Rugged pH/Redox (ORP) Sensor Systems with Rapid Temperature Response for Critical Processes

AP200 Series
The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company, and is indicative of our dedication to quality and accuracy.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and Safety
To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.
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1 DESCRIPTION

1.1 Introduction
This manual describes the installation and maintenance of the AP200 Series Process pH and Redox (ORP) Electrode Holder Systems.

1.2 Systems – Fig. 1.1

1.2.1 Typical Systems
- AP201 Insertion system
- AP202 In-line, flow-through system
- AP203 Dip (immersion) system

1.2.2 AP120 Series Electrodes Used with Holders
AP121/11000 General process 0 to 14 pH, 0 to 100°C
AP121/21000 High temperature 0 to 14 pH, 0 to 130°C
AP121/31000 Low temperature 0 to 10 pH, –5 to +50°C
AP121/60000 Redox (ORP) platinum 0 to 100°C

See Section 6 – SPECIFICATION for full details

Fig. 1.1 System Schematics
2 MECHANICAL INSTALLATION

2.1 Installing the Systems

2.1.1 Model AP201 Insertion System – Fig. 2.1
This system is designed to mount directly into a pipeline or tank. Mounting adaptors are available:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7690 130</td>
<td>PPS Ryton™ R 1 1/4 in. adaptor</td>
</tr>
<tr>
<td>7690 134</td>
<td>Polypropylene 1 1/4 in. NPT adaptor</td>
</tr>
<tr>
<td>7690 129</td>
<td>Polypropylene R 1 1/4 in. adaptor</td>
</tr>
<tr>
<td>7690 131</td>
<td>1 in. NPT Stainless steel adaptor</td>
</tr>
<tr>
<td>7690 128</td>
<td>R 1 in. Stainless Steel adaptor</td>
</tr>
<tr>
<td>7690 132</td>
<td>DN25 Straight-weld socket</td>
</tr>
<tr>
<td>7690 133</td>
<td>DN25 Angled-weld socket</td>
</tr>
</tbody>
</table>

Dimensions in mm (in.)

Pipe-Mount System

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value (mm)</th>
<th>Value (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø50</td>
<td>12.87</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>3.54</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>3.94</td>
<td></td>
</tr>
<tr>
<td>327</td>
<td>12.87</td>
<td></td>
</tr>
</tbody>
</table>

Tank-Mount System

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value (mm)</th>
<th>Value (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angled-Weld Socket</td>
<td>15° min. from horizontal</td>
<td></td>
</tr>
</tbody>
</table>

Allowable Mounting Position

<table>
<thead>
<tr>
<th>Angle</th>
<th>Value (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15° min.</td>
<td></td>
</tr>
</tbody>
</table>

Note. When installing the Model AP201 insertion system, ensure that the electrode is fully immersed in sample under all operating conditions.

Mounting Adaptors

<table>
<thead>
<tr>
<th>Adaptor</th>
<th>Dimensions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1/4</td>
<td>R 1 1/4</td>
<td>or 1 1/4 in. NPT</td>
</tr>
<tr>
<td>ø25</td>
<td>1 in. NPT</td>
<td>or R 1 in.</td>
</tr>
<tr>
<td>7690 130</td>
<td></td>
<td>PPS Ryton™ R 1 1/4 in. Adaptor</td>
</tr>
<tr>
<td>7690 134</td>
<td></td>
<td>PP 1 1/4 in. NPT Adaptor</td>
</tr>
<tr>
<td>7690 129</td>
<td></td>
<td>PP R 1 1/4 in. Adaptor</td>
</tr>
<tr>
<td>7690 131</td>
<td></td>
<td>1 in. NPT Stainless Steel Mounting Adaptor</td>
</tr>
<tr>
<td>7690 132</td>
<td></td>
<td>DN25 Straight-Weld Socket (316 SS)</td>
</tr>
<tr>
<td>7690 133</td>
<td></td>
<td>DN25 Angled-Weld Socket (316 SS)</td>
</tr>
</tbody>
</table>

Fig. 2.1 Model AP201 Insertion System
2.1.2 Model AP202 Inline System – Fig. 2.2
This system is supplied with an inline tee-piece for mounting the system directly into a pipeline. Allow sufficient height above the system to enable the sensor to be withdrawn from the tee-piece.

Dimensions in mm (in.)

Note. Refer to Section 6 – SPECIFICATION for information about the different versions.

