AP300
Combination pH/Redox (ORP) sensors
Measurement made easy
A reliable economic solution for a wide range of applications

Long life
• large PTFE junction provides resistance to fouling
• double junction with gelled electrolyte provides better-defined junction potentials, creating an inherently-stable reference junction that is resistant to poisoning

High accuracy
• specially formulated, low sodium-error glass for accuracy at high pH
• temperature sensor positioned perfectly to compensate for measurement and reference element temperature, ensuring rapid compensation and process temperature tracking

High reliability
• operates up to 105 °C (221 °F) and 6 bar (90 psi) @ 25 °C (77 °F)
• fouling-resistant flat glass available

High flexibility
• suitable for a wide range of applications
• available for insertion, immersion, flow-through and hot-tap
• standard- and blue-glass options
• bulb and flat-glass options

Economical
• cost-effective
• long life
• highly reliable
**Introduction**

ABB provides an unrivalled range of dedicated pH/Redox (ORP) sensors for a wide range of industrial duties.

The AP300 range of pH/Redox sensors offers a reliable and cost-effective solution for most industrial pH applications. It is the perfect starting point for pH or Redox measurements.

Combining measurement, reference and temperature compensation elements in a single unit, the AP300 is an economical solution for a wide variety of industrial applications; including water, food, pharmaceutical and chemical.

The AP300 probe is available in three different body types enabling the sensor to be used in immersion, insertion/flow-through and hot-tap applications.

The ‘Hot-tap’ sensor variant enables fitting and retraction through a standard, full-port ball-valve keeping maintenance costs to a minimum.

**Robust design, maximum protection**

The electrolyte is a highly resistant gel, faced with a large area, dirt-resistant PTFE junction. These are encapsulated in a robust body, providing maximum resistance to chemical attack. The sensor can withstand operating conditions up to 105 °C and 6 bar @ 25 °C (221 °F and 90 psi @ 77 °F).

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**Insertion, flow-through, immersion (dip) and hot-tap**

**AP301**

General-purpose in-line/immersion, twistlock sensors.

The AP301 is a PPS (Ryton) sensor for general applications that can be adapted to 1 in. NPT fittings using threaded twistlock process adapters. Dip-type immersion is achieved using an immersion guard and connection of the ¾ in. NPT back-thread to a customer-supplied dip-tube.

![AP301 sensor with optional immersion guard](image)

For flow-through applications, a flow cell can be fitted with either 1 in. BSP (part no. 7670043) or 1 in. NPT (part no. 7670046) threaded process connections.

![Optional flow cell (flow-through)](image)
...Insertion, flow-through, immersion (dip) and hot-tap

**AP302 and AP303**
General-purpose insertion, flow-through, immersion, ¾ in. NPT threaded sensors.

The AP302 and AP303 are constructed from PVDF (Kynar) and can be used in insertion, flow-through or immersion (dip) applications.

AP302 models have no sensor guard (flush) for use with flat glass to provide a flow-cleaned configuration.

AP303 models have a notched sensor guard to protect the bulb glass.

**AP304 and AP305**
General-purpose, hot-tap retractable sensors. Completing the series, the AP304 and AP305 are fully-retractable PVDF stainless steel-clad sensors. With these sensors, project and maintenance costs can be reduced significantly as the need for expensive by-pass systems or long immersion sensors are eliminated.
Hot-tap sensor

The safety of operators is paramount. This is maintained by incorporating an anti-blowout tip in the design of the AP304 & AP305, preventing accidental sensor removal. Unlike chain restraints, this safety-by-design is an integral part of the sensor’s construction.

Connection with customer-supplied ball valve is achieved with either wrench or hand fittings. The hand compression fitting provides additional safety through two separate locking rings. A body nut union ring locks the sensor to the ball valve and enables sensor dismounting without complete disassembly. In addition, a compression ring fixes the sensor into position at the required insertion depth and seals the body from the process. This compression ring has an integral shroud that prevents access to the smaller body nut when the compression ring is loosened for sensor maintenance.

Double junction for long life

To maximize the life-span of the sensor, the AP300 features an inherently-stable, double junction arrangement. In addition, the sensor is designed to resist poisoning in two ways, by:

- effectively doubling the length of the diffusion path between the PTFE interface and the electrode, so any poisoning from the sample takes longer to reach it.
- discouraging any movement of the reference gel around the electrode by enclosing it in a glass tube open only at the top.
**Temperature compensation**

The AP300’s temperature compensator offers fast response and high accuracy. The temperature sensor is located at the tip of the AP300, together with the measuring and reference electrodes. This arrangement provides accurate process temperature measurement used to compensate for the effects of temperature on the electrodes to produce a precise pH measurement.

