Introduction

The Endura AZ20 is the latest in a long line of high-quality, combustion gas analyzers from ABB.

The sensor, based on a zirconium oxide cell, is mounted at the tip of the probe that is inserted in the flue duct. The resulting direct, in situ measurement provides accurate and rapid oxygen reading for combustion control / optimization and emissions monitoring purposes.

Endura AZ20 has been designed for extended periods of maintenance-free operation. The modular design with reduced component count improves the reliability and robustness of the system and simplifies breakdown repair if it occurs.

Kits containing all the parts needed to complete on-site repairs are available from ABB, ensuring that service personnel can effect repairs quickly and efficiently at minimum cost. The Endura AZ20 probe has retained an easy-access cell arrangement, similar to the proven ZFG2 probe. This ensures cell replacement can be carried out on-site using readily available, basic hand tools, even after long periods of high temperature operation.

This User Guide should be used in conjunction with the following publications:

— Transmitter User Guide (IM/AZ20E–EN)
— Maintenance Guide (IM/AZ20M–EN)
The Company

We are an established world force in the design and manufacture of measurement products 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.
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1 Safety

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.

1.1 Health & Safety

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

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- 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 Material Safety Data Sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

1.2 Electrical Safety – CEI / IEC 61010-1:2001-2
This equipment complies with the requirements of CEI / IEC 61010-1:2001-2 ‘Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use’ and complies with US NEC 500, NIST and OSHA.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.3 Symbols – CEI / IEC 61010-1:2001-2
One or more of the following symbols may appear on the equipment labelling:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☢️</td>
<td>Protective earth (ground) terminal.</td>
</tr>
<tr>
<td>💦</td>
<td>Functional earth (ground) terminal.</td>
</tr>
<tr>
<td>---</td>
<td>Direct current supply only.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Alternating current supply only.</td>
</tr>
<tr>
<td>🌙</td>
<td>Both direct and alternating current supply.</td>
</tr>
<tr>
<td>🛡️</td>
<td>The equipment is protected through double insulation.</td>
</tr>
<tr>
<td>⚠️</td>
<td>This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.</td>
</tr>
<tr>
<td>⚠️</td>
<td>This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and / or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.</td>
</tr>
<tr>
<td>⚠️</td>
<td>This symbol indicates that the marked item can be hot and should not be touched without care.</td>
</tr>
</tbody>
</table>
1.4 Product Recycling Information

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. In conformity with 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.

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

1.5 Product Disposal

Note. The following only applies to European customers.

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. The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002 / 96 / EC) that came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment.

In conformity with European local and national regulations (EU Directive 2002 / 96 / EC stated above), electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.
1.6 Restriction of Hazardous Substances (RoHS)

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

1.7 Safety Precautions

Please read the entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

1.8 Safety Conventions

**Warning.** In this manual, a warning is used to indicate a condition which, if not met, could cause serious personal injury and/or death. Do not move beyond a warning until all conditions have been met.

If a warning sign appears on the instrument itself, refer to Precautionary Labels – UL Certification and Electrical Safety – CEI / IEC 61010-1:2001-2 for an explanation.

**Caution.** A caution is used to indicate a condition which, if not met, could cause minor or moderate personal injury and/or damage to the equipment. Do not move beyond a caution until all conditions have been met.

**Note.** A note is used to indicate important information or instructions that should be considered before operating the equipment.

1.9 Safety Recommendations

For safe operation, it is imperative that these service instructions be read before use and that the safety recommendations mentioned herein be scrupulously respected. If danger warnings are not heeded to, serious material or bodily injury could occur.

**Warning.** The installation of the instrument should be performed exclusively by personnel specialized and authorized to work on electrical installations, in accordance with relevant local regulations.

1.10 Service and Repairs

Other than the serviceable items listed in Appendix D, page 36, none of the instrument’s components can be serviced by the user. Only personnel from ABB or its approved representative(s) is (are) authorized to attempt repairs to the system and only components formally approved by the manufacturer should be used. Any attempt at repairing the instrument in contravention of these principles could cause damage to the instrument and corporal injury to the person carrying out the repair. It renders the warranty null and void and could compromise the correct working of the instrument and the electrical integrity or the CE compliance of the instrument.

If you have any problems with installation, starting, or using the instrument please contact the company that sold it to you. If this is not possible, or if the results of this approach are not satisfactory, please contact the manufacturer’s Customer Service.

1.11 Potential Safety Hazards

The following potential safety hazards are associated with operating the system:

- Electrical (line voltage)
- Probe weight
2 System Overview

This User Guide provides the following information:

- schematics for systems fitted with or without restrictors (including test gas and reference air requirements) – see section 3.3, page 6 for product identification
- installation details for integral and remote Endura AZ20 probes – see section 3, page 6
- electrical connection details:
  - for standard probe connection details (without automatic calibration [AutoCal]) between a remote Endura AZ20 probe and a remote Endura AZ20 transmitter – see section 4.3.1, page 20
  - for automatic calibration connection details between a remote Endura AZ20 probe and a remote Endura AZ20 transmitter – see section 4.3.2, page 21
- electrical connection details between an existing ZDT analyzer or ZMT transmitter and a remote Endura AZ20/ZFG2 replacement probe (where the Endura AZ20/ZFG2 replacement probe replaces an existing ZFG2 probe)
  - refer to appendix B.2, page 33 for ZDT-FG connections
  - refer to appendix B.3, page 34 for ZMT connections

**Warning.**
- System configuration must be carried out only by users or personnel with approved access rights (user privileges).
- Read all relevant sections of this guide before configuring the system or modifying system parameters.
- Install and use this equipment as detailed in this guide. Install and use associated equipment in accordance with the relevant national and local standards.

The Endura AZ20 oxygen probe measures oxygen concentration in flue gas using an in situ ‘wet analysis’ method. The ‘wet analysis’ method avoids measurement error (typically 20% of reading higher than the actual value) that is introduced by a sampling system using the ‘dry analysis’ method.

For customers with an existing installed ZFG2 probe with a ZMT or ZDT transmitter, a 55 V heater version of the Endura AZ20 probe (the Endura AZ20 / ZFG2 replacement probe) is available. System equipment comprises a (flue-mounted) Endura AZ20 probe controlled by an integral or remote transmitter. During operation, a zirconia cell within the probe is held at a constant temperature of 700°C (1292 °F) by a probe heater and control thermocouple assembly. If the heater control circuitry or software fails (unsafe), the probe heater power supply is switched off, ensuring the system fails ‘safe’ and protects the heater from an over-temp failure.

An output generated at the zirconia cell is processed in the transmitter giving a locally displayed O₂ reading and a 4 to 20 mA retransmission signal over any range between 0 % and 100 % O₂.

Optional automatic calibration (AutoCal*) enables automatic, semi-automatic or manual calibration to be performed using a probe-mounted gas control manifold mounted within the probe head. Calibration sequencing is software-controlled from the transmitter.

Optional restrictors (where fitted*) in the probe head control the test gas and reference air flow without the need for flowmeters. The probe requires only preset test gas and reference air pressures of 1 bar (15 psi) to maintain a constant flow of 2.2 l / min (4.662 scfh). This flow is not affected by changes in the measured gas pressure of ± 0.35 bar (5 psi).

**Warning.** Endura AZ20 probes must be connected only to an integral or remote Endura AZ20 transmitter (AZ20XX1 or 2). Endura AZ20/ZFG2 replacement probes (AZ200002) must be connected only to a ZDT-FG or ZMT transmitter.