Fig. 2.2 Model AP202 Inline System
2.1.3 Model AP203 Flanged Dip (Immersion) System – Fig. 2.3

This system is designed to be installed over an unpressurized tank or channel. A sliding flange is supplied to enable adjustment of the immersion depth. A suitable mounting bracket or support must be supplied by the user.

Dimensions in mm (in.)

![Dimensions Diagram]

**Note.** Ensure the thumb-screws compress the insert when clamping the flange to the dip tube.

![Typical Installation Diagram]

Fig. 2.3 Model AP203 Flanged Dip (Immersion) System
2.2 Removing the Sensor Holder

2.2.1 Models AP201 Insertion and AP202 Inline Systems – Fig. 2.4

1. Open cover and detach cables and jetwash tubing (if fitted) from cap

2. Twist cable shroud counter-clockwise and remove

3. Unscrew sensor holder retaining nut and remove sensor holder from in-line adaptor

4. Check O-ring is in position, located on underside of electrode holder

Fig. 2.4 Models AP201 and AP202 – Removing the Sensor Holder
Open cover and detach cables and jetwash tubing (if fitted) from cap.

Unscrew sensor guard from dip tube (see Note below).

Remove the sensor holder from the dip tube using the sensor guard as a tool. Engage the sensor guard lugs in the sensor holder slots. Twist the sensor holder counter-clockwise to disengage the bayonet lugs from the slots in the dip tube and withdraw the sensor holder. Ensure the O-ring remains clean.

Notes.
- Before refitting the sensor guard, clean and regrease the threads and O-ring.
- Do not overtighten the sensor guard.

Fig. 2.5 Model AP203 – Removing the Sensor Holder
2.3 System Assembly – Fig 2.6

**Note.** Model AP201 shown. When assembling Models AP202 and AP203, refit the Tee piece to the sensor holder (AP202) or the sensor guard to the dip tube (AP203) – see Figs. 2.4 and 2.5.

1. Route cables and jetwash tube (if required) through cable shroud
2. Ensure support washer and O-ring are fitted to electrode
3. Insert sensor in holder
4. Tighten to recommended torque value of 125cNm
5. Locate sensor cable connector over keyway
6. Connect earth (ground) terminal to rod
7. Connect jetwash supply tube (if required – see Section 2.5) and tighten to recommended torque value of 60cNm
8. Locate cable shroud over sensor holder and twist clockwise to engage bayonet lugs in slots
9. Clip cables and jetwash tube (if required) into slots in protective cover
10. Tighten

**Fig. 2.6 System Assembly**
2.4 Jetwash System – Figs 2.6 to 2.8

Note. Installation must be carried out in accordance with local water company and council bylaws.

The jetwash system enables automatic cleaning of both the measuring element and the reference junction by spraying either water or a cleaning solution at them in situ, thus reducing system maintenance requirements.

An external pump or solenoid valve is required, controlled by a pH analyzer with auto-cleaning control functions.

Note. For optimal performance, the pressure of the jetwash system should be 2 to 3 bar (30 to 45 psi) greater than the process pressure.

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>1M nitric acid</td>
</tr>
<tr>
<td>Metal hydroxides</td>
<td></td>
</tr>
<tr>
<td>Cyanides</td>
<td>1M sulphuric or nitric acid</td>
</tr>
<tr>
<td>Heavy biological</td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td>Mixture of 1M sulphuric or nitric acid and pepsin (saturated)</td>
</tr>
<tr>
<td>Fibres</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 Note below)</td>
<td>Pressurized cold water</td>
</tr>
</tbody>
</table>

Note. If removed from the process the latex must be completely removed quickly before it hardens.
2.5 Jetwash System Assembly – Fig. 2.9
The system is supplied with a blanking plug fitted to the jetwash tubing connector. If the jetwash system is to be used, remove the plug and fit the jetwash supply tube as shown in Fig. 2.9.

Note. Recommended tubing is 6mm OD semi-rigid polyethylene tube (part no. 0212035).

Remove jetwash port sealing nut and retain for further use (See Note below)

Note. The seal nut must be fitted when the jetwash tubing is not being used.

Slide connector onto tubing
Slide ferrule onto tubing
Push tubing onto jetwash port, screw connector onto jetwash port and tighten to recommended torque of 60cNm

Fig. 2.9 Fitting Jetwash Supply Tubing
3 ELECTRICAL INSTALLATION

3.1 Analyzer Connections – Fig. 3.1
System cable connections are identified in Fig. 3.1 to enable connection to the appropriate terminal on the analyzer.

