Introduction

The 100 GP, 100 ULTRA and 500 PRO pH/ORP sensors offer a rugged, built-for-purpose design targeting applications ranging from high-purity to light industrial.

The analog sensors are designed for use with ABB's AWT210 and AWT420 transmitters with analog-capable inputs.

The digital sensors are designed for use with ABB's AWT420 and AWT440 multi-input transmitters featuring EZLink connectivity. EZLink enables new or replacement sensors to be connected easily without the need to power down the transmitter.

The digital sensors feature advanced warning of electrode poisoning giving the user notice of imminent electrode failure.
For more information

Publications for the associated transmitters are available for free download from:

www.abb.com/measurement

or by scanning these codes:

<table>
<thead>
<tr>
<th>AWT420</th>
<th>AWT440</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="AWT420" alt="QR Code" /></td>
<td><img src="AWT440" alt="QR Code" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Search for or click on:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Sheet</strong></td>
</tr>
<tr>
<td><strong>Data Sheet</strong></td>
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<tr>
<td><strong>Data Sheet</strong></td>
</tr>
<tr>
<td><strong>Operating Instruction</strong></td>
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<td><strong>Operating Instruction</strong></td>
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<tr>
<td><strong>Operating Instruction</strong></td>
</tr>
<tr>
<td><strong>Parts List</strong></td>
</tr>
</tbody>
</table>

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1 Health & Safety

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

WARNING
The signal word ‘WARNING’ indicates an imminent danger. Failure to observe this information may result in death or severe injury.

NOTICE
The signal word ‘NOTICE’ indicates potential material damage.

Note
‘Note’ indicates useful or important information about the product.

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.

Potential safety hazards
The sensor operates on 3.3 V DC. There are no hazardous voltages present in the sensor.

WARNING
Before removing a sensor from the process, reduce process pressure to zero and ensure the sensor is cool enough to handle.

WARNING
ATEX/IECEx
All 500 PRO and 500 PRO-D elecrodex are certified to ATEX/IECEx. The plastic enclosure is a potential electrostatic hazard. Clean with a damp cloth only and do not mount in a high-velocity dust laden atmosphere.

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

直接 Current supply only.

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.

This symbol indicates the need for protective eye wear.

This symbol indicates the need for protective hand wear.

Recycle separately from general waste under the WEEE directive.

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.

NOTICE
For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

Information on RoHS Directive 2011/65/EU (RoHS II)
ABB, Industrial Automation, Measurement & Analytics, UK, fully supports the objectives of the ROHS II directive. All in-scope products placed on the market by IAMA UK on and following the 22nd of July 2017 and without any specific exemption, will be compliant to the ROHS II directive, 2011/65/EU.
2 Preparation for use

When required for use, remove the sensor from its packaging and the sensor storage bottle and rinse the end of the sensor with clean water.

3 System overview

<table>
<thead>
<tr>
<th>Item</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Glass electrode</td>
</tr>
<tr>
<td>B</td>
<td>Temperature sensor (Pt100)</td>
</tr>
<tr>
<td>C</td>
<td>Reference electrode</td>
</tr>
<tr>
<td>D</td>
<td>Sensor body</td>
</tr>
<tr>
<td>E</td>
<td>VarioPin (VP) connector (illustrated) or integral cable</td>
</tr>
</tbody>
</table>

Figure 1 Analog pH sensor components

<table>
<thead>
<tr>
<th>Item</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Glass electrode</td>
</tr>
<tr>
<td>B</td>
<td>Temperature sensor (Pt1000)</td>
</tr>
<tr>
<td>C</td>
<td>Reference electrode</td>
</tr>
<tr>
<td>D</td>
<td>Dual reference electrode</td>
</tr>
<tr>
<td>E</td>
<td>Sensor body</td>
</tr>
<tr>
<td>F</td>
<td>EZLINK connector (illustrated) or integral cable</td>
</tr>
</tbody>
</table>

Figure 2 Digital pH sensor components
4 Dimensions

Dimensions in mm (in)

- 170.0 (6.7) in NPT
- 30.0 (1.2) in

3/4 in NPT

3/4 in NPT

3/4 in wrench flats

3/4 in NPT

3/4 in wrench flats

Analog sensors

Digital sensors

Figure 3 Flush sensor body dimensions

5 Installation

**WARNING**

- Sensors must be installed and maintained by suitably trained personnel only.
- Shut down and de-pressurize process lines before inserting or removing sensors.

The 100 GP, 100 ULTRA and 500 PRO sensors are threaded style sensors suitable for in-line, immersion or flow-through applications. The mounting thread size is 3/4 in NPT and the sensor body is made from chemically resistant PVDF (Kynar).

Do not use sensors with notched sensor guards on in-line applications where fouling of the sensor is to be expected (for example, fibrous coatings). Use an in-line flush sensor body with a flat glass sensor, mounted at 90° for optimal self-cleaning.

- Not for fouling applications
- For fouling applications

**Note.**

- The flow of sample passing the sensor helps to keep the sensor clean
- Position sensors such that they are immersed in sample at all times

For horizontal pipe, the preferred mounting position is in the shaded area. Allowable mounting is anywhere within the full circumference of the pipe.