*Not available for Endura AZ20/ZFG2 replacement probes.
3 Mechanical Installation

3.1 General Installation Requirements

Warning.
- Before installing the probe, check the probe data and the alteration labels on the head of the probe – see Section 3.3.
- Select a location away from strong electrical and magnetic fields. If this is not possible, particularly in applications where mobile communications equipment is expected to be used, screened cables within flexible, earthed metal conduit must be used.
- Before installing the probe, read the Safety notes in Section 1.
- Ensure suitable lifting equipment and qualified personnel are available to suit the probe length being installed – see page 16 for probe weights.

3.2 Unpacking

Caution. Visually inspect equipment for damage before installing. Do not install damaged or faulty equipment.

Warning.
- Handle the probe with care and do not subject it to hammer blows or other sharp shocks. The probe inners have fragile ceramic components that can be damaged.
- It is recommended to retain the protective probe packing materials to allow for re-shipping in the unlikely event of a return.

3.3 Identifying the Probe

Each probe is identified by 2 probe-specific labels attached to the probe head (separate transmitter-specific labels are also attached to each system transmitter).

Caution. Details on the probe labels are unique to the cell / probe combination they are attached to and cannot be used to identify any other probe or system.

The probe labels comprise:

1. Data Label – used to identify the probe code (A), probe serial number (B), probe power rating (C) and approval symbols (D) (if applicable).

2. Commissioning Label – contains the cell number (A), date (B), cell zero (C) and the calibration factor value (D) required to calibrate the probe for the zirconia cell fitted – see IM/AZ20E-EN for commissioning procedures.

The Commissioning Label also indicates if automatic calibration and / or restrictors have been added. If either item has been added, the information on this label overrides some of the product code on the Data Label 1.
3.4 Siting

Avoid locations where:

- obstructions or bends create turbulence in the gas flow and/or hinder probe insertion and removal
- vibration induced by other plant or vortex shedding is present
- the probe may be subject to shock loading, for example, close to ash hammers

If excessive abrasive dust is present, fit a protective shield along the whole length of the inserted probe section.

If liquid condensation is present or could be created (for example a cold start on a gas boiler), mount the probe at a downward angle to prevent water entering the cell.

If necessary, thermally lag the probe mounting flange and body to prevent acid dew-point corrosion and to maintain the probe head temperature within the range of –20 to 70 °C (4 to 176 °F).

3.4.1 System Overview

![Diagram of system overview](image)

*Can withstand 35 kPa (5.1 psi) – positive or negative (pressure compensation required above 5 kPa [0.7 psi] – transmitter can supply fixed pressure compensation)

**Transmitter does not contain a reference air supply for the probe.

Fig. 3.2 Probe and Transmitter Temperature / Environmental Limits and Power Input / Output Supplies
3.5 Pneumatic Connections

Caution.

- The configuration option of having flow restrictors fitted to the probe determines the way the reference air and test gas flow is controlled. Ensure the instructions for the pneumatic connections are followed accurately – an incorrect configuration at the probe can cause errors and / or permanent damage.

- All configurations – do not use gas mixers online to supply test gases to the probe(s) unless it can be confirmed that errors are not introduced by the high delivery pressures required to the probe(s).

- Probes with restrictors – the reference air and test gas flow is regulated by the restrictors installed in the probe which require a set pressure of 1 bar (15 psi) to deliver the correct flows. Because the gases are delivered as a pressure at the probe it is permissible to use parallel pipework for multiple-probe installations.

- Probes without restrictors – the reference air and test gas flow is regulated by flowmeters (with integral needle valves) fitted in the delivery lines to the sensor – one flowmeter is required in each delivery line.

3.5.1 Pneumatic Connection Configurations

Refer to the pneumatic configuration flowchart (Fig. 3.3) below to identify which system configuration is the closest match for your components and then refer to the relevant figure in Section 3.5.2, page 9 or 3.5.3, page 10 for pneumatic settings.

![Fig. 3.3 Pneumatic Connection Configurations (Schematic)](image-url)
3.5.2 Pneumatic Connections for Probes with Restrictors

**Fig. 3.4 AutoCal with Test Gas Air and Optional Certified Test Gas**

- Clean Dry Oil-free Instrument Air \[\text{in}\]
- 10 Bar (145 psi) max.
- 5 µm / Oil Coalescing Filter Regulator
- 1 Bar (15 psi) Test Gas 1
- Vent to Dry Area (Unrestricted Flow)
- Reference Air
- Test Gas 2 (Optional)

**Fig. 3.6 Non-AutoCal with Test Gas Air and Optional Certified Test Gas**

- Clean Dry Oil-free Instrument Air \[\text{in}\]
- 10 Bar (145 psi) max.
- 5 µm / Oil Coalescing Filter Regulator
- 1 Bar (15 psi) Test Gas 1
- Vent to Dry Area (Unrestricted Flow)
- Reference Air
- *Shut-off Valve
- 3-Way Valve
- Test Gas 2 (Optional)
- 1 Bar (15 psi)

**Fig. 3.5 AutoCal with 2 Certified Test Gases**

- Reference Air Pump*
- Reference Air Supply
- 0.3 to 0.5 l/min (0.64 to 1.06 scfh)
- Preset Flow
- 1 Bar (15 psi) Test Gas 1
- 1 Bar (15 psi) Test Gas 2 (Optional)
- *Refer to page 36 for part numbers

**Fig. 3.7 Non-AutoCal with 2 Certified Test Gases**

- Reference Air Pump**
- Reference Air Supply
- 0.3 to 0.5 l/min (0.64 to 1.06 scfh)
- Preset Flow
- 1 Bar (15 psi) Test Gas 1
- 1 Bar (15 psi) Test Gas 2 (Optional)
- 3-Way Valve
- *Shut-off valve for test gas runs >10 m (33 ft.)
- **Refer to page 36 for part numbers
3.5.3 Pneumatic Connections for Probes without Restrictors

**Fig. 3.8 AutoCal with Test Gas Air and Optional Certified Test Gas**

- **AutoCal Probe**
- Vent to Dry Area (Unrestricted Flow)
- **Reference Air**
- Clean Dry Oil-free Instrument Air in 10 Bar (145 psi) max.
- **Test Gas 1**
- 1 Bar (15 psi)
- **5 µm / Oil Coalescing Filter Regulator**
- **Test Gas 2** (Optional)
- 1 Bar (15 psi)
- **Flow set to 2.2 l/min (4.662 scfh) STP**
- **Flow set to 0.3 to 0.5 l/min (0.64 to 1.06 scfh) STP**

**Fig. 3.9 AutoCal with 2 Certified Test Gases**

- **AutoCal Probe**
- Vent to Dry Area (Unrestricted Flow)
- **Reference Air Pump**
- Reference Air Supply 0.3 to 0.5 l/min (0.64 to 1.06 scfh) Preset Flow
- 1 Bar (15 psi)
- **Test Gas 1**
- 1 Bar (15 psi)
- **Test Gas 2** (Optional)
- 1 Bar (15 psi)
- **Flow set to 2.2 l/min (4.662 scfh) STP**
- **Refer to page 36 for part numbers**

**Fig. 3.10 Non-AutoCal with Test Gas Air and Optional Certified Test Gas**

- **Non-AutoCal Probe**
- Vent to Dry Area (Unrestricted Flow)
- **Reference Air Pump**
- Reference Air Supply 0.3 to 0.5 l/min (0.64 to 1.06 scfh) Preset Flow
- **Test Gas 1**
- 1 Bar (15 psi)
- **Test Gas 2** (Optional)
- 1 Bar (15 psi)
- **Flow set to 2.2 l/min (4.662 scfh) STP**
- **Refer to page 36 for part numbers**

**Fig. 3.11 Non-AutoCal with 2 Certified Test Gases**

- **Non-AutoCal Probe**
- Vent to Dry Area (Unrestricted Flow)
- **Reference Air Pump**
- Reference Air Supply 0.3 to 0.5 l/min (0.64 to 1.06 scfh) Preset Flow
- **Test Gas 1**
- 1 Bar (15 psi)
- **Test Gas 2** (Optional)
- 1 Bar (15 psi)
- **Flow set to 2.2 l/min (4.662 scfh) STP**
- **Refer to page 36 for part numbers**
3.6 Overall Dimensions

3.6.1 Remote Endura AZ20 Probe

Fig. 3.12 Overall Dimensions – Remote Endura AZ20 Probe

3.6.2 Integral Endura AZ20 Probe

Fig. 3.13 Overall Dimensions – Integral Endura AZ20 Probe
### 3.7 Endura AZ20 Probe Flanges – All Probe Lengths

**Note.** These flanges are not pressure rated.

Dimensions in mm (in).