Fig. 3.1 Cable Termination

3.2 Shortening the Connection Cable – Fig. 3.2
The connection cable is supplied in various standard lengths. If it is necessary to shorten the cable, prepare the cable ends as shown in Fig. 3.2.

The cable comprises:
  a) an outer insulating layer
  b) an inner braided shield
  c) a shielded coaxial core
  d) four insulated wires

Note. Do not allow the shielding to contact any other bare wires.

Note. The sensor is equipped with a solution earth (ground) which is designed to provide full sensor diagnostics when connected to a suitable analyzer. If sensor diagnostics are not required, it is not necessary to connect the solution earth (ground).

Note. Cut off and discard remaining unused cores.

Fig. 3.2 Shortening the Connection Cable

Key
A Temperature compensator
B Reference electrode
C Measuring electrode
D Screen
E Solution earth (see Note below)

A White
B Green
C Grey
D Blue
E Transparent
F Red
G Green/yellow

Note. The sensor is equipped with a solution earth (ground) which is designed to provide full sensor diagnostics when connected to a suitable analyzer. If sensor diagnostics are not required, it is not necessary to connect the solution earth (ground).

Key
A Measuring electrode
B Reference electrode

A Transparent
B Blue

Note. Cut off and discard remaining unused cores.

pH

Redox (ORP)

A Transparent
B Blue

Key
A Measuring electrode
B Reference electrode

Note. Cut off and discard remaining unused cores.

Fig. 3.1 Cable Termination

Fig. 3.2 Shortening the Connection Cable
3.3 Extending the Connection Cable – Fig. 3.3
If it is necessary to extend the cable, a suitable junction box and the correct length of 6-core cable are required. Connect the junction box as shown in Fig. 3.3.

Notes.
- Junction box (part no. 7690/049) is recommended.
- 6-core cable, part no. AA101/0XX (where XX is the cable length, from 0.5 to 50 meters, in increments of 0.5 meters) is recommended.
- Cable AA101/0XX is identical to that fitted to the sensor. See Fig. 3.2 for cable end preparation instructions.

3.4 Jetwash System Connections
The electrical supply to the jetwash system pump or solenoid valve is connected to the analyzer relay used for automatic cleaning – see Fig. 3.4. The analyzer controls the frequency of the wash sequence and the duration for which the cleaning solution flows.

The analyzer outputs are held during a cleaning sequence.
4 CALIBRATION

4.1 Method
When the electrode system has been correctly connected and all electrical connections made to the associated pH analyzer, the system is ready for calibration by immersing the sensor (using suitably sized beakers) either:

a) in a calibration solution (buffer) of known pH value for a single-point calibration, or

b) in two separate calibration solutions of known pH values for a two-point calibration.

For sensors already in use:
1) Remove the electrode from the process or sample.
2) Wash the visible electrode surface with demineralised water.
3) Proceed as described in the paragraph above.

To have agreement with a measured sample, there may be times when a process calibration is necessary.
1) Perform a buffer calibration.
2) Ensure that the electrode is returned to the process for at least 10 minutes before performing a process calibration.
3) To minimize solution temperature effects, measure the sample at the same temperature as the process.

Refer to the instruction manual for the pH analyzer for full details of the calibration procedures.

Warning. Close all isolating valves before removing an electrode from a flow line.

4.2 Buffer Solutions
Recommended buffer solutions are shown in Table 4.1.

<table>
<thead>
<tr>
<th>Buffer Solution</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4pH 0.05M potassium hydrogen phthalate</td>
<td>0400 110</td>
</tr>
<tr>
<td>7pH Disodium hydrogen phosphate/monopotassium dihydrogen phosphate mix</td>
<td>0400 120</td>
</tr>
<tr>
<td>9pH 0.05M borax</td>
<td>0400 130</td>
</tr>
</tbody>
</table>

Table 4.1 Recommended Buffer Solutions

Notes.
- Ensure that the visible surface of the electrode has been cleaned using demineralized water.
- When moving from one buffer solution to the next, wash the electrode using demineralized water and dry it carefully using a soft tissue.

Table 4.2 shows the change in pH value that occurs with a change in the temperature of the recommended 4, 7, and 9 pH buffer solutions.