Figure 4 Notched sensor body dimensions

Figure 5 Recommendations for fouling applications

Figure 6 Horizontal pipe mounting position
### ATEX/IECEx installation

#### 500 PRO (analog)

**Hazardous/Non-hazardous location**

- ABB transmitter

**Notes.**
- Single multi-channel IS barrier or apparatus manufacturers' control drawings must be followed when installing the system. IS barrier or equipment may be installed within the hazardous location for which it is certified.
- Single multi-channel IS barrier or apparatus must be approved.
- Single multi-channel IS barrier or apparatus must be installed in accordance with the requirements of EN/IEC 600079-14

**Entity parameters (including maximum 50 m cable)**
- $U_i = 15 \text{ V}$
- $I_i = 20 \text{ mA}$
- $C_i = 15 \text{ nF}$
- $L_i = 30 \text{ uH}$

**Sensor – 500 PRO**

#### 500 PRO-D (digital)

**Hazardous/Non-hazardous location**

- ABB transmitter

**Notes.**
- Single multi-channel IS barrier or apparatus manufacturers' control drawings must be followed when installing the system. IS barrier or equipment may be installed within the hazardous location for which it is certified.
- Single multi-channel IS barrier or apparatus must be approved.
- Single multi-channel IS barrier or apparatus must be installed in accordance with the requirements of EN/IEC 600079-14

**Entity parameters (including maximum 50 m cable)**
- $U_i = 6 \text{ V}$
- $I_i = 20 \text{ mA}$
- $P_i = 120 \text{ mW}$
- $C_i = 0 \text{ uF}$
- $L_i = 20 \text{ uH}$

**Sensor – 500 PRO-D**

#### Conditions of safe use

The following conditions of safe use are required to meet ATEX/IECEx requirements.

1. The plastic enclosure is a potential electrostatic hazard. Clean only with a damp cloth and do not mount in a high velocity dust laden atmosphere

2. The stainless steel threaded connector is a potential electrostatic hazard. Ensure that the earth connection on the connector is provided with an earth connector as described in the instructions.

**Note.**

If a VP cable is used, the stainless steel threaded connector **must** be connected to earth with a wire minimum diameter 0.4 mm (0.02 in). A tag is provided on the connector that may be soldered or crimped to provide this connection.
...5 Installation

Mounting options

<table>
<thead>
<tr>
<th>Item</th>
<th>Mounting option</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Dip pole assembly 1¼ in NB comprising: dip pole, pole mounting adapter and end cap assembly: 3KXA163000L0021: 2.5 m (8.2 ft) 3KXA163000L0022: 1 m (3.3 ft) Pole mounting adapter kit for user-supplied pole comprising: pole mounting adapter, end cap assembly and O-ring (excludes dip pole) 3KXA163000L0023</td>
</tr>
<tr>
<td>B</td>
<td>Protective shroud: 3KXA163000L0024</td>
</tr>
<tr>
<td>C</td>
<td>Handrail mounting bracket – tilt action only: ATS4000760 for 40 mm or 1¼ in NB dip pole, suitable for 42 or 51 mm (1.7 or 2.0 in) dia handrail</td>
</tr>
<tr>
<td>D</td>
<td>BSP screw T-piece: 3KXA163000L0006 NPT screw T-piece: 3KXA163000L0008</td>
</tr>
<tr>
<td>E</td>
<td>BSP bayonet T-piece: 3KXA163000L0002 NPT bayonet T-piece: 3KXA163000L0004</td>
</tr>
<tr>
<td>F</td>
<td>NPT flow-cell and ¼ in adapter: 3KXA163000L0012 NPT stainless steel flow-cell and ¼ in adapter: 3KXA163000L0011</td>
</tr>
<tr>
<td>G</td>
<td>Automatic cleaning system (liquid): 3KXA163000L0025</td>
</tr>
<tr>
<td>H</td>
<td>Calibration kit: 3KXA163000L0120</td>
</tr>
</tbody>
</table>

Note.
Sample levels in tanks, sumps and channels may vary. The sensor must be immersed to the lowest anticipated level to ensure the sensor is always immersed in the sample.
6 Cleaning solutions

The spray jet tube is available in 316 stainless steel. Some typical cleaning solutions are:

<table>
<thead>
<tr>
<th>Coating</th>
<th>Cleaning Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease and oils</td>
<td>Alkaline detergents or water-soluble solvents such as alcohols</td>
</tr>
<tr>
<td>Resins</td>
<td>Dilute alkalis</td>
</tr>
<tr>
<td>Limestone/Carbonates</td>
<td>Dilute acid</td>
</tr>
<tr>
<td>Metal hydroxides</td>
<td>Dilute acid</td>
</tr>
<tr>
<td>Cyanides</td>
<td>Dilute acid</td>
</tr>
<tr>
<td>Heavy biological</td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td>Mixture of 1M sulphuric acid and pepsin (saturated)</td>
</tr>
<tr>
<td>Fibers</td>
<td>Pressurized water with or without wetting agents</td>
</tr>
<tr>
<td>Light biological</td>
<td>Pressurized water</td>
</tr>
<tr>
<td>Latex (see Notice below)</td>
<td>Pressurized cold water</td>
</tr>
</tbody>
</table>

**NOTICE**

If the jet wash system is removed from a latex process, all traces of latex must be removed quickly and completely before it hardens.

**General cleaning**

⚠️ **WARNING**

Before removing a sensor from a flow line, ensure that all isolating valves have been closed.

To ensure accurate monitoring, keep the sensor free of contaminants by periodic cleaning, the frequency of which depends on the particular application.

Methods of removing various types of deposits are detailed below. Use a soft, non-abrasive material to clean the sensor tip. Replace the sensor if its performance does not improve after cleaning.

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Cleaning agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease and oils</td>
<td>Alkaline detergents or water soluble solvents such as alcohols</td>
</tr>
<tr>
<td>Resins</td>
<td>Dilute alkalis</td>
</tr>
<tr>
<td>Limestone/Carbonates</td>
<td>Dilute acid</td>
</tr>
<tr>
<td>Metal hydroxides, cyanides, heavy biological</td>
<td>Dilute acid</td>
</tr>
<tr>
<td>Proteins</td>
<td>Mixture of 1M sulphuric or nitric acid and pepsin (saturated)</td>
</tr>
</tbody>
</table>
7 Sensor setup

Notes.
- Perform this procedure when connecting a new/replacement sensor to an AWT420 or AWT440 transmitter.
- If connecting to a transmitter other than an AWT420 or AWT440, refer to the appropriate Operating Instruction.