The temperature compensator is available as Balco 3k or Pt100.

![Temperature compensation graph](image)

**Glass options**

The AP300 range is available with ABB’s specially formulated standard pH-sensitive glass or, optionally, with low-resistance glass that speeds up the response of the sensor by an order of magnitude at temperatures below 60 °C (140 °F). For applications with higher pH levels and temperatures, ABB’s standard glass offers a much lower sodium error than competing products, enabling the sensor to maintain its accuracy even at very high pH levels, when sodium ions would otherwise cause inaccurate readings.

Sodium error at 25 °C (77 °F): 0.02pH in 1M NaOH

![ABB-manufactured electrodes](image)
Cable options
Several connections are possible from the probe. An integral cable with tagged pins for direct connection to a transmitter or a male BNC connector for connection to an extension cable. Both tagged and BNC cables are available in versions that accommodate temperature signals. Cables are available in short, junction box-only lengths and in 5, 10, 20 and 30 m (16, 33, 66 and 98 ft.) lengths.

Without temperature compensator

- Male BNC
- Pin leads
- Junction box

With temperature compensator

- Male BNC and temperature compensator connector
- Tagged pin leads
- Female BNC (to sensor or junction box)
- Tagged pin extension cable
  - 5-core to AX400:
    - 1015 160 5 m
    - 1015 161 10 m
    - 1015 162 20 m
    - 1015 163 30 m

Sensor cables and junction box wiring
Overall dimensions

**AP301**
Dimensions in mm (in.)

- 165.1 (6.50)
- No. 1 18 Viton O-rings 2 each
- 1 in. NPT flow cell (part no. 7670046)

**Optional threaded adaptor**

- 95.0 (3.74)
- 71.1 (2.80)
- 120.0 (4.73)
- 276.9 (10.90)

**Sensor**

- 1/4 in. NPT flex conduit and coupling
- 33.0 (1.30)

**Sensor with optional junction box**

- 22.2 (0.80)
- 38.1 (1.5) insertion length
- 381.5 (15.0) length

**AP302 and AP303**
Dimensions in mm (in.)

**AP302 (flush) sensor**

- 3/4 in. NPT
- 1/4 in. NPT wrench flats 127.0 (5.00)
- 1/4 in. NPT 28.0 (1.1)

**AP303 (notched) sensor**

- 3/4 in. NPT conduit port
- 1/4 in. coupling (customer supplied)
- Rear of sensor and cable to be sealed in conduit or pipe (customer supplied)

**AP303 (notched) sensor with optional junction box**

- Sample outlet
- Sample in
- Conduit (customer supplied)
- 1/4 in. flow cell (customer supplied)

**AP303 (notched) sensor immersion applications**

- 95.0 (3.74)
- 71.1 (2.80)
- 120.0 (4.73)
- 238.1 (9.38)
- 381.5 (15.0) length

**AP303 (notched) sensor flow applications**

- 1/4 in. NPT
- Electrode
- 22.2 (0.80)
- 38.1 (1.5) insertion length

**AP301**

- Overall dimensions
- Dimensions in mm (in.)
- 165.1 (6.50)
- No. 1 18 Viton O-rings 2 each
- 1 in. NPT flow cell (part no. 7670046)

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- 1/4 in. NPT 28.0 (1.1)

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- 3/4 in. NPT conduit port
- 1/4 in. coupling (customer supplied)
- Rear of sensor and cable to be sealed in conduit or pipe (customer supplied)

**AP303 (notched) sensor with optional junction box**

- Sample outlet
- Sample in
- Conduit (customer supplied)
- 1/4 in. flow cell (customer supplied)

**AP303 (notched) sensor immersion applications**

- 95.0 (3.74)
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- 381.5 (15.0) length

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- 1/4 in. NPT
- Electrode
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- 38.1 (1.5) insertion length

**AP301**

- Overall dimensions
- Dimensions in mm (in.)
- 165.1 (6.50)
- No. 1 18 Viton O-rings 2 each
- 1 in. NPT flow cell (part no. 7670046)

**Optional threaded adaptor**

- 95.0 (3.74)
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**AP302 and AP303**
Dimensions in mm (in.)