<table>
<thead>
<tr>
<th>Flange Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
</tr>
<tr>
<td><strong>4-Hole Flanges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANSI 2 in 150</td>
<td>152.4 (6.00)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>120.6 (4.75)</td>
</tr>
<tr>
<td>ANSI 2.5 in 150</td>
<td>177.8 (7.00)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>139.7 (5.50)</td>
</tr>
<tr>
<td>ANSI 3 in 150</td>
<td>190.5 (7.50)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>152.4 (6.00)</td>
</tr>
<tr>
<td>DIN 65 PN16</td>
<td>185 (7.28)</td>
<td>12 (0.47)</td>
<td>18 (0.70)</td>
<td>145 (5.70)</td>
</tr>
<tr>
<td>JIS 65 5K</td>
<td>155 (6.10)</td>
<td>12 (0.47)</td>
<td>15 (0.59)</td>
<td>130 (5.12)</td>
</tr>
<tr>
<td>JIS 80 5K</td>
<td>180 (7.08)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>145 (5.71)</td>
</tr>
</tbody>
</table>

**Table 3.1 4-Hole Probe Flange Types and Dimensions**

<table>
<thead>
<tr>
<th>Flange Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
</tr>
<tr>
<td><strong>6-Hole Flanges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABB Standard (0.5 m [1.64 ft.] probes only)</td>
<td>101 (3.97)</td>
<td>6 (0.24)</td>
<td>7.3 (0.29)</td>
<td>80 (3.15)</td>
</tr>
<tr>
<td>ABB Standard</td>
<td>165 (6.50)</td>
<td>12 (0.47)</td>
<td>12.5 (0.50)</td>
<td>140 (5.51)</td>
</tr>
</tbody>
</table>

**Table 3.2 6-Hole Probe Flange Types and Dimensions**

<table>
<thead>
<tr>
<th>Flange Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
<td>(Ø)</td>
</tr>
<tr>
<td><strong>8-Hole Flanges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANSI 4 in 150</td>
<td>228.6 (9.0)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>190.5 (7.50)</td>
</tr>
<tr>
<td>DIN 80 PN16</td>
<td>200 (7.87)</td>
<td>12 (0.47)</td>
<td>18 (0.70)</td>
<td>160 (6.30)</td>
</tr>
<tr>
<td>DIN 100 PN16</td>
<td>220 (8.66)</td>
<td>12 (0.47)</td>
<td>18 (0.70)</td>
<td>180 (7.08)</td>
</tr>
<tr>
<td>JIS 100 5K</td>
<td>200 (7.87)</td>
<td>12 (0.47)</td>
<td>19 (0.75)</td>
<td>165 (6.50)</td>
</tr>
</tbody>
</table>

**Table 3.3 8-Hole Probe Flange Types and Dimensions**
3.8 Mounting Plates for ABB Standard Flanges

In addition to the probe flange, the probe can be supplied with a mounting plate assembly for use with ABB Standard flanges (see Table 3.2, page 12) if specified.

**Note.** A mounting plate is required if there is no existing mounting on the flue or boiler.

### 3.8.1 0.5 m (1.7 ft) Probe – Part No. AZ200 796

The 0.5 m (1.7 ft) probe mounting plate comprises the following items:
- probe mounting plate
- probe mounting gasket
- 6 x M6 shakeproof washers
- 6 x M6 plain washers
- 6 x M6 nuts

### 3.8.2 1.0 to 4.0 m (3.3 to 13.1 ft) Probes – Part No. AZ200 795

The 1.0 to 4.0 m (3.3 to 13.1 ft) probe mounting plates comprise the following items:
- probe mounting plate
- probe mounting gasket
- 6 x M10 shakeproof washers
- 6 x M10 plain washers
- 6 x M10 nuts

### 3.8.3 Long Probe to 0.5 m (1.7 ft) Probes Adaptor Plate – Part No. AZ200 794

The Long Probe to 0.5 m (1.7 ft) Probes Adaptor Plate comprises the following items:
- probe mounting plate
- probe adaptor gasket
- probe mounting gasket
- 6 x M6x16 hexagon-head steel screws
- 6 x M6 shakeproof washers

---

**Fig. 3.14 Standard Mounting Plate – 0.5 m (1.7 ft) Probe**

**Fig. 3.15 Standard Mounting Plate – 1.0 to 4.0 m (3.3 to 13.1 ft) Probes**

**Fig. 3.16 Long Probe to 0.5 m (1.7 ft) Probes Adaptor Plate**
3.9 Mounting

**Note.** Mount integral probes with the transmitter at the top of the probe head. Mount remote probes with the conduit at the bottom of the probe head.

3.9.1 Probe
To mount the probe (all sizes):

1. Cut a 120 mm (4.72 in) diameter hole in the flue wall (A).
2. Either:
   a. weld the mounting plate (B) into place, concentric with the hole in the flue
   or
   b. drill and bolt the plate to the flue
3. Fit the probe gasket (C) and insert the probe into the flue.
4. Secure the probe and gasket using nuts and washers (D) as follows:
   a. 0.5 m (1.7 ft) probe – 6 x M6 nuts and washers
   b. 1.0 to 4.0 m (3.3 to 13.1 ft) probe – 6 x M10 nuts and washers

*Fig. 3.17 Mounting the Probe*
3.9.2 0.5 m (1.64 ft) Probe to Large Probe Adapter Plate Mounting

Note. The following procedure enables a 0.5 m (1.7 ft) probe to be fitted into a large probe (1.0 to 4.0 m [3.3 to 13.1 ft]) ABB Standard flange hole.

1. Locate the adapter gasket A on the existing mounting plate.
2. Locate the adapter plate B on the gasket.
3. Secure the gasket and plate with 6 x M10 nuts and washers C.
4. Fit the probe gasket D over the probe end. Insert the probe into the flue.
5. Secure the probe and gasket using 6 x M6 screws and washers E.

Fig. 3.18 Adaptor Plate Mounting – 0.5 m (1.7 ft) Probe to Large Probe
3.10 End of Life Disposal
Both the integral and remote transmitters contain a small lithium battery that must be disposed of responsibly in accordance with local environmental regulations.

The remainder of the equipment does not contain any substance that causes undue harm to the environment and must be disposed of in accordance with the Directive on Waste Electrical and Electronic Equipment (WEEE). It must not be disposed of in Municipal Waste Collection.