3 Connect the sensor to the transmitter. The following menu prompt is displayed:

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

The Easy Setup start screen is displayed:

4 Press the key (below the Select prompt).

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

6 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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>16-character user-defined tag</td>
</tr>
<tr>
<td>Range High</td>
<td>Customizable range high</td>
</tr>
<tr>
<td>Range Low</td>
<td>Customizable range low</td>
</tr>
<tr>
<td>Analog output</td>
<td>Configure the analog output channels</td>
</tr>
</tbody>
</table>

Note. Refer to page 11 for parameter details – not all parameters are displayed at Easy Setup level.

7 Continue with configuration of the required parameters.

8 On completion the Easy Setup start screen is displayed:

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 first-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.
<table>
<thead>
<tr>
<th>Menu</th>
<th>Comment</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1(to 4):pH/Redox(ORP)</td>
<td>Select the pH/Redox sensor to set up.</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>Filter Type</td>
<td>Set the filter type:   <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>• Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• High</td>
<td></td>
</tr>
<tr>
<td>Temp. Compensation</td>
<td>Set the temperature compensation type* <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>Automatic Sol</td>
</tr>
<tr>
<td></td>
<td>• Automatic Sol. (Nernstian with solution sample coefficient)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Automatic (Nernstian without solution sample coefficient)</td>
<td></td>
</tr>
<tr>
<td>Sample Coefficient</td>
<td>Set the sample coefficient for solution compensation* <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>0.0 pH/10 °C</td>
</tr>
<tr>
<td>Low pH Slope Limit</td>
<td>Set the low slope level for pH calibrations. Calibrations fail at this level. Diagnostics warning is displayed at 20 % above this level</td>
<td>40 %</td>
</tr>
<tr>
<td>pH Diagnostics</td>
<td>Enable/disable the following diagnostics: <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>• Out of solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Broken glass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dual reference warning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dual reference failure</td>
<td></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 Type</td>
<td>None or External</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The external option enables the transmitter to control an external cleaning device through the digital I/O lines</td>
<td>None</td>
</tr>
<tr>
<td>Note. Refer to Aztec ADS430 EZCLEAN Operating Instructions (OI/ADS430/EZCLN-EN) for an example of the use of this facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Type</td>
<td>Continuous/Pulsed</td>
<td>Continuous</td>
</tr>
<tr>
<td>Clean On Time</td>
<td>Set the duration of the clean: 1 to 60s <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>30 s</td>
</tr>
<tr>
<td>Clean Off Time</td>
<td>Set the duration between cleans: 1 to 60s <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>30 s</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 <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>1 min</td>
</tr>
<tr>
<td>Clean Duration</td>
<td>Display the total duration of the clean: <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean type set to continuous = clean on time + recovery time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean type set to pulsed = (clean on time + clean off time) * number of pulses + recovery time</td>
<td></td>
</tr>
<tr>
<td>Clean Output</td>
<td>Displays the output signal the clean is assigned to. This can be set to relay 1 to 6 or digital output 1 to 6 <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td>Not assigned</td>
</tr>
<tr>
<td>Restore Defaults</td>
<td>Restores the sensor back to default configuration <img src="https://via.placeholder.com/150" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>

* Available only for pH sensors
8 Calibration

This section describes how to calibrate the sensor and involves measuring the sensor's sensitivity to pH and temperature by exposing the sensor to samples of known pH/temperature values.

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 the transmitter's Operating Instruction OI/AWT210-EN, OI/AWT420-EN or OI/AWT440-EN for all transmitter menu options.

Note. Before removing the sensor for calibration purposes, set the currents outputs and alarms to Hold (enabled via the Operator Menu/Manual Hold function).

Calibration procedure

pH sensor
When the sensor has been correctly connected and all electrical connections made to the transmitter, the sensor is ready for calibration by immersing the sensor (using suitably sized beakers) in either:
• a calibration solution (buffer) of known pH value for a single-point calibration
  or
• sequentially in two separate calibration solutions of known pH values for a two-point calibration

For sensors already in use:

⚠️ WARNING

Before removing a sensor from a flow line, ensure that all isolating valves have been closed.

1 Remove the sensor from the flow line.
2 Wash the sensor surface of the electrode with a soft, non-abrasive material and a cleaning solution. Refer to Cleaning solutions on page 9 for additional information.
3 Perform a single- or two-point calibration.

To have agreement with a measured sample, there may be times when an in-process calibration is necessary.

1 Perform a buffer calibration.
2 Return the sensor to the process for a minimum of 10 minutes before performing an in-process calibration.

3 To minimize solution temperature effects, measure the sample at the same temperature as the process.

Refer to the Operating Instruction for the pH transmitter for full details of the calibration procedures.

Note. To ensure measurement accuracy when buffering:
• clean the visible surfaces of the electrodes using demineralized water or cleaning solution (see Cleaning solutions on page 9) using a soft, non-abrasive material.
• wash the electrodes and dry them carefully using a soft tissue when moving from one buffer solution to the next

Redox/ORP sensor
When the sensor has been correctly connected and all electrical connections made to the transmitter, the sensor is ready for calibration. Follow the calibration procedure in the transmitter instruction manual.

For sensors that are connected to transmitters that do not have Redox calibration capabilities, it is possible to check the response as follows:

1 Prepare standard 4 and 7 pH buffer solutions. Add one gram (heaped spatula) of analar quinhydrone to 100 ml of each buffer solution. Let them stand for 30 minutes.
2 Immerse the sensor in each solution in turn and note the mV value when stable.
Calibrate menu

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).