<table>
<thead>
<tr>
<th>°C</th>
<th>pH 0</th>
<th>pH 10</th>
<th>pH 20</th>
<th>pH 25</th>
<th>pH 30</th>
<th>pH 40</th>
<th>pH 50</th>
<th>pH 60</th>
<th>pH 70</th>
<th>pH 80</th>
<th>pH 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.01</td>
<td>4.01</td>
<td>4.03</td>
<td>4.05</td>
<td>4.08</td>
<td>4.12</td>
<td>4.16</td>
<td>4.21</td>
</tr>
<tr>
<td>7</td>
<td>7.11</td>
<td>7.06</td>
<td>7.01</td>
<td>7.00</td>
<td>6.98</td>
<td>6.97</td>
<td>6.97</td>
<td>6.97</td>
<td>7.00</td>
<td>7.03</td>
<td>7.08</td>
</tr>
</tbody>
</table>

Table 4.2 Buffer pH Value / Temperature (°C)

4.3 Redox (ORP Sensor)
When the sensor has been correctly connected and all electrical connections have been made to the associated Redox (ORP) analyzer, it is ready for calibrating. Follow the calibration procedure in the analyzer User Guide.

For sensors that are connected to analyzers that do not have Redox (ORP) sensor calibration capabilities, it is possible to check the response as follows:

1) Prepare standard 4 and 7 pH buffer solutions. Add one gramme (heaped spatula) of analar quinhydrone to 100 ml (3.5 Flu oz.) 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.

The values obtained should be within ±15 mV of the following:

<table>
<thead>
<tr>
<th>pH Buffer</th>
<th>mV</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>+259</td>
</tr>
<tr>
<td>7</td>
<td>+82</td>
</tr>
</tbody>
</table>
5 MAINTENANCE

5.1 General Cleaning

**Warning.** Close all isolating valves before removing an electrode from a flow line.

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

Automatic cleaning using the optional jetwash system and controlling the cleaning solution using a suitable controller or analyzer, will reduce the amount of manual cleaning.

Methods of removing various types of deposit are detailed below. Replace the sensor if the performance of the sensor does not improve after cleaning.

5.1.1 General Sludge and Loosely Adhering Matter
Rinse off the excess matter and wipe the sensor with a soft cloth or tissue before calibrating.

5.1.2 Heavy, Non-Greasy Deposits
For example: lime, salts, etc.
Immerse the sensor in 1 to 2 M hydrochloric acid until the deposit has dissolved. Rinse with demineralized water before calibrating.

5.1.3 Greasy or Organic Deposits
Wipe the glass membrane with a detergent or acetone-based solvent. Rinse with demineralized water before calibrating.

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

**Short scaling (Low Slope) or sluggish response**
1) Glass sensor membrane dirty or coated – refer to Section 5.1 for cleaning.
2) Poor insulation on cable connectors, possibly due to moisture – dry connectors with warm air.

Replace sensor if no improvement is seen. (It may also be necessary to replace the extension cable if used.)

**No response to pH buffer or sample**
1) Sensor incorrectly connected – see Section 3.1 and the analyzer user guide for connection details.
2) Glass sensor membrane broken or cracked – replace sensor.

**Unstable readings or drift**
1) Sensor incorrectly connected – see Section 3.1 and the analyzer user guide for connection details.
2) Dry or dirty reference junction – clean junction as detailed in Section 5.1. Leave to soak in a buffer solution for several hours.

Replace sensor if no improvement is seen.

**Stable but incorrect readings**
1) Incorrect calibration – recalibrate using fresh buffer solutions.
2) Incorrect temperature compensation settings – enter correct manual temperature or check that automatic temperature compensation is reading correctly.
3) Sensor responds correctly to pH changes, but there is an offset of <1.0 pH and >0.2 pH – perform a one-point process calibration – see Section 4.1.

**Note.** All the above symptoms could be caused by a faulty extension cable. Check and replace it, if necessary.

5.3 Storing the Electrode

**Note.** Allowing the glass membrane and reference junction to dry out irreversibly affects the response of the electrode.

If it is necessary to remove the electrode from the sample line, fill the retained protective cap with buffer solution and cotton wool, or equivalent, and fit it to the sensor.
### All Systems

**Materials**
- Shaft and cap: Polypropylene
- Sensor body: Ryton™ PPS
- Ground rod/Spray tube: 316 Stainless steel

**Jet-wash facility**
- Non-return function: Integral one-way valve
- Spray tube connection: 6mm compression fitting
- Recommended operating pressure: Min. 1 bar (15 psi) over process pressure