3.11 Endura AZ20 Probe and Transmitter Weights (Unpacked and Packed)

<table>
<thead>
<tr>
<th>Length m (ft.)</th>
<th>Unpacked – kg (lb)</th>
<th>Packed – kg (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 (1.7)</td>
<td>9 (19.9)</td>
<td>14.2 (31.4)</td>
</tr>
<tr>
<td>1.0 (3.3)</td>
<td>11.3 (24.9)</td>
<td>17.9 (39.6)</td>
</tr>
<tr>
<td>1.5 (5.0)</td>
<td>13.5 (29.8)</td>
<td>21.7 (47.7)</td>
</tr>
<tr>
<td>2.0 (6.6)</td>
<td>15.8 (34.8)</td>
<td>25.4 (55.9)</td>
</tr>
<tr>
<td>2.5 (8.2)</td>
<td>18 (39.7)</td>
<td>30.7 (67.7)</td>
</tr>
<tr>
<td>3.0 (9.9)</td>
<td>20.3 (44.7)</td>
<td>34.4 (75.8)</td>
</tr>
<tr>
<td>3.5 (11.5)</td>
<td>22.5 (49.6)</td>
<td>38.1 (84.0)</td>
</tr>
<tr>
<td>4.0 (13.1)</td>
<td>24.8 (54.6)</td>
<td>41.8 (92.2)</td>
</tr>
</tbody>
</table>

Table 3.4 Endura AZ20 Probe Only (Excludes Transmitter)

<table>
<thead>
<tr>
<th>Length m (ft.)</th>
<th>Unpacked – kg (lb)</th>
<th>Packed – kg (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 (1.7)</td>
<td>12.5 (27.5)</td>
<td>17.72 (39.1)</td>
</tr>
<tr>
<td>1.0 (3.3)</td>
<td>14.8 (32.5)</td>
<td>21.43 (47.3)</td>
</tr>
<tr>
<td>1.5 (5.0)</td>
<td>17.0 (37.5)</td>
<td>25.14 (55.5)</td>
</tr>
<tr>
<td>2.0 (6.6)</td>
<td>19.3 (42.5)</td>
<td>28.35 (63.6)</td>
</tr>
<tr>
<td>2.5 (8.2)</td>
<td>21.5 (47.5)</td>
<td>34.17 (75.4)</td>
</tr>
<tr>
<td>3.0 (9.9)</td>
<td>23.8 (52.4)</td>
<td>37.38 (83.5)</td>
</tr>
<tr>
<td>3.5 (11.5)</td>
<td>26.0 (57.4)</td>
<td>41.59 (91.7)</td>
</tr>
<tr>
<td>4.0 (13.1)</td>
<td>28.3 (62.3)</td>
<td>45.30 (99.9)</td>
</tr>
</tbody>
</table>

Table 3.5 Integral Endura AZ20 Probe

<table>
<thead>
<tr>
<th>Length m (ft.)</th>
<th>Unpacked – kg (lb)</th>
<th>Packed – kg (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 (1.7)</td>
<td>11.5 (25.4)</td>
<td>16.7 (36.9)</td>
</tr>
<tr>
<td>1.0 (3.3)</td>
<td>13.6 (30.3)</td>
<td>20.5 (45.1)</td>
</tr>
<tr>
<td>1.5 (5.0)</td>
<td>16.0 (35.3)</td>
<td>24.2 (53.3)</td>
</tr>
<tr>
<td>2.0 (6.6)</td>
<td>18.3 (40.3)</td>
<td>27.9 (61.4)</td>
</tr>
<tr>
<td>2.5 (8.2)</td>
<td>20.5 (42.2)</td>
<td>33.2 (73.2)</td>
</tr>
<tr>
<td>3.0 (9.9)</td>
<td>22.8 (50.2)</td>
<td>36.9 (81.3)</td>
</tr>
<tr>
<td>3.5 (11.5)</td>
<td>25.0 (55.2)</td>
<td>40.6 (89.5)</td>
</tr>
<tr>
<td>4.0 (13.1)</td>
<td>27.3 (60.1)</td>
<td>44.3 (97.7)</td>
</tr>
</tbody>
</table>

Table 3.6 Endura AZ20 Probe and Remote Transmitter
4 Connections

4.1 Electrical Safety

Warning.

- The transmitter is not fitted with a switch therefore a disconnecting device such as a switch or circuit breaker conforming to local safety standards must be fitted to the final installation. It must be fitted in close proximity to the instrument within easy reach of the operator and must be marked clearly as the disconnection device for the transmitter – see IM/AZ20E–EN.

- The probe must be bonded to local earth via the external earth connection – see Fig. 4.1.

- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.

- Remove all power from supply, relay and any powered control circuits and high common mode voltages before accessing or making any connections.

- The Endura AZ20 cable carries the screened signal wires and the separately screened 90 to 264 V AC heater wires safely. Do not use alternative wires.

- The equipment conforms to Installation Category II of IEC 61010.

- All connections to secondary circuits must have basic insulation.

- After installation, there must be no access to live parts, for example, terminals.

- Terminals for external circuits are for use only with equipment with no accessible live parts.

- If the equipment is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.

- All equipment connected to the transmitter’s terminals must comply with local safety standards (IEC 60950, EN601010-1).

Caution.

- Make connections only as shown.

- Maintain Environmental Protection at all times.

- Ensure the seal and mating surfaces are clean to maintain environmental rating.

- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further 1/2 to 3/4 turn using a suitable spanner or wrench.

- Fit blanking plugs where required.

- Inductive loads must be suppressed or clamped to limit voltage swings.

- Operation of outputs is programmable.
4.2 Cable Preparation

4.2.1 Endura AZ20 Probe to Remote Endura AZ20 Transmitter

Warning. The Endura AZ20 cable carries the screened signal wires and the separately screened 90 to 264 V AC heater wires safely.

- If alternative cables are used, the cable sizes and insulation specifications must be adhered to and the 90 to 264 V AC heater wires must be screened separately to prevent interference to the signal cables.
- If the signal cables are not contained in a suitable metallic conduit, they must also be screened separately to prevent external interference.

Referring to Fig. 4.2:

1. Expose the signal and screen wires by cutting the outer insulation sheath and screen foil and inner (heater) insulation sheath and screen foil back to the following lengths:
   - Probe connection wires \( \text{A} \) – 150 mm (6 in.)
   - Transmitter connection wires \( \text{B} \) – 100 mm (4 in.)

2. At both ends of the probe cable, twist the 2 screen wires \( \text{C} \) together to form one twisted pair at each end and fit an earth sleeve (not supplied) over each twisted pair.

   Leave 10 mm (0.4 in.) of each twisted pair exposed for connection at the terminal plugs.

3. Prepare the signal and heater wire ends \( \text{D} \) for connection at the terminal plug(s) by cutting sleeves back to expose 10 mm (0.4 in.) of bare wire.

4. Important – on non-AutoCal probes, do not cut the AutoCal wires back to the outer insulation sheath. Instead, bundle them together at both the transmitter and probe end to allow a future AutoCal upgrade if required to be performed using the existing cable.

   AutoCal wires comprise:
   - White / Yellow – PS2
   - White / Black – PS Common
   - White / Orange – PS1
   - White / Green – SV1
   - White / Red – SV Common
   - White / Blue – SV2

5. Proceed to Section 4.3, page 20 to make probe cable connections at the remote probe.
Warning:
*Heater wires (blue, brown) rated at 85 to 265 V.
**Screens 1 and 2 must be joined for correct operation.
4.3 Electrical Connections

4.3.1 Endura AZ20 Probe Transmitter Connections

Notes.
- Non-AutoCal probes are not fitted with the 6-way AutoCal terminal block or pressure switch / solenoid valve block.
- For probes fitted with AutoCal, make standard connections (steps 1 to 5), then AutoCal connections as detailed in Section 4.3.2, page 21.
- For non-AutoCal probes, retain the unused AutoCal wires to allow for a future upgrade – see Table 4.2 for AutoCal wire colors.