<table>
<thead>
<tr>
<th>Menu</th>
<th>Comment</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1(to 4):pH/Redox(ORP)</td>
<td>Select the pH/Redox (ORP) sensor to calibrate.</td>
<td></td>
</tr>
<tr>
<td>Sensor Cal</td>
<td>Perform a sensor calibration.</td>
<td></td>
</tr>
<tr>
<td>1 Point Manual</td>
<td>Perform a 1-point manual calibration</td>
<td></td>
</tr>
<tr>
<td>2 Point Manual</td>
<td>Perform a 2-point manual calibration</td>
<td></td>
</tr>
<tr>
<td>1 Point Auto</td>
<td>Perform a 1-point automatic calibration using standard buffers with automatic temperature compensation. Note. Available only on pH</td>
<td></td>
</tr>
<tr>
<td>2 Point Auto</td>
<td>Perform a 2-point automatic calibration using standard buffers with automatic temperature compensation. Note. Available only on pH</td>
<td></td>
</tr>
<tr>
<td>Edit Cal</td>
<td>Manually edit the calibration values</td>
<td></td>
</tr>
<tr>
<td>pH Slope</td>
<td>Edit the pH slope</td>
<td></td>
</tr>
<tr>
<td>pH Offset</td>
<td>Edit the pH offset</td>
<td></td>
</tr>
<tr>
<td>mV Slope</td>
<td>Edit the mV slope</td>
<td></td>
</tr>
<tr>
<td>mV Offset</td>
<td>Edit the mV offset</td>
<td></td>
</tr>
<tr>
<td>Sample Collection</td>
<td>Perform the sample collection procedure</td>
<td></td>
</tr>
<tr>
<td>Sample Complete</td>
<td>Perform the sample complete procedure</td>
<td></td>
</tr>
<tr>
<td>Restore Defaults</td>
<td>Restores values to default factory settings</td>
<td></td>
</tr>
<tr>
<td>Set Auto pH Buffers</td>
<td>Sets the buffer type to be used. Also enables a custom buffer to be defined.</td>
<td></td>
</tr>
<tr>
<td>Hold Outputs</td>
<td>Enable/disable the hold outputs function. The current outputs and alarm functions are held during calibrations.</td>
<td>Enabled</td>
</tr>
</tbody>
</table>
...8 Calibration

Automatic calibration

Note. Automatic calibration is applicable only to pH sensors.

Automatic calibration calibrates the sensor to measure pH using pH buffers. Automatic calibration provides automatic temperature compensation to the selected buffer. There are two possible calibration modes:

- 1-point calibration
- 2-point calibration

A 1-point calibration adjusts the calibration offset value. A 2-point calibration adjusts the calibration offset and slope values.

Before starting the calibration procedure ensure that the automatic buffer is set to the correct buffer (see Automatic calibration buffers on page 15)

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

   The sensor selection menu is displayed:

2 Highlight the sensor to be calibrated (for example, S1:pH/Redox(ORP)) and press the key (below the Select prompt)

   The menu options for S1:pH/Redox(ORP) are displayed:

   3 Select Sensor Cal

   Sensor Cal

   | 1 Pt Manual | ![Image](image1.png) |
   | 2 Pt Manual | ![Image](image2.png) |
   | 1 Pt Auto   | ![Image](image3.png) |
   | 2 Pt Auto   | ![Image](image4.png) |

   Back Select

   4 Select 1 Point Auto or 2 Point Auto as required

   ![Image](image5.png)

   5 Immerse the sensor in the buffer of the value displayed on the screen.

   6 Press the key (below the Continue prompt) to perform the calibration. The calibration process screen is displayed. The calibration can be canceled at any time during the process by pressing the key (below the Abort prompt)

   If 1 Point Cal was selected, the result screen is displayed. If 2 Point Cal was selected repeat steps 5 and 6 for the second buffer.

   On completion of the calibration the result is displayed on the screen automatically. If the calibration passes, the slope and offset is displayed. If the calibration fails, the reason for failure is displayed on the screen. See pH/Redox calibration failure reasons on page 23 for explanation of calibration failure reasons.
Automatic calibration buffers

Automatic calibration uses buffer tables programmed into the sensor to provide more accurate calibrations.

The following buffers are supported by the sensor:

**ABB capsules NIST**
- 4.01
- 7.00
- 9.00
- 10.00

**Technical Phthalate free**
- 4.01
- 7.00
- 9.01

**DIN19266 ABB sachets**
- 1.679
- 4.005
- 6.865
- 9.180
- 10.012

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

2. Highlight Set Auto pH Buffers and press the key (below the Select prompt)

   The menu options for Set Auto pH Buffers are displayed:

   ![Set Auto pH Buffers menu](image)

3. Select the buffer to be set and press the key (below the Select prompt). The Set Buffer X menu is displayed:

   ![Set Buffer X menu](image)

4. Press the key (below the Edit prompt). The buffer selection menu is displayed:

   ![Buffer selection menu](image)

5. Highlight the buffer to use.

6. Repeat for buffer 2 if performing a two point calibration.

   **Note.** Buffer 1 is used for single point calibrations.
...8 Calibration

User-defined automatic calibration buffers

Two user-defined buffers may be used for automatic calibrations. Automatic buffers are defined using a table that relates the value of the buffer to a given temperature point. The software extrapolates between the user-defined points during the calibration. The graph below shows an example of the data required to define a buffer.

Note.

- If the temperature of the buffer is below the minimum value entered, the pH of the buffer is set to the value that corresponds with the minimum temperature value entered.
- If the temperature of the buffer is above the maximum value entered, the pH of the buffer is set to the value that corresponds with the maximum value entered.
- pH/Temperature pairs must be entered such that the temperature increases from pair 0 to pair 4.

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

The sensor selection menu is displayed:

The menu options for Set Auto pH Buffers are displayed:

2. Highlight Set Auto pH Buffers and press the key (below the Select prompt)

3. Select the buffer to be set and press the key (below the Select prompt). The Set Buffer X menu is displayed:

4. Select User Defined X and press the key (below the Edit prompt). The buffer selection menu is displayed:

5. Select User Buffer 1 and press the key (below the Select prompt). The buffer edit screen is displayed:

   Note. Pressing the key cycles between the point number, temperature input and pH input.
6 With point 00 selected, press the key to select the temperature input and press the key to edit the temperature.

