lb) without cable

Power
Consumption (maximum)
100 mA @ 24 V DC

Cable
Fixed length
1 or 10 m (3.28 or 32.8 ft.)

EZLink digital sensor connector IP rating
IP67 (when connected)

Extension cable (options)
1, 5, 10, 15, 25, 50 m (3.2, 16.4, 32, 49.2, 82, 164 ft.)

Maximum length (including optional extension cable)
Up to 210 m (826 ft.)

Methods

Materials of construction
Stainless steel version
316L Stainless Steel, Viton, Noryl (wiper version only),
Sapphire and F08 Epoxy

Titanium version
Titanium grade 2, Sapphire and F08 Epoxy

Sensor flow cell body
ABS

Retractable insertion assembly
Parts in contact with sample:
Stainless steel (316/1.4408), Viton, TFM™1600

---

2 ±0.1 NTU for measurement below 5 NTU, provided an accurate calibration is performed to compensate for environmental interferences. To achieve the best accuracy at low levels a two-point calibration is advised.
3 Tested in accordance with BS ISO 15839: 2003.
9 Spares and accessories

9.1 ATS430 spares

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS4000788</td>
<td>Replacement O-ring (pack of 2)</td>
</tr>
<tr>
<td>ATS4000799</td>
<td>Wiper replacement kit (pack of 6)</td>
</tr>
</tbody>
</table>

Table 9.1 ATS430 spares

9.2 ATS 430 accessories

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS4000650</td>
<td>ATS430 Sensor calibration and verification kit</td>
</tr>
<tr>
<td>ATS4000725</td>
<td>Wiper arm protection shroud</td>
</tr>
<tr>
<td>ATS4000740</td>
<td>Calibration pot</td>
</tr>
<tr>
<td>ATS4000717</td>
<td>Hook wrench, Ø40 mm</td>
</tr>
</tbody>
</table>

Table 9.2 Accessories

9.3 EZLink digital sensor extension cables

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWT4009010</td>
<td>1 m (3.2 ft.) extension cable</td>
</tr>
<tr>
<td>AWT4009050</td>
<td>5 m (16.4 ft.) extension cable</td>
</tr>
<tr>
<td>AWT4009100</td>
<td>10 m (32 ft.) extension cable</td>
</tr>
<tr>
<td>AWT4009150</td>
<td>15 m (49.2 ft.) extension cable</td>
</tr>
<tr>
<td>AWT4009250</td>
<td>25 m (82 ft.) extension cable</td>
</tr>
<tr>
<td>AWT4009500</td>
<td>50 m (164 ft.) extension cable</td>
</tr>
</tbody>
</table>

