Endura AZ10 oxygen analyzer
Combustion gas analysis for small package boilers and marine
Measurement made easy
Superior technology and quality from the world leader in oxygen measurement

Advanced design and precision manufacturing
- robust, long-life probe for process temperatures up to 800 °C (1472 °F)
- multi-layered electrode prolongs cell life even in SO$_x$ environment
- proven cell design from over 50 years experience
- fast response to process variations
- stable and accurate oxygen measurement
- accuracy better than ≤1 % of reading or ±0.05 %O$_2$

Marine certification
- IACS E10 Rev. 5.0 2006 Test Specification for type approval
- ABS certificate 15-LD1262098-PDA

Advanced transmitters
- onboard sensor lifetime indicator gives pre-warning of sensor status
- HART® communication v5.7

Manual-, remote- or automatic-calibration
- automatically on time schedule
- can be initiated locally or by external command

Rapid commissioning and start-up
- commissioning in less than 10 minutes using 'Easy Set-up' function
- supplied ready to operate using factory calibrated data

Simple installation and operation
- close-coupled sensor and standard intake tubes
- no need for pumped- or compressed-reference air

Minimal maintenance even in hostile environment
- can be performed in situ with basic tools
- extremely low drift ABB zirconia technology (typically ≤0.2 %O$_2$/month)
- normally needs only periodic 1-point calibration with air
What is Endura AZ10?
Endura AZ10 is the latest in a long line of high-performance, combustion gas oxygen analyzers from ABB. It is designed specifically for small, industrial boilers and marine applications.

The system is designed to work in process temperatures up to 800 °C (1472 °F) and is limited only by a maximum mounting flange temperature of 400 °C (752 °F).

Endura AZ10 comprises a remote transmitter and zirconia-based sensor located on the outside of the process duct wall. The sample travels to the sensor using a guide tube. In applications where the process duct is small, the sensor may be mounted directly in the process without the use of a sample guide tube.

Compact auto-calibration system
ABB's fully automatic calibration system controls the test gas sequence and detects test gas availability, eliminating incorrect calibrations due to loss of test gas. Auto-calibration provides security of measurement and complete confidence in system performance.

Operation without pumped- or compressed-reference air
All reliable zirconia-based sensors need reference air for accurate oxygen measurement. The AZ10 sensor provides atmospheric, reference air by diffusion. It passes through a porous membrane that permits air to enter, yet maintains the probe’s IP66 (NEMA 4X) rating. An external