Referring to Fig. 4.3:
1. Unscrew and remove the probe end cap A.
2. Pass probe cable B through probe entry gland C taking care not to disturb the existing wiring D.
3. Remove terminal plug E from probe terminal block F.
4. Make terminal plug connections as shown in Table 4.1:

<table>
<thead>
<tr>
<th>Terminal / Cable Color</th>
<th>Tag ID</th>
<th>Tx Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violet</td>
<td>ACJC</td>
<td>Pt1000 Cold Junction Compensation</td>
</tr>
<tr>
<td>Grey</td>
<td>ACJC</td>
<td>Pt1000 Cold Junction Compensation</td>
</tr>
<tr>
<td>Red</td>
<td>Cell +</td>
<td>Oxygen Input (+ve)</td>
</tr>
<tr>
<td>Black</td>
<td>Cell -</td>
<td>Oxygen Input (-ve)</td>
</tr>
<tr>
<td>Green</td>
<td>TC+</td>
<td>Thermocouple (+ve)</td>
</tr>
<tr>
<td>White</td>
<td>TC -</td>
<td>Thermocouple (-ve)</td>
</tr>
<tr>
<td>Light Yellow (Sleeved Screens)</td>
<td>SCN</td>
<td>Screens 1 and 2 (Screens 1 and 2 must be connected for correct operation)</td>
</tr>
<tr>
<td>Brown</td>
<td>H</td>
<td>Oven</td>
</tr>
<tr>
<td>Blue</td>
<td>H</td>
<td>Oven</td>
</tr>
</tbody>
</table>

5. Carefully connect terminal plug E into probe terminal block F taking care not to disturb the existing wiring D.
6. For probes fitted with AutoCal, proceed to Section 4.3.2, page 21.
7. For probes without AutoCal, tighten cable gland C.
8. Refit the probe end cap A and tighten hand-tight.
9. Refer to IM/AZ20E-EN for transmitter connections.
4.3.2 AutoCal Connections at Endura AZ20 Probe

1. Make standard connections – see section 4.3.1, page 20, steps 1 to 5.

Referring to Fig. 4.4:

2. Remove terminal plug (A) from probe terminal block (B) taking care not to disturb the existing wiring (C).

3. Make AutoCal terminal plug connections as shown in Table 4.2:

<table>
<thead>
<tr>
<th>Terminal / Cable Color</th>
<th>Tag ID</th>
<th>AutoCal Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>White / Yellow</td>
<td>PS2</td>
<td>Pressure Switch Gas 2</td>
</tr>
<tr>
<td>White / Black</td>
<td>PS COM</td>
<td>Pressure Switch Common</td>
</tr>
<tr>
<td>White / Orange</td>
<td>PS1</td>
<td>Pressure Switch Gas 1</td>
</tr>
<tr>
<td>White / Green</td>
<td>SV1</td>
<td>Solenoid Valve Gas 1</td>
</tr>
<tr>
<td>White / Red</td>
<td>SV COM</td>
<td>Solenoid Valve Common</td>
</tr>
<tr>
<td>White / Blue</td>
<td>SV2</td>
<td>Solenoid Valve Gas 2</td>
</tr>
</tbody>
</table>

Table 4.2 AutoCal Connections at Probe

4. Carefully plug the terminal plug (A) into probe terminal block (B) taking care not to disturb the existing wiring (C).

5. Tighten cable gland (D).

6. Refit the probe end cap (E) and tighten hand-tight.

7. Refer to IM/AZ20E-EN for transmitter connections.
4.4 Gas and Air Connections
Two test gas inlets, one reference air inlet and one vent inlet are located on the probe head. An external earth (bonding) point is also provided.

Caution. Only use clean dry oil-free instrument air,* or traceable certified bottled test gas mixtures of O₂ / N₂.

4.4.1 Restrictors
Systems can be ordered with or without restrictors – refer to Sections 3.5.2 and 3.5.3 on pages 9 and 10 for schematics of all configuration options.

Where restrictors are not fitted, it is necessary to add flowmeters to the test gas lines and reference air line.

- on systems with restrictors, set pressures to 1 bar (15 psi) = 2.2 l / min (0.58 US gal / min)
- on systems without restrictors, pressure is still set to 1 bar (15 psi) then flow is restricted by valves on flowmeters

4.4.2 Connection Types
Note. Connection types comprise:

- 1/4 NPT female threaded entry supplied with 1/4 in OD compression fitting

or

- 1/4 BSP female threaded entry supplied with 6 mm OD compression fitting

4.4.3 Orientation of External Connections
Fig. 4.5 shows the 2 orientations for test gas, reference air and the vent.

Caution. Only use clean dry oil-free instrument air,* or traceable certified bottled test gas mixtures of O₂ / N₂.

4.4.3 Orientation of External Connections
Fig. 4.5 shows the 2 orientations for test gas, reference air and the vent.

*ABB recommend our 5 µm / Oil Coalescing Filter Regulator – see Appendix D, page 36.
### 4.4.4 Test Gas Inlets

Two test (calibration) gas inlets are provided for in situ AutoCal probe testing using a test gas.

If AutoCal is not fitted, Test Gas 1 connection is used for Test Gases 1 and 2. The gas connections are switched manually, as requested by the calibration sequencing in the transmitter.

**Note.** Test gas connection to non-AutoCal transmitters is made to the external TG1 connection only. TG2 connection is blanked off permanently.

If the probe is connected permanently to the test gas supply pipework:

- fit a high quality, corrosion-resistant (stainless steel), solenoid valve, manually operated valve or non-return valve (that is leaktight even at zero back-pressure) in the pipework, as close to the test gas inlet valve as possible
- keep the valve closed when the calibration system is not in use

**Caution.** If the test gas connection is not sealed when not in use, air leaking into the probe via the connection causes measurement errors. In a pressurized flue, gases venting to atmosphere through the connection cause corrosion of, and / or block, the test gas tube. In a negative pressure flue, air leakage causes high O₂ reading errors.

**Note.** It is preferable to use air (20.95 % O₂) as one of the test gases as this is the sensor’s zero point. Alternative representative gases can be used according to local environmental conditions.

To ensure better accuracy, use 2 test gases that represent the top and bottom limits of the known operating range.

Due to resolution accuracies, do not calibrate the system with gases of less than 1 % O₂.

---

![Test Gas Connections](image-url)
4.4.5 Vent
The vent allows the reference air to escape to atmosphere. If the vent is likely to be exposed to moisture, connect a tube to the vent and route to a dry area.

Ensure that the vent, or the vent tube, does not become blocked during probe use.

Fig. 4.7 Vent

4.4.6 Reference Air Inlet
A clean, dry, oil-free air supply is required, (for example, from a pump or filter-regulator – see Appendix D, page 36.

Connect the reference air tubing to the external reference air inlet – see Fig. 4.8.

Note.
- The reference air supply must be to instrument air standards – clean, dry and free of oil vapor and particle contamination; see schematics in Sections 3.5.2 and 3.5.3 on pages 9 and 10.
- ABB recommend using the ABB 5µm / Oil Coalescing Filter Regulator to supply reference air – see Appendix D, page 36.
- If oil vapor is suspected, use an ABB Reference Air Pump to supply reference air to the probe – see Appendix D, page 30.

4.4.7 Inline Shut-off Valves
On non-AutoCal systems, if the test gas line is connected permanently and is >10 m (33 ft.) from the supply, fit non-return valves at the probe head to prevent breathing of flue gas in and out of test gas lines.
4.4.8 Internal Test Gas and Reference Air Tubes

Fig. 4.9  Internal Test Gas and Reference Air Tubes – Non-AutoCal

Fig. 4.10  Internal Test Gas and Reference Air Tubes – AutoCal Fitted
5 Start-up and Operation

5.1 Preparation

1. If the probe is not connected permanently to test gas pipework for automatic calibration purposes, ensure blanking plugs are securely fitted to the test gas inlet connections on the probe.