Table 9.3 EZLink digital sensor extension cable

9.4 Mounting accessories

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS4000741</td>
<td>Flow cell</td>
</tr>
<tr>
<td>ATS4000785</td>
<td>Open tank flanged dip mount</td>
</tr>
<tr>
<td>ATS4000768</td>
<td>Open channel mounting kit supplied with 3 mm (9.8 ft.) chain</td>
</tr>
<tr>
<td>ATS4000720</td>
<td>Chain fitting adaptor kit supplied with 3 mm (9.8 ft.) chain</td>
</tr>
<tr>
<td>ATS4000700</td>
<td>Wall mounting bracket for dip pole (40 mm or 1.25 in NB)</td>
</tr>
<tr>
<td>ATS4000760</td>
<td>Handrail mounting bracket (Tilt) for dip pole (40 mm or 1.25 in NB) suitable for 42 or 51 mm (1.7 or 2.0 in.) dia. handrail</td>
</tr>
<tr>
<td>ATS4000762</td>
<td>Handrail mounting bracket (Swivel &amp; Tilt) for dip pole (1.25 in NB) suitable for 42 or 51 mm (1.7 or 2.0 in.) dia. handrail</td>
</tr>
<tr>
<td>ATS4000763</td>
<td>Handrail mounting bracket (Swivel &amp; Tilt) for dip pole (40 mm) suitable for 42 or 51 mm (1.7 or 2.0 in.) dia. handrail</td>
</tr>
<tr>
<td>ATS4000751</td>
<td>Pole mounting adaptor kit (straight) for attachment to 40 mm or 1.25 in NB pole</td>
</tr>
<tr>
<td>ATS4000710</td>
<td>Pole mounting adaptor kit (90°) for attachment to 1.25 in NB pole</td>
</tr>
<tr>
<td>ATS4000711</td>
<td>Pole mounting adaptor kit (45°) for attachment to 1.25 in NB pole</td>
</tr>
<tr>
<td>ATS4000714</td>
<td>Pole mounting adaptor kit (90°) for attachment to 40 mm pole</td>
</tr>
<tr>
<td>ATS4000715</td>
<td>Pole mounting adaptor kit (45°) for attachment to 40 mm pole</td>
</tr>
<tr>
<td>ATS4000750</td>
<td>Dip / pole assembly (straight), metric 2.5 m (8.2 ft)</td>
</tr>
<tr>
<td>ATS4000716</td>
<td>Dip / pole assembly (90° bend), metric 2.5 m (8.2 ft)</td>
</tr>
<tr>
<td>ATS4000719</td>
<td>Dip / pole assembly (45° bend), metric 2.5 m (8.2 ft)</td>
</tr>
<tr>
<td>ATS4000780</td>
<td>Retractable insertion assembly</td>
</tr>
<tr>
<td>ADS430168</td>
<td>Flow cell spares kit – contains replacement push-fit connectors, o-ring, gasket and base plug</td>
</tr>
<tr>
<td>ATS4000796</td>
<td>Retractable insertion assembly spares kit – contains replacement o-rings, washers and circlip</td>
</tr>
</tbody>
</table>

Table 9.4 Mounting accessories

9.5 Replacement parts for ATS430 sensor calibration and verification kit (part no. ATS4000650)

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS4000692</td>
<td>Replacement puck, low, non wiper (typically 900 NTU)</td>
</tr>
<tr>
<td>ATS4000693</td>
<td>Replacement puck, high, non wiper (typically 2500 NTU)</td>
</tr>
<tr>
<td>ATS4000697</td>
<td>Replacement puck, low (wiper) (typically 900 NTU)</td>
</tr>
<tr>
<td>ATS4000698</td>
<td>Replacement puck, high (wiper) (typically 2500 NTU)</td>
</tr>
<tr>
<td>ATS4000643</td>
<td>ATS430 sensor calibration coupling agent (15 ml)</td>
</tr>
</tbody>
</table>

Table 9.5 Replacement parts for ATS430 sensor calibration and verification kit (part no. ATS4000650)
Appendix A – Principle of operation

A.1 Turbidity
Turbidity provides a measurement of water clarity. When there is material in water that scatters light, its presence manifests itself as turbidity, this material may be (for example) algae, silt, air bubbles.

The ABB turbidity sensor determines turbidity by measuring the amount of light scattered by the sample at 90° from the direction of illumination, see Fig. A.1. This arrangement is commonly referred to as Nephelometric detection.

The optical design of the instrument follows the guidelines set out in the ISO7027 Standard*. The light source is an LED emitting at a wavelength of 850 nm. Light scattered at 90° is collected by a photodiode.


Fig. A.1 Light scattering from a turbid sample

A.2 Suspended solids
Suspended solids content in water is usually measured using ASTM method D5907-10**, that involves filtering the sample through filter paper and measuring the increase in weight of the filter paper. This method can provide quite accurate results, but is rather time consuming, requires trained personnel and precision laboratory equipment, and cannot provide results in real time.

It is possible to use the long known relation between the amount of solids in suspension and the turbidity of a sample to estimate, in real time, the suspended solids content of the sample.

For a given sample, it is possible to build a calibration curve to convert the turbidity value to a suspended solids value, as shown in Fig. A2:

As can be seen in Fig. A2, the relationship between turbidity and suspended solids is specific to a particular sample, as is the range of suspended solids values that can be measured.


For a detailed explanation of the measurement of turbidity and suspended solids, refer to white paper WP/ANAINS T/002-EN