![User Buffer 1](image)

7 Use the keys to select a required temperature value between the limits shown on the screen and press the key to accept it.

![User Buffer 1](image)

8 Repeat steps 6 and 7 to select a required pH value.

9 Press the key to highlight the point number followed by the keys to select the next point to edit and press the key.

10 Repeat steps 6 to 9 to edit the remaining points as required or press the key to exit the buffer edit page.

---

**Manual calibration**

Manual calibration calibrates the pH or Redox (ORP) value to a value defined by the user. There are two possible calibration modes:
- 1-point calibration
- 2-point calibration

A 1-point calibration adjusts the pH offset value.
A 2-point calibration adjusts the pH offset and slope values.

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

![Menu](image)

The sensor select menu is displayed:

![Calibrate](image)

2 Highlight the sensor to be calibrated (for example, S1:pH/Redox(ORP)) and press the key (below the Select prompt)

The menu options for S1:pH/Redox(ORP) are displayed:

![Sensor Cal](image)

(continued on next page)
...8  Calibration

...Manual calibration

3  Select Sensor Cal.

4  Select 1 Point Manual or 2 Point Manual as required.

5  Immerse the sensor in buffer of the value displayed on the screen and press the key (below the Next prompt).

6  Press the key (below the Continue prompt) to perform the calibration. The calibration process screen is displayed. The calibration can be canceled at any time during the process by pressing the key (below the Abort prompt).

If 1 Point Cal was selected, the result screen is displayed. If 2 Point Cal was selected repeat steps 5 and 6 for the second buffer.

On completion of the calibration the result is displayed on the screen automatically. If the calibration passes, the slope and offset are displayed. If the calibration fails, the reason for failure is displayed on the screen. See pH/Redox calibration failure reasons on page 23 for explanation of calibration failure reasons.

Edit calibration

Edit calibration enables the user to enter the calibration coefficients directly. The following calibration coefficients can be entered:

- **pH slope and offset**
  
  Note. Available only if a pH sensor is connected to the transmitter.
  
  - The following formula is used to calculate pH from the measured millivolts:
    \[
    \text{pH} = \text{offset} - \frac{\text{slope} \times \text{mv}}{100 \times 59.15296}
    \]
  
  Where:
  
  - \(\text{pH}\) = the measured pH of the solution
  - \(\text{offset}\) = calibration offset (an ideal sensor has an offset value of 7.00 pH)
  - \(\text{slope}\) = calibration slope (an ideal sensor has a slope value of 100.0 %)
  - \(\text{mv}\) = measured millivolts of the solution
  - \(kT\) = slope factor at the temperature of the solution

- **ORP slope and offset**
  
  Note. Available only if an ORP sensor is connected to the transmitter.
  
  - The following formula is used to calculate ORP from the measured millivolts:
    \[
    \text{ORP} = \text{offset} + \frac{\text{slope} \times \text{mv}}{100}
    \]
  
  Where:
  
  - \(\text{ORP}\) = the calibrated ORP mV of the solution
  - \(\text{offset}\) = calibration offset (an ideal sensor has an offset value of 0.0 mV)
  - \(\text{slope}\) = calibration slope (an ideal sensor has a slope value of 100.0 %)
  - \(\text{mv}\) = measured millivolts of the solution
1. At the Calibrate level, press the key (below the Select prompt).

![Sensor selection menu]

The sensor selection menu is displayed:

2. Highlight the sensor to be calibrated (for example, S1:pH/Redox(ORP)) and press the key (below the Select prompt).

The menu options for S1:pH/Redox(ORP) are displayed:

3. Select Manual Cal

4. To enter a coefficient, select the required coefficient from the menu and press the key (below the Select prompt).

![Edit Cal menu]

5. Press the key (below the Edit prompt) to enter the value of a coefficient and press the key (below the OK prompt) when complete.
8 Calibration

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 sample is used to calibrate the sensor.

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 measured value of the sample at that time. The pH of the sample is then measured in the laboratory and entered into the transmitter in the second step.

Note.
- An in-process calibration adjusts the calibration offset only.
- Take care when collecting, transferring and storing the collected sample; any contamination could result in an inaccurate calibration. This is especially important for low conductivity solutions.

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

The sensor selection menu is displayed:

2 Highlight the sensor to be calibrated (for example, S1:pH/Redox(ORP)) and press the key (below the Select prompt)

The menu options for S1:pH/Redox(ORP) are displayed:

3 Select Sample Collection and press the key (below the Select prompt).

Note. Performing this step erases any sample data stored previously for the selected sensor. Only the data from the last sample collection is stored in each sensor.

The Collect Sample screen is displayed:

4 Press the key (below the Continue prompt) to initiate sample collection.

The Collect Sample screen is displayed:

5 Collect a sample from the process for laboratory analysis as close to the sensor as possible to ensure accurate results.
6 When acquisition is complete, press the (key (below the Exit prompt) to return to the main menu.

The process pH and temperature values are now stored in the sensor.

7 When the result of the laboratory analysis has been obtained, select Sample Complete:

8 Press the (key (below the Next prompt).

9 Enter the lab pH value.

10 Enter the lab temperature value

In-process calibration is now complete.
9 Calibration log (digital sensors)

The calibration log stored in the sensor holds a record of the last 15 sensor calibration operations performed. To view the calibration log in the transmitter, logs must be enabled. Refer to the transmitter’s Operating Instruction OI/AWT420-EN or OI/AWT440-EN for details of how to enable logs.

When logs are enabled, a calibration log page is available for each of the sensors connected to the transmitter. To access the calibration log, press the View key on the transmitter’s keypad to display the result from the first most recent calibration.

Use the group key on the keypad to cycle through the calibration logs for each sensor. Calibration results can be:

- **Calibration aborted**
  the calibration was stopped by the user
- **Calibration failed**
  the log entry displays the reason for the calibration failure
- **Calibration successful**
  the log entry displays the new calibration parameters

Each entry displays the date and time of the calibration.