2. If the probe is connected permanently to test gas pipework for automatic calibration purposes, ensure that the valve installed in the pipework adjacent to the test gas connection is closed.

3. Check the connections on both the probe and the transmitter. Test gas connections must be checked for leaktight joints. Leaks, especially on permanently pressurized AutoCal-fitted probes, can cause errors and drain away expensive bottles of test gas.

4. Adjust the reference air flow to a stable flow rate between 0.3 and 0.5 l/min (0.64 and 1.06 scfh) for probes with no restrictors fitted or 1 bar (15 psi) for probes with restrictors fitted.
   - refer to Section 3.5.2, page 9 for probes fitted with AutoCal.
   - refer to Section 3.5.3, page 10 for probes without AutoCal.

5. Set the test gas flows – Section 5.2, following.

6. Calibrate the system as detailed in IM/AZ20E-EN

---

**Caution.** If the test gas connection is not sealed when not in use, air leaking into the probe via the connection causes measurement errors. In a pressurized flue, gases venting to atmosphere through the connection cause corrosion of, and/or block, the test gas tube. In a negative pressure flue, air leakage causes high O₂ reading errors.

---

5.2 Setting Up Test Gases

This section prepares the system for manual and automatic calibration routines by setting up the test gas flows and pressures to suit different AutoCal / restrictor configurations:

- refer to Sections 3.5.2 and 3.5.3, pages 9 and 10 for test gas and reference air supply configurations.
- connections are the same for remote and integral transmitters.

---

**Note.** The following sections assume the transmitter and probe are energized, the reference air supply is on and test gases are available.

5.2.1 AutoCal System with Restrictors

To set up an AutoCal system with restrictors:

1. Make test gas and reference air connections as detailed in Section 3.5.2, page 9 (remote or integral transmitter).

2. Turn on Test Gas 1 and set the pressure to a nominal 1 bar (15 psi).

3. At the transmitter, check the Calibrate / AutoCal Hardware / Hardware Type parameter is set to Internal.

4. At the transmitter, open the Test Gas 1 valve by selecting: Calibrate / AutoCal Hardware / Valve Manual Control / Test Gas 1 and pressing to open the valve.

   A small icon is displayed to indicate the valve is in the Open position:

   ![Valve Icon Open Position](image)

5. Fine tune Test Gas 1 pressure to 1 bar (15 psi).

6. Turn gas off at the transmitter by pressing , then turn Test Gas 1 off at the supply.

7. Repeat steps 2 to 6 for Test Gas 2 (if present).

8. Refer to IM/AZ20E-EN to perform a calibration when required.

---

**Note.** Only perform a final system calibration after the probe has been thermally stable for 2 hours.
5.2.2 AutoCal System without Restrictors
To set up an AutoCal system without restrictors:

1. Make test gas and reference air connections as detailed in Section 3.5.2, page 9 (remote or integral transmitter).

2. Turn on Test Gas 1 and set the pressure to a nominal 1 bar (15 psi).

3. At the transmitter, check the Calibrate / AutoCal Hardware / Hardware Type parameter is Internal.

4. At the transmitter, open the ‘Test Gas 1’ valve by selecting: Calibrate / AutoCal Hardware / Valve Manual Control / Test Gas 1 and pressing \( \text{\textbullet} \) to open the valve.

A small icon is displayed to indicate the valve is in the Open position:

5. Fine tune Test Gas 1 pressure to 1 bar (15 psi) and set the flow on the flowmeter to 2.2 l / min (4.662 scfh).

6. Turn gas off at the transmitter by pressing \( \text{\textbullet} \), then turn Test Gas 1 off at the supply.

7. Repeat steps 2 to 6 for Test Gas 2 (if present).

8. Refer to IM/AZ20E-EN to perform a calibration when required.

5.2.3 Non-AutoCal System with Restrictors
To set up an Non-AutoCal system with restrictors:

1. Make test gas and reference air connections as detailed in Section 3.5.3, page 10 (remote or integral transmitter).

2. Turn on Test Gas 1 and adjust the pressure to 1 bar (15 psi).

3. Turn Test Gas 1 off at the supply.

4. Repeat steps 2 to 4 for Test Gas 2 (if present), connect the Test Gas 2 line to the probe’s external TG1 connection.

5. Refer to IM/AZ20E-EN to perform a calibration when required.

5.2.4 Non-AutoCal System without Restrictors
To set up an Non-AutoCal system without restrictors:

1. Make test gas and reference air connections as detailed in Section 3.5.3, page 10 (remote or integral transmitter).

2. Turn on Test Gas 1, adjust the pressure to 1 bar (15 psi) and the flow on the flowmeter to 2.2 l / min (4.662 scfh).

3. Turn Test Gas 1 off at the supply.

4. Repeat steps 2 to 4 for Test Gas 2 (if present), connecting the Test Gas 2 line to the probe’s external TG1 connection.

5. Refer to IM/AZ20E-EN to perform a calibration when required.

Note. Test Gas 1 and 2 connections are made to the probe’s external Test Gas 1 (TG1) connection and must be switched manually – see section 3.5.3, page 10.
6 Endura AZ20 Probe Specification

Physical

Probes insertion lengths

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Insertion Length (ft)</th>
</tr>
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<td>0.5</td>
<td>1.7</td>
</tr>
<tr>
<td>1.0</td>
<td>3.3</td>
</tr>
<tr>
<td>1.5</td>
<td>5.0</td>
</tr>
<tr>
<td>2.0</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Process connection

All probe lengths:
- ANSI B16.5 150 lb
- 2, 2.5, 3, 4 in
- DIN 2501 Part 1
- 65, 80, 100 mm
- JIS B2238 5K
- NPT

Note. Flange pressure ratings do not apply for 0.5 m (1.7 ft.) probes.

Probes with restrictors

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Insertion Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>19.7 in (500 mm)</td>
</tr>
<tr>
<td>1.0</td>
<td>39.4 in (1000 mm)</td>
</tr>
</tbody>
</table>

Probe body material

316L stainless steel

Mounting angle

Horizontal to vertically down

Operational requirements

Reference air

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulated supply</td>
<td>Probes with restrictors: 1 bar (15 psi), flowmeters not required</td>
</tr>
<tr>
<td></td>
<td>Probes without restrictors: 1 bar (15 psi), flowmeters required with flow set to 0.3 ... 0.5 l/min (0.64 ... 1.06 scfh)</td>
</tr>
<tr>
<td>Pumped supply</td>
<td>Probes with / without restrictors: preset flow 0.3 ... 0.5 l/min (0.64 ... 1.06 scfh)</td>
</tr>
</tbody>
</table>

Test gas

User-selectable, 100 ... 0.1 % O₂ balance N₂ and / or air (air is recommended as one of the test gases)

- Probes with restrictors: 1 bar (15 psi), flowmeters not required as restrictors preset flow to 2.2 l/min (4.662 scfh)
- Probes without restrictors: 1 bar (15 psi), flowmeters required, set to 2.2 l/min (4.662 scfh) flow

Calibration

Manual, semi-automatic or automatic (controlled by Endura AZ20 transmitter)

Automatic calibration

AutoCal hardware

Optional built-in solenoid valves for control of test gas flow

Built-in pressure switches to detect presence of test gases

Heater Operational Requirements

Endura AZ20 Probe Heater

Nominally 190 Ω, 70 W at 115 V AC – power is limited to 70 W max. by Endura AZ20 transmitter over a 100 ... 240 V AC ±10 % (90 V min, 264 V max.) 50 / 60 Hz range.