**Certification**
The systems comply with SEP (Safe Engineering Practice) level Pressure Equipment Directive 97/23/EC

### AP201 Insertion System

**Maximum Temperature**
- 130°C (266°F)
- 90°C (194°F)

**Maximum Pressure**
- 6 bar (90 psi)

**Process Connections**
- Union nut: G 1 1/4 in. (BSP)
- PPS process adapter: R1 1/4 in. (tapered BSP male)
- PP process adapters: R1 1/4 in., 1 1/4 in. NPT
- Stainless steel adapters: R1 in. (tapered BSP male), 1 in. NPT
- Stainless steel sockets: Angled DN25, Straight DN25

### AP202 Flow-through System

**Materials**
- Flow-cells: Polypropylene, Stainless steel

**Maximum Temperature**
- 90°C (194°F)
- 130°C (266°F)

**Maximum Pressure**
- 6 bar (90 psi)

**Process Connections**
- Union nut: G 1 1/4 in. (BSP)
- Flow-cell inlet & outlet: Rp 1 in. (BSP female), or 1 in. NPT

### AP203 Immersion (Dip) System

**Materials**
- Guard, shaft and cap: Polypropylene

**Maximum Temperature**
- 90°C (194°F)

**Maximum Pressure**
- Not applicable

**Process Connections**
- Sliding flange: Composite Din & ANSI
- Immersion lengths: 1m (3.3 ft), 2m (6.6 ft), 3m (10 ft)

### AP120 Combination Sensor

**Measuring Ranges**
- AP121/0 General Process 0 to 14pH 0 to +100°C (32 to 212°F)
- AP121/1 High Temp/Alkali 0 to 14pH 10 to 130°C (50 to 266°F)
- AP121/2 Low Resistance 0 to 10pH –5 to 50°C (23 to 122°F)
- AP121/6 Pt Redox (ORP) ± 2000mV 0 to 130°C (32 to 266°F)

### Reference Electrode System

**Primary Electrolyte**
- Solid, Ag-free Gel with KCl charge

**Inner reference system**
- Ag/AgCl

**Junction**
- Annular PTFE, sterilizable

**Nominal zero point, E₀**
- 7 pH

**Minimum Conductivity**
- > 50 µS/cm

### General Data

- Temperature Sensor: pH only, Integral Pt100
- Temperature response: T°C <70s
- Electrode Shaft Length: 120mm
- Max. Pressure: 6 bar (90 psi)
- Ingress Protection: IP67/NEMA 6P (exceeds NEMA4X)
- Connection head: Sterilizable VP (VarioPin) connector with PG13.5 thread

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7 SPARES

7.1 Model AP201 Insertion System – Fig. 7.1

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7690130</td>
<td>Adaptor R1(\frac{1}{4}) in, PPS *</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0211209</td>
<td>O-Ring 1(\frac{1}{16}) in. ID x 0.103 in. CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>7690160</td>
<td>Cable Shroud, Molded</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>7690135</td>
<td>Sensor Collar PPS</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>0216561</td>
<td>Knurled Nut, M10, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>0216560</td>
<td>Compression Ferrule, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>7690160</td>
<td>Cable Shroud</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>7690218</td>
<td>Adaptor Sleeve, Protective Cover</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0212843</td>
<td>Double-Sided, Self-Adhesive Tape 38W</td>
<td>A/R</td>
</tr>
</tbody>
</table>

* Refer to Fig 2.1 for alternatives

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>7690140</td>
<td>Protective Cover</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>7690145</td>
<td>Protective Lid</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>7690086</td>
<td>Cleaning Screw</td>
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</tr>
<tr>
<td>13</td>
<td>0211029</td>
<td>O-Ring 3mm. ID x 1.5mm CH Viton</td>
<td>1</td>
</tr>
</tbody>
</table>

7690040 Service Pack Comprising:
- 0211161 O-Ring 11.6 mm ID x 2.4 mm CH Viton | 1
- 0211209 O-Ring 1\(\frac{1}{16}\) in. ID x 0.103 in. CH Viton | 1
- 0211351 O-Ring 37.77 mm ID x 2.62 mm CH Viton | 1
- 0211353 O-Ring 46 mm ID x 2 mm CH Viton | 1

Fig. 7.1 Model AP201 Insertion System Spares
### 7.2 Model AP202 Inline System – Fig. 7.2