**Note.** 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.

10 Device information (digital sensors)

This section describes the information available within the Device Information menu for digital pH sensors.

1 Connect the sensor to the transmitter’s EZLink connector – refer to the transmitter’s Operating Instruction OI/AWT420-EN or OI/AWT440-EN.

2 Press the transmitter’s key to display the Operator Page menu, then select Enter Configuration to display the Access Level page.

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

If the Device Information menu is not displayed use the keys to scroll to it:

3 Press the key (below the Select prompt)

The Sensor Setup page is displayed

4 Select the desired sensor and press the key (below the Select prompt)

The sensor’s device information page is displayed:

<table>
<thead>
<tr>
<th>Menu</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Sensor type (pH/Redox)</td>
</tr>
<tr>
<td>Sensor Type</td>
<td>Sensor type (100GP/100Ultra/500Pro)</td>
</tr>
<tr>
<td>Electrode Type</td>
<td>Electrode type (pH/Redox)</td>
</tr>
<tr>
<td>Glass Type</td>
<td>Glass type (standard/low temperature)</td>
</tr>
<tr>
<td>Serial Number</td>
<td>Factory programmed serial number (3KXA...)</td>
</tr>
<tr>
<td>Date of Manufacture</td>
<td>Sensor’s date of manufacture</td>
</tr>
<tr>
<td>Hardware revision</td>
<td>Sensor’s hardware revision</td>
</tr>
<tr>
<td>Software revision</td>
<td>Sensor’s software revision</td>
</tr>
<tr>
<td>Product code</td>
<td>Sensor’s product code for reorder.</td>
</tr>
</tbody>
</table>
11 Diagnostics

Diagnostic messages

The table below shows sensor-specific icon types, diagnostic messages and possible causes/suggested remedial action.

Note. The diagnostic icons in the following table conform to NAMUR 107.

For transmitter-specific diagnostic messages, refer to the transmitter’s Operating Instruction OI/AWT210-EN, OI/AWT420-EN or OI/AWT440-EN.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Message</th>
<th>Possible cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC failure</td>
<td>An error has been reported by the on board ADC.</td>
<td>Cycle power to the sensor.</td>
<td></td>
</tr>
<tr>
<td>NV failure</td>
<td>Failure of non-volatile memory on the sensor board.</td>
<td>Cycle power to the sensor. If power cycling fails, reset the sensor configuration to default and reconfigure as required.</td>
<td></td>
</tr>
<tr>
<td>Temperature failure</td>
<td>Failure detected in the temperature measurement circuit.</td>
<td>Cycle power to the sensor.</td>
<td></td>
</tr>
<tr>
<td>Calibration failed</td>
<td>The last calibration failed.</td>
<td>Check buffer solutions Repeat the calibration procedure.</td>
<td></td>
</tr>
<tr>
<td>PV out of range</td>
<td>The measured process value is out of range.</td>
<td>Change the PV of the sample to a value that is within the sensor’s operating range.</td>
<td></td>
</tr>
<tr>
<td>Process temperature out of range</td>
<td>The measured process temperature is out of range.</td>
<td>Change the process temperature to a value that is within the electrode’s operating range.</td>
<td></td>
</tr>
<tr>
<td>Internal temperature out of range</td>
<td>The internal temperature of the electronics is out of range.</td>
<td>Move the sensor to a position where the temperature is within the sensor’s operating range.</td>
<td></td>
</tr>
<tr>
<td>Out of solution*</td>
<td>The sensor has detected it is out of solution.</td>
<td>Move the sensor into the solution.</td>
<td></td>
</tr>
<tr>
<td>Broken glass*</td>
<td>The sensor has detected that the pH glass is broken.</td>
<td>Replace the sensor.</td>
<td></td>
</tr>
<tr>
<td>Reference warning*</td>
<td>The sensor has detected that the reference will be poisoned imminently.</td>
<td>Prepare to replace the sensor.</td>
<td></td>
</tr>
<tr>
<td>Reference failure*</td>
<td>The sensor has detected that the reference is poisoned.</td>
<td>Replace the sensor.</td>
<td></td>
</tr>
<tr>
<td>Low pH slope warning</td>
<td>The last calibration slope was below the user set level.</td>
<td>Prepare to replace the sensor.</td>
<td></td>
</tr>
</tbody>
</table>

* These diagnostics may be enabled/disabled by the user.

pH/Redox calibration failure reasons

The table below shows the various reasons for pH/Redox calibration failure together with possible causes/remedial action.

<table>
<thead>
<tr>
<th>Failure reason</th>
<th>Possible cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response*</td>
<td>No difference in millivolts was seen between the two calibration points.</td>
<td>Ensure that two different buffers were used.</td>
</tr>
<tr>
<td>Low slope*</td>
<td>The slope is below the user-set low slope limit.</td>
<td>Re-calibrate with fresh buffers Clean the sensor Replace the sensor.</td>
</tr>
<tr>
<td>High slope*</td>
<td>The slope exceeds 110 %.</td>
<td>Replace the sensor.</td>
</tr>
<tr>
<td>Unstable temperature</td>
<td>Stability could not be achieved within 1 minute due to temperature variations.</td>
<td>Clean the sensor and ensure probe and solution are at the same temperature.</td>
</tr>
<tr>
<td>Unstable mV</td>
<td>Stability could not be achieved within 1 minute due to millivolt variations.</td>
<td>Clean the sensor.</td>
</tr>
<tr>
<td>Slow response</td>
<td>A response has been detected but it has not reached steady state within 1 minute.</td>
<td>Clean the sensor.</td>
</tr>
</tbody>
</table>

* These failure reasons are applicable only to 2-point calibrations.
12 Fault finding

Listed below are some common symptoms of sensor malfunction together with possible cures.