Endura AZ20/ZFG2 Replacement Probe Heater

Nominally 25Ω, 120 W at 55 V AC – for use with ZDT or ZMT transmitters only
Appendix A – Principle of Operation

The Endura AZ20 probe’s zirconia cell is a thimble-shaped sensing element fitted with inner and outer electrodes at its closed end. The inner electrode is exposed to the flue gas entering the open end of the cell; the outer electrode is supplied with reference air from a pump or regulator and is therefore exposed to a constant partial pressure of oxygen (20.95 % O₂). The cell is held at a constant 700°C (1292 °F) by a heater and control thermocouple.

Because zirconia is an electrolyte that conducts only oxygen ions at temperatures in excess of 600°C (1112 °F), the voltage generated between the electrodes (the cell output) is a function of the ratio of the oxygen partial pressure difference between the reference electrode and the measuring electrode and its temperature. Therefore, any change in the oxygen partial pressure of the flue gas at the exposed electrode produces a change in the cell output voltage as dictated by the Nernst equation.

Cell output voltage increases logarithmically with decreasing oxygen, thus providing high sensitivity at low oxygen levels.

---

Fig. A.1 Endura AZ20 Probe Construction
Appendix B – Endura AZ20/ZFG2 Replacement Probe

The Endura AZ20/ZFG2 replacement probe can be connected to existing ZMT transmitters or ZDT-FG analyzers to replace existing ZFG2 probes. To allow direct replacement, Endura AZ20/ZFG2 replacement probes are supplied with a single M20 gland conduit of 6 or 10 m (18 or 30 ft) length. NPT versions are supplied with a single 1/2 in NPT female threaded entry only.

Note. For Endura AZ20/ZFG2 replacement probe test gas and connection details at the existing ZMT transmitter or ZDT-FG analyzer, refer to the following manuals:

- IM/ZDT-FG – copies of the IM/ZDT/FG manual can be downloaded from the ABB web site (www.abb.com).
- IM/ZMT – copies of the IM/ZMT manual can be downloaded from the ABB website (www.abb.com).

Fig. B.1 Endura AZ20/ZFG2 Replacement Probe with Existing System
B.1 Endura AZ20/ZFG2 Replacement Probe Conduit Electrical Connections

Important.
- For removal of the existing ZFG2 probe (complete with its conduit assembly) and installation of the Endura AZ20/ZFG2 replacement probe, refer to the ZFG2 probe manual (this manual can be downloaded from the ABB web site at [www.abb.com](http://www.abb.com) or by clicking the following link: IM/ZFG2).
- The Endura AZ20/ZFG2 replacement probe must be installed using the new conduit supplied with the probe.

B.1.1 Electrical Connections

Referring to Fig. B.2:

1. Unscrew and remove probe end cap A.
2. Pass conduit B through probe entry gland C taking care not to disturb the probe’s internal wiring D.
3. Tighten cable gland C.
4. Make connections E to colored terminal plug connections as shown in Table B.1:

<table>
<thead>
<tr>
<th>Terminal / Cable Color</th>
<th>Tag ID</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violet</td>
<td></td>
<td>Not Used</td>
</tr>
<tr>
<td>Grey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Cell +</td>
<td>Oxygen Input (+ve)</td>
</tr>
<tr>
<td>Blue</td>
<td>Cell –</td>
<td>Oxygen Input (–ve)</td>
</tr>
<tr>
<td>White</td>
<td>TC+</td>
<td>Thermocouple (+ve)</td>
</tr>
<tr>
<td>Blue</td>
<td>TC –</td>
<td>Thermocouple (–ve)</td>
</tr>
<tr>
<td>Braid</td>
<td>Cell SCN</td>
<td>Screen</td>
</tr>
<tr>
<td>Brown</td>
<td>H</td>
<td>Heater</td>
</tr>
<tr>
<td>Blue</td>
<td>H</td>
<td>Heater</td>
</tr>
</tbody>
</table>

Table B.1 Probe Transmitter Cable Connections

B.1.2 Endura AZ20/ZFG2 Replacement Probe – Conduit Reference Air Connections

Referring to Fig. B.3:

1. For probes using the conduit (internal) Reference Air line:
   a. disconnect pipe A at the hexagonal fitting B.
   b. reconnect pipe A to the internal Reference Air tube C coming from the conduit – ensure flexible tubing does not kink (especially after the probe end cap is re-fitted)
   c. fit a blanking plug to the external ‘Ref. Air’ connection at B on the probe body to prevent water ingress
   d. proceed to step 3.

2. For probes using an external Reference Air line, connect the existing reference air supply line to the probe’s external ‘Ref. Air’ connection – see section 4.4.6, page 24.

3. Refit probe end cap D and screw it hand-tight.

4. Refer to Appendix B.2, page 33 for connections to ZDT-FG analyzers or Appendix B.3 page 34 for connections to ZMT transmitters.

Fig. B.3 Endura AZ20/ZFG2 Replacement Probe – Conduit Reference Air Connections
B.2 ZDT-FG Analyzer Connections

**Warning.** Before disconnecting existing ZFG2 conduit, or connecting the new Endura AZ20/ZFG2 replacement probe conduit, ensure the power supply, any powered control circuits and high common-mode voltages are switched off.

B.2.1 Disconnecting the Existing ZFG2 Probe

Referring to Fig. B.4:

1. Unlock and remove the lower panel (A) from the ZDT-FG analyzer, remove the 2 shroud retaining screws (B) and remove shroud (C).

2. Disconnect wires from heater terminal (D), cell terminal (E), thermocouple terminal (F) and loosen conduit entry gland (G).

3. For analyzers using the conduit’s Reference Air line, disconnect existing reference air supply (H), remove the conduit and proceed to step 5.

4. For analyzers using an external Reference Air connection, leave the existing reference air supply pipe (I) in place.

**Note.** For analyzers without internal pumps, the Reference Air connection is made directly to the probe’s external ‘Ref. Air’ connection – see Fig. B.1, page 30.

B.2.2 Connecting the Endura AZ20/ZFG2 Replacement Probe

Referring to Fig. B.4:

1. Pass the new conduit through entry gland (G) and tighten the gland.

2. Make connections to heater terminal (D), cell terminal (E), thermocouple terminal (F) as shown in Table B.2.

3. For probes using the conduit’s Reference Air supply, connect conduit reference air line (H).

4. Refit shroud (C) and secure it with the 2 shroud retaining screws (B).

5. Refit the lower panel (A).

---

**Table B.2 Conduit Connections at ZDT-FG Analyzer**

<table>
<thead>
<tr>
<th>ZDT-FG Terminal</th>
<th>Connection</th>
<th>Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Heater</td>
<td>Brown</td>
</tr>
<tr>
<td>H</td>
<td>Heater</td>
<td>Blue</td>
</tr>
<tr>
<td>E</td>
<td>Heater Earth</td>
<td>Green / Yellow</td>
</tr>
<tr>
<td>Cell +</td>
<td>Oxygen Input (+ve)</td>
<td>Red</td>
</tr>
<tr>
<td>Cell –</td>
<td>Oxygen Input (-ve)</td>
<td>Blue</td>
</tr>
<tr>
<td>Cell SCN</td>
<td>Oxygen Input Screen</td>
<td>Braid</td>
</tr>
<tr>
<td>TC+</td>
<td>Thermocouple (+ve)</td>
<td>White</td>
</tr>
<tr>
<td>TC–</td>
<td>Thermocouple (-ve)</td>
<td>Blue</td>
</tr>
</tbody>
</table>

*External air line to internal pump (used if conduit air line is not connected). For analyzers with no internal pump, the Reference air line connects directly to the probe’s external ‘Ref. Air’ connection – see Fig. B.1, page 30.