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>7690150</td>
<td>Tee-piece*</td>
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<tr>
<td>2</td>
<td>0212730</td>
<td>PTFE Thread Sealing Tape</td>
<td>A/R</td>
</tr>
<tr>
<td>3</td>
<td>7690130</td>
<td>Adaptor 1⅛ in. BSP in PPS**</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0211209</td>
<td>O-Ring 1⅛ in. ID x 0.103 in. CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>7690135</td>
<td>Sensor Collar PPS</td>
<td>1</td>
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<tr>
<td>6</td>
<td>7690163</td>
<td>Split Ring</td>
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<tr>
<td>7</td>
<td>0216561</td>
<td>Knurled Nut, M10, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0216560</td>
<td>Compression Ferrule, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>7690160</td>
<td>Cable Shroud</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>7690218</td>
<td>Adaptor Sleeve, Protective Cover</td>
<td>1</td>
</tr>
</tbody>
</table>

* Contact ABB for alternatives
** Refer to Fig 2.1 for alternatives

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0212843</td>
<td>Double-Sided, Self-Adhesive Tape 38W</td>
<td>A/R</td>
</tr>
<tr>
<td>12</td>
<td>7690140</td>
<td>Protective Cover</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>7690145</td>
<td>Protective Lid</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>7690085</td>
<td>Cleaning Screw</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>0211029</td>
<td>O-Ring 3mm. ID x 1.5mm CH Viton</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
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<tbody>
<tr>
<td>16</td>
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<td>Service Pack Comprising:</td>
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</tr>
<tr>
<td>17</td>
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<td>O-Ring 11.6 mm ID x 2.4 mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>0211209</td>
<td>O-Ring 1⅛ in. ID x 0.103 in. CH Viton</td>
<td>1</td>
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<tr>
<td>19</td>
<td>0211351</td>
<td>O-Ring 37.77 mm ID x 2.62 mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>0211353</td>
<td>O-Ring 46 mm ID x 2 mm CH Viton</td>
<td>1</td>
</tr>
</tbody>
</table>

Fig. 7.2 Model AP202 Inline System Spares
7.3 Model AP203 Flanged Dip (Immersion) System – Fig. 7.3

Fig. 7.3 Model AP203 Flanged Immersion (Dip) System Spares
## Table 7.1 Key to Fig 7.3

<table>
<thead>
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<th>Item</th>
<th>Part No.</th>
<th>Description</th>
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<tbody>
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</tr>
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<td>2</td>
<td>7690085</td>
<td>Cleaning Screw</td>
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</tr>
<tr>
<td>3</td>
<td>0211029</td>
<td>O-Ring 3mm. ID x 1.5mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0216561</td>
<td>Knurled Nut, M10, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>0216560</td>
<td>Compression Ferrule, Polyamid, 6mm ID</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>0211351</td>
<td>O-Ring 37.71mm ID x 2.62mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>0211353</td>
<td>O-Ring 46mm ID x 2mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0216126</td>
<td>Knob, Scallop M5 x 15mm Black</td>
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<td>9</td>
<td>7690212</td>
<td>Ind Dip Non-Seal Flange</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>7690213</td>
<td>Ind Dip Flange Insert</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
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</thead>
<tbody>
<tr>
<td>11</td>
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<td>Adaptor Sleeve, Protective Cover</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>0212843</td>
<td>Double-Sided, Self-Adhesive Tape 38W A/R</td>
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<td>Protective Cover</td>
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<td>Service Pack Comprising:</td>
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</tr>
<tr>
<td></td>
<td>0211161</td>
<td>O-Ring 11.6 mm ID x 2.4 mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0211209</td>
<td>O-Ring 1,,,,1/8 in. ID x 0.103 in. CH Viton</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0211351</td>
<td>O-Ring 37.77 mm ID x 2.62 mm CH Viton</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0211353</td>
<td>O-Ring 46 mm ID x 2 mm CH Viton</td>
<td>1</td>
</tr>
</tbody>
</table>
PRODUCTS & CUSTOMER SUPPORT

Products

Automation Systems
- for the following industries:
  - Chemical & Pharmaceutical
  - Food & Beverage
  - Manufacturing
  - Metals and Minerals
  - Oil, Gas & Petrochemical
  - Pulp and Paper

Drives and Motors
- AC and DC Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flow Meters
- Turbine Flowmeters
- Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics Instrumentation
- pH, conductivity, and dissolved oxygen transmitters and sensors
- ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine analyzers.
- Zirconia oxygen analyzers, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.

Customer Support

We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

United Kingdom
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

United States of America
ABB Inc.
Tel: +1 775 850 4800
Fax: +1 775 850 4808

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company’s published specification. Periodic checks must be made on the equipment’s condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:
1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all operating and maintenance records relating to the alleged faulty unit.