- **Short scaling (low slope) or sluggish response**
  - Glass sensor membrane dirty or coated – clean sensor
  - Poor insulation on cable connectors, possibly due to moisture – dry connector with warm dry air (analog sensor only)
  - Replace the sensor if no improvement is seen. It may also be necessary to replace the extension cable (analog sensor only)

- **No response to pH buffer or sample**
  - Check the sensor has been connected correctly to the transmitter (analog sensors only)
  - Check the glass sensor membrane is not broken or cracked
  - Replace the sensor if no improvement

- **Unstable readings or drift**
  - Check the sensor has been connected correctly to the transmitter (analog sensors only)
  - Dry or dirty reference junction – clean the junction
  - Replace the sensor if no improvement

- **Stable but incorrect readings**
  - Recalibrate using fresh buffer solutions
  - Check temperature compensation settings are correct

**Note.** All the above symptoms could be caused by a faulty cable (analog sensors only).

13 Storage

**NOTICE**

- Always store the sensor in its original packaging until required for use.
- Store the sensor between 15 and 35 °C (59 and 95 °F).
- For long term storage, store the sensor in the original sensor storage bottle.
- Ensure that the glass membrane and the reference junction do not dry out as this may irreversibly affect the response of the electrode.
- Do not store electrodes in de-ionized water.

If it is necessary to remove the electrode from the sample line, fill the sensor storage bottle with storage solution and fit it to the sensor.
14 Specification

100 GP/100 GP-D

Measurements
• pH/ORP (Platinum)
• Temperature

Measurement range
High performance (S) glass
0 to 14 pH
Low temperature (LT) glass
0 to 10 pH
ORP
–2000 to 2000 mV

Temperature range
High performance (S) glass (bullet)
0 to 60 °C (32 to 140 °F)
(typical glass impedance at 25 °C (77°F) = 250 MΩ)
High performance (S) glass (flat)
5 to 60 °C (41 to 140 °F)
(typical glass impedance at 25 °C (77°F) = 600 MΩ)
Low temperature (LT) glass
–5 to 50 °C (23 to 122 °F)
(typical glass impedance at 25 °C (77 °F) = 25 MΩ)
ORP platinum electrode
0 to 60 °C (32 to 140 °F)

Temperature sensor
100 GP
Pt100 (Class B, IEC 60751)
100 GP-D
Pt1000 (Class B, IEC 60751)

Maximum pressure
6 bar (90 psi)

Recommended minimum sample conductivity
50 μS/cm

Recommended sensor storage
Between 15 and 35 °C (59 and 95 °F)

Isothermal point at 25 °C (77 °F)
pH 7
...14 Specification

100 ULTRA/100 ULTRA-D

Measurements
- pH/ORP (Platinum)
- Temperature

Measurement range
High performance (S) glass
- 0 to 14 pH
Low temperature (LT) glass
- 0 to 10 pH
ORP
- –2000 to 2000 mV

Temperature range
High performance (S) glass (bullet)
- 0 to 100 °C (32 to 212 °F)
  (typical glass impedance at 25 °C (77°F) = 250 MΩ)
High performance (S) glass (flat)
- 5 to 100 °C (41 to 212 °F)
  (typical glass impedance at 25 °C (77°F) = 600 MΩ)
Low temperature (LT) glass
- –5 to 50 °C (23 to 122 °F)
  (typical glass impedance at 25 °C (77 °F) = 25 MΩ)
ORP platinum electrode
- 0 to 60 °C (32 to 140 °F)

Temperature sensor
100 ULTRA
- Pt100 (Class B, IEC 60751)
100 ULTRA-D
- Pt1000 (Class B, IEC 60751)

Maximum pressure
- 6 bar (90 psi)

Recommended minimum sample conductivity
- 2 μS/cm

Recommended sample flowrate
- ≥100 ml/min

Recommended sensor storage
- Between 15 and 35 °C (59 and 95 °F)

Isothermal point at 25 °C (77 °F)
- pH 7

Reference system
- Ag/AgCl with KCl gel electrolyte, double junction plus ion trap

Process connections
- ¾ in NPT

Wetted materials
Electrode body
- PVDF (Kynar)
Reference junction system
- Porous PTFE and Viton O-rings
Measure system
- pH: Glass
- ORP: Platinum

Approvals, certification and safety
CE Mark
- Covers EMC+LV directives (including latest version of EN61010)

Regulation 31
- Drinking water approval: Complies to DWI Regulation 31(4)(b)
- Additional tests: BS6920 parts 2.2 and 2.4 on all wetted parts

EMC
- Meets requirements of IEC61326 for an industrial environment

DS/100ULTRA-EN Rev. B
DS/100ULTRAD-EN Rev. B
500 PRO/500 PRO-D

Measurements
- pH/ORP (Platinum)
- Temperature

Measurement range
High performance (S) and high temperature (HT) glass
0 to 14 pH
Hydrofluoric acid-resistant (HF) glass
0 to 12 pH
Low temperature (LT) glass
0 to 10 pH
ORP
-2000 to 2000 mV

Temperature range
High performance (S) glass (bullet)
0 to 100 °C (32 to 212 °F)
(typical glass impedance at 25 °C (77°F) = 250 MΩ)
High performance (S) glass (flat)
0 to 100 °C (41 to 212 °F)
(typical glass impedance at 25 °C (77°F) = 600 MΩ)
High temperature (HT) glass
0 to 105 °C (32 to 221 °F)
(typical glass impedance at 25 °C (77°F) = 800 MΩ)
Hydrofluoric acid-resistant (HF) glass
0 to 80 °C (32 to 176 °F)
(typical glass impedance at 25 °C (77°F) = 700 MΩ)
Low temperature (LT) glass
-5 to 50 °C (23 to 122 °F)
(typical glass impedance at 25 °C (77°F) = 25 MΩ)
ORP platinum electrode
0 to 60 °C (32 to 140 °F)

Temperature sensor
500 PRO
Pt100 (Class B, IEC 60751)
500 PRO-D
Pt1000 (Class B, IEC 60751)