---

Fig. B.4 Endura AZ20/ZFG2 Replacement Probe
Conduit Connections at ZDT-FG Analyzer
B.3 ZMT Transmitter Connections

**Warning.** Before disconnecting or connecting conduit, ensure the power supply, any powered control circuits and high common-mode voltages are switched off.

### B.3.1 Disconnecting the Existing ZFG2 Probe

Referring to Fig. B.3:

1. Unlock and open the door A, remove the 2 retaining screws B and remove the mains protection plate C.
2. Disconnect wires from heater terminal D, cell terminal E and thermocouple terminal F and loosen conduit entry gland G.
3. For probes using the conduit’s Reference Air line, disconnect existing reference air supply pipe H, remove the conduit and proceed to step 5.
4. For probes using an external Reference Air connection, leave the existing reference air supply I in place.

**Note.** For transmitters without internal pumps, the Reference Air connection is made directly to the probe’s external ‘Ref. Air’ connection – see Fig. B.1, page 30.

### B.3.2 Connecting the Endura AZ20/ZFG2 Replacement Probe

Referring to Fig. B.3:

1. Pass the new conduit through entry gland G and tighten the gland.
2. Make connections to heater terminal D, cell terminal E and thermocouple terminal F, as listed in Table B.2.

<table>
<thead>
<tr>
<th>ZMT Terminal</th>
<th>Connection</th>
<th>Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Heater</td>
<td>Brown</td>
</tr>
<tr>
<td>H</td>
<td>Heater</td>
<td>Blue</td>
</tr>
<tr>
<td>E</td>
<td>Heater Earth</td>
<td>Green / Yellow</td>
</tr>
<tr>
<td>Cell +</td>
<td>Oxygen Input (+ve)</td>
<td>Red</td>
</tr>
<tr>
<td>Cell –</td>
<td>Oxygen Input (–ve)</td>
<td>Blue</td>
</tr>
<tr>
<td>Cell SCN</td>
<td>Oxygen Input Screen</td>
<td>Braid</td>
</tr>
<tr>
<td>TC+</td>
<td>Thermocouple (+ve)</td>
<td>White</td>
</tr>
<tr>
<td>TC–</td>
<td>Thermocouple (–ve)</td>
<td>Blue</td>
</tr>
</tbody>
</table>

**Table B.3 Conduit Connections at ZMT Transmitter**

3. For probes using the conduit’s Reference Air supply, connect conduit reference air line H.
4. Refit the mains protection plate C and secure it with the 2 retaining screws B.
5. Close and lock the door A.

---

Fig. B.5 Endura AZ20/ZFG2 Replacement Probe
Conduit Connections at ZMT Transmitter
Appendix C – Using an External Automatic Calibration Panel

Warning. Isolate the Endura AZ20 transmitter and external automatic calibration panel before making AutoCal connections.

Referring to Fig. C.1, relay outputs 1 and 2 from the Endura AZ20 transmitter can be used to switch solenoid valves in an external automatic calibration panel to provide AutoCal functionality. The external automatic calibration components must be powered by an independent supply.

![Diagram of Endura AZ20 Transmitter Relay Outputs and External Automatic Calibration Panel Connections]

*24 V, 2 W or relay NO / NC

Test gas pressure 1 bar (15 psi) = 2.2 L / min (4.662 scfh)

Fig. C.1 Schematic – Example of External Automatic Calibration Panel
### Appendix D – Accessories and Spares

#### D.1 Documentation

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM/AZ20M-EN</td>
<td>Maintenance Guide</td>
</tr>
<tr>
<td>D.2 Probe Spares</td>
<td></td>
</tr>
</tbody>
</table>

- **Download** the Maintenance Guide from: [www.ABB.com/analytical-instruments](http://www.ABB.com/analytical-instruments)
  - Enter this address in your browser and then type IM/AZ20M-EN in the search box. The Maintenance Guide is the top link.

#### D.2 Probe Spares

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ200 700</td>
<td>Cell Assembly (includes Commissioning label and C-ring)</td>
</tr>
<tr>
<td>AZ200 727</td>
<td>Restrictor Upgrade Kit</td>
</tr>
<tr>
<td>AZ200 728</td>
<td>Probe End Cap (includes wiring labels)</td>
</tr>
<tr>
<td>AZ200 729</td>
<td>Diffuser Flame Arrestor Assembly (includes C-ring)</td>
</tr>
<tr>
<td>AZ200 730 (NPT) AZ200 733 (BSP)</td>
<td>AutoCal Upgrade Assembly</td>
</tr>
<tr>
<td>Length dependant:</td>
<td></td>
</tr>
<tr>
<td>AZ20 Standard – see Table D.2</td>
<td></td>
</tr>
<tr>
<td>AZ20/ZFG2 Replacement Probe – see Table D.3</td>
<td></td>
</tr>
<tr>
<td>Application dependant – see Table D.4</td>
<td></td>
</tr>
<tr>
<td>Length dependant – see Table D.1</td>
<td></td>
</tr>
</tbody>
</table>

#### Table D.1 Thermocouple / Electrode Assembly

<table>
<thead>
<tr>
<th>Probe Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m (1.7 ft.)</td>
<td>AZ200 701</td>
</tr>
<tr>
<td>1.0 m (3.3 ft.)</td>
<td>AZ200 702</td>
</tr>
<tr>
<td>1.5 m (5.0 ft.)</td>
<td>AZ200 703</td>
</tr>
<tr>
<td>2.0 m (6.6 ft.)</td>
<td>AZ200 704</td>
</tr>
</tbody>
</table>

#### Table D.2 AZ20 Standard Probe Heater Assembly

<table>
<thead>
<tr>
<th>Probe Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m (1.7 ft.)</td>
<td>AZ200 710</td>
</tr>
<tr>
<td>1.0 m (3.3 ft.)</td>
<td>AZ200 711</td>
</tr>
<tr>
<td>1.5 m (5.0 ft.)</td>
<td>AZ200 712</td>
</tr>
<tr>
<td>2.0 m (6.6 ft.)</td>
<td>AZ200 713</td>
</tr>
</tbody>
</table>

#### Table D.3 AZ20/ZFG2 Replacement Probe Heater Assembly

<table>
<thead>
<tr>
<th>Probe Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 m (1.7 ft.)</td>
<td>AZ200 720</td>
</tr>
<tr>
<td>1.0 m (3.3 ft.)</td>
<td>AZ200 721</td>
</tr>
<tr>
<td>1.5 m (5.0 ft.)</td>
<td>AZ200 722</td>
</tr>
<tr>
<td>2.0 m (6.6 ft.)</td>
<td>AZ200 723</td>
</tr>
</tbody>
</table>

#### Table D.4 ABB NPT/BSP Flowmeters

<table>
<thead>
<tr>
<th>Flowmeter Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 NPT Flowmeter (Reference Air): 0.1 to 0.85 l / min (0.21 to 1.8 scfh) STP</td>
<td>AZ200 786</td>
</tr>
<tr>
<td>1/4 BSP Flowmeter (Reference Air): 0.1 to 0.85 l / min (0.21 to 1.8 scfh) STP</td>
<td>AZ200 787</td>
</tr>
<tr>
<td>1/4 NPT Flowmeter (Test Gas): 0.6 to 4.4 l / min (1.27 to 9.32 scfh) STP</td>
<td>AZ200 788</td>
</tr>
<tr>
<td>1/4 BSP Flowmeter (Test Gas): 0.6 to 4.4 l / min (1.27 to 9.32 scfh) STP</td>
<td>AZ200 789</td>
</tr>
</tbody>
</table>
Products and customer support

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 Flowmeters
- Turbine Flowmeters
- Wedge 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.

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

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

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:
- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.