**AP302 (flush) sensor**

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- 1/4 in. NPT wrench flats 127.0 (5.00)
- 1/4 in. NPT 28.0 (1.1)

**AP303 (notched) sensor**

- 3/4 in. NPT conduit port
- 1/4 in. coupling (customer supplied)
- Rear of sensor and cable to be sealed in conduit or pipe (customer supplied)

**AP303 (notched) sensor with optional junction box**

- Sample outlet
- Sample in
- Conduit (customer supplied)
- 1/4 in. flow cell (customer supplied)

**AP303 (notched) sensor immersion applications**

- 95.0 (3.74)
- 71.1 (2.80)
- 120.0 (4.73)
- 238.1 (9.38)
- 381.5 (15.0) length

**AP303 (notched) sensor flow applications**

- 1/4 in. NPT
- Electrode
- 22.2 (0.80)
- 38.1 (1.5) insertion length
AP304 and AP305

Dimensions in mm (in.)

Sensor shaft

![Sensor shaft diagram]

Replacement sensor

![Replacement sensor diagram]

Sensor shaft and junction box

![Sensor shaft and junction box diagram]

Sensor shaft and hand fitting

![Sensor shaft and hand fitting diagram]

Ball valve insertion and hand fitting – installation detail

![Ball valve insertion and hand fitting diagram]

Sensor shaft wrench fitting – installation detail

![Sensor shaft wrench fitting diagram]

Ball valve insertion wrench fitting – installation detail

![Ball valve insertion wrench fitting diagram]
## Specification

### General

**pH measuring range**
- Standard (yellow glass) 0 to 14 pH
- Low temperature (blue glass) 0 to 10 pH

**Redox (ORP) measuring range**
- -2000 to 2000 mV

**Temperature range**
- Body 0 to 105 °C (32 to 221 °F)
- Bulb glass 0 to 105 °C (32 to 221 °F)
- Flat glass 5 to 100 °C (41 to 212 °F)
- Blue glass -5 to 60 °C (23 to 140 °F)
- Redox (ORP) 0 to 105 °C (32 to 221 °F)

**Pressure maximum**
- 6 bar (90 psi) @ 25 °C (77 °F)

**Temperature compensator (pH sensors only)**
- Integral Pt100 or Balco 3 kΩ

**Wetted materials**
- pH electrode Glass
- Redox (ORP) electrode Platinum
- Junction PTFE
- Body AP301 PPS (Ryton)
- Body AP302/3 and AP304/5 PVDF (Kynar)
- Flow cell PVC
- Immersion guard PVC
- AP304 and AP305 shaft and Stainless steel compression fitting

**pH glass types**
- Bulb general duties
- Flat in-line, self-cleaning
- Blue low temperature

**Reference system**
- Ag/AgCl-3.5M KCl in gel matrix

**Reference junction**
- Porous PTFE

## Spares and accessories

### Threaded lock-nut adapter, PPS (Ryton)
- 4TB9515-0120 (1 in. NPT)
- 4TB5205-0120 PVC Immersion / dip guard
- 4TB5023-0162 Junction box (requires cable gland)
- 4TB9515-0244 Cable gland

### Flow cells
- 1 in. NPT (for adapter) + 1 in. NPT (for process connection)
- 1 in. BSPT (for adapter) + 1 in. BSPT (for process connection)

### Flow cell pipeline adapters
- 1 in. BSPT to ½ in. BSPT polypropylene
- 7601 420 1 in. BSPT to ½ in. NPT polypropylene
- 7601 430

### Extension cables
- Tagged pin extension cables (5-core 1015/16X for AX460 and AX466)
  - 5 m (16 ft) 1015 160
  - 10 m (33 ft) 1015 161
  - 20 m (66 ft) 1015 162
  - 30 m (98 ft) 1015 163

### Buffer sachets (box of 25)
- 4 pH 0400/110
- 7 pH 0400/120
- 9 pH 0400/130

### Buffer sachets (mixed box of 10 of each)
- 4, 7 and 9 pH 0400/135
### Ordering information – sensor system

**pH/Redox (ORP) sensor assembly**

<table>
<thead>
<tr>
<th>Component</th>
<th>AP30</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>O</th>
<th>X</th>
<th>X</th>
<th>XX</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gel-filled, disposable sensor with dirt-repellent PTFE junction</td>
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</table>