Maximum pressure
10 bar (145 psi)

Recommended minimum sample conductivity
50 µS/cm

Recommended sensor storage
Between 15 and 35 °C (59 and 95 °F)

Isothermal point at 25 °C (77 °F)
pH 7

Reference system
Ag/AgCl with triple junction, KCl gel electrolyte plus ion trap

Process connections
¾ in NPT

Wetted materials
Electrode Body
PVDF (Kynar)
Reference junction system
Porous PTFE and Viton extreme O-rings
Measure system
pH: Glass
ORP: Platinum

Approvals, certification and safety
CE Mark
Covers EMC+LV directives
(including latest version of EN61010)
Regulation 31
Drinking water approval: Complies to DWI Regulation 31(4)(b)
Additional tests: BS6920 parts 2.2 and 2.4 on all wetted parts

EMC
Meets requirements of IEC61326 for an industrial environment

ATEX/IECEx

500 PRO
Certificate numbers:
IECEx BAS 18.0047X
Bassefa18ATEX0071X
Entity parameters:
Uu = 15.0 V
Ii = 20 mA
Cu = 5 NF
Li = 30 uH

500 PRO-D
Certificate numbers:
IECEx BAS 18.0055X
Baseefa18ATEX0081X
Entity parameters:
Uu = 6.0 V
Ii = 20 mA
Cu = 30 uF
Li = 20 uH

DS/500PRO-EN Rev. B
DS/500PROD-EN Rev. B
## 15 Accessories and spares

### Accessories

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3KXA163000L0002</td>
<td>1 in BSP bayonet polycarbonate T-piece</td>
</tr>
<tr>
<td>3KXA163000L0004</td>
<td>1 in NPT bayonet polycarbonate T-piece</td>
</tr>
<tr>
<td>3KXA163000L0006</td>
<td>1 in BSP screw polycarbonate T-piece</td>
</tr>
<tr>
<td>3KXA163000L0008</td>
<td>1 in NPT screw polycarbonate T-piece</td>
</tr>
<tr>
<td>3KXA163000L0012</td>
<td>½ in NPT polycarbonate flow-cell and ¼ in adapter</td>
</tr>
<tr>
<td>3KXA163000L0011</td>
<td>½ in NPT stainless steel flow-cell and ¼ in adapter</td>
</tr>
<tr>
<td>3KXA163000L0024</td>
<td>Protective shroud for ¼ in body</td>
</tr>
<tr>
<td>3KXA163000L0026</td>
<td>T-piece cleaning adapter</td>
</tr>
<tr>
<td>3KXA163000L0120</td>
<td>Calibration kit (includes calibration beaker and holder)</td>
</tr>
<tr>
<td>ATS4000760</td>
<td>Rail mounting kit (tilt only)</td>
</tr>
<tr>
<td>3KXA163000L0021</td>
<td>1¼ in NB dip pole assembly</td>
</tr>
<tr>
<td>3KXA163000L0022</td>
<td>2.5 m (8.2 ft)</td>
</tr>
<tr>
<td></td>
<td>1m (3.3ft)</td>
</tr>
<tr>
<td>3KXA163000L0023</td>
<td>Dip pole kit (customer-supplied 1¼ in NB tube)</td>
</tr>
<tr>
<td>3KXA163000L0025</td>
<td>Automatic cleaning system (liquid)</td>
</tr>
</tbody>
</table>
### Spares

#### Flow cell

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3KXA163000L0113</td>
<td>Pack of flow-cell O-rings</td>
</tr>
<tr>
<td>3KXA163000L0118</td>
<td>Flow-cell ¾ in NPT adapter</td>
</tr>
<tr>
<td>3KXA163000L0116</td>
<td>Flow-cell locking ring</td>
</tr>
</tbody>
</table>

#### T-piece and bayonet adapter

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3KXA163000L0121</td>
<td>Straight adapter, R ¼ male, push-in 6 mm</td>
</tr>
<tr>
<td>3KXA163000L0111</td>
<td>pH bayonet adapter</td>
</tr>
<tr>
<td>3KXA163000L0112</td>
<td>Bayonet adapter O-rings</td>
</tr>
<tr>
<td>3KXA163000L0114</td>
<td>pH cleaning adapter nozzle</td>
</tr>
<tr>
<td>3KXA163000L0115</td>
<td>pH T-piece blanking plugs</td>
</tr>
</tbody>
</table>

### Extension cables

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP cable</td>
<td></td>
</tr>
<tr>
<td>3KXA163000L0051</td>
<td>1 m (3.3 ft)</td>
</tr>
<tr>
<td>3KXA163000L0052</td>
<td>3 m (9.9 ft)</td>
</tr>
<tr>
<td>3KXA163000L0053</td>
<td>5 m (16.4 ft)</td>
</tr>
<tr>
<td>3KXA163000L0054</td>
<td>10 m (32.8 ft)</td>
</tr>
<tr>
<td>3KXA163000L0055</td>
<td>15 m (49.2 ft)</td>
</tr>
<tr>
<td>3KXA163000L0056</td>
<td>30 m (98.4 ft)</td>
</tr>
<tr>
<td>EZLink cable</td>
<td></td>
</tr>
<tr>
<td>AWT4009010</td>
<td>1 m (3.3 ft)</td>
</tr>
<tr>
<td>AWT4009050</td>
<td>5 m (16.4 ft)</td>
</tr>
<tr>
<td>AWT4009100</td>
<td>10 m (32.8 ft)</td>
</tr>
<tr>
<td>AWT4009150</td>
<td>15 m (49.2 ft)</td>
</tr>
<tr>
<td>AWT4009250</td>
<td>25 m (82 ft)</td>
</tr>
<tr>
<td>AWT4009500</td>
<td>50 m (164 ft)</td>
</tr>
</tbody>
</table>

### Acknowledgments

Kynar is a registered trademark of Arkema Inc.
Viton is a registered trademark of the Chemours Company