**Body style**

<table>
<thead>
<tr>
<th>Insertion / Immersion Style</th>
<th>Body Style</th>
<th>Insertion Depth</th>
<th>Sensor Guard</th>
<th>Sensor Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twist-lock insertion / immersion (TB551 style)</td>
<td>Standard insertion – no sensor guard (flush)</td>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>¼ in. threaded insertion / immersion (TB556 style)</td>
<td>2</td>
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<tr>
<td></td>
<td>Insertion depth 28 mm (1.1 in.) – no sensor guard (flush)</td>
<td>3</td>
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<tr>
<td></td>
<td>Insertion depth 38 mm (1.5 in.) – notched sensor guard</td>
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<tr>
<td>Hot-tap ball valve insertion (TB557 style)</td>
<td>No sensor guard (flush)</td>
<td>4</td>
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<tr>
<td></td>
<td>Notched sensor guard</td>
<td>5</td>
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**Measuring electrode**

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<tr>
<th>Electrode Type</th>
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<th>X</th>
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<th>XX</th>
<th>X</th>
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</thead>
<tbody>
<tr>
<td>Flat glass pH for in-line, fouling applications (5 to 100 °C [41 to 212 °F], 0 to 14 pH)</td>
<td>1</td>
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<tr>
<td>Standard yellow glass, pH (0 to 105 °C [32 to 221 °F], 0 to 14 pH)</td>
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<tr>
<td>Low resistance blue glass, pH (–5 to 60 °C [23 to 140 °F], 0 to 10 pH)</td>
<td>3</td>
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<tr>
<td>Platinum, Redox (ORP)</td>
<td>5</td>
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**Integral temperature sensor**

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<tr>
<th>Sensor Type</th>
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<th>X</th>
<th>X</th>
<th>X</th>
<th>O</th>
<th>X</th>
<th>X</th>
<th>XX</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>None – Redox (ORP) sensors only</td>
<td>0</td>
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<tr>
<td>Pt100 – pH sensors only</td>
<td>1</td>
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<tr>
<td>3 kΩ – pH sensors only</td>
<td>2</td>
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**Liquid junction**

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<th>Junction Box</th>
<th>AP30</th>
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<th>X</th>
<th>X</th>
<th>O</th>
<th>X</th>
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<td>PTFE</td>
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**Junction box or integral cable length**

<table>
<thead>
<tr>
<th>Cable Length</th>
<th>AP30</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>O</th>
<th>X</th>
<th>X</th>
<th>XX</th>
<th>X</th>
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</thead>
<tbody>
<tr>
<td>Short length cable – supplied without junction box</td>
<td>0</td>
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<td>3 m (10 ft)</td>
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<td>6 m (20 ft)</td>
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<td>9 m (30 ft)</td>
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<tr>
<td>Integral junction box supplied with short length cable</td>
<td>8</td>
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**Sensor connectors**

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>AP30</th>
<th>X</th>
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<th>XX</th>
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<tbody>
<tr>
<td>Tagged pin leads – all tagged terminations</td>
<td>0</td>
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<tr>
<td>Connectors – BNC on pH/Redox (ORP) + temperature compensator connector (if used)</td>
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<tr>
<td>Also select for electrodes used with junction box</td>
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**Accessory hardware**

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>AP30</th>
<th>X</th>
<th>X</th>
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<th>O</th>
<th>X</th>
<th>X</th>
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<tbody>
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<td>No accessory supplied</td>
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<tr>
<td>For AP301:</td>
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<tr>
<td>1 in. NPT, twist-lock adapter – Ryton (PPS)</td>
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<td>PVC immersion (dip) guard</td>
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<td>For AP304 &amp; AP305:</td>
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<tr>
<td>406 mm (16 in.) stainless steel sheath</td>
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<tr>
<td>406 mm (16 in.) stainless steel sheath and 316 stainless steel wrench fitting</td>
<td>21</td>
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<tr>
<td>406 mm (16 in.) stainless steel sheath and 316 stainless steel hand fitting</td>
<td>22</td>
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<tr>
<td>508 mm (20 in.) stainless steel sheath</td>
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<tr>
<td>508 mm (20 in.) stainless steel sheath and 316 stainless steel wrench fitting</td>
<td>24</td>
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<tr>
<td>508 mm (20 in.) stainless steel sheath and 316 stainless steel hand fitting</td>
<td>25</td>
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**Instruction manual**

<table>
<thead>
<tr>
<th>Language</th>
<th>AP30</th>
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<th>X</th>
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<th>X</th>
<th>X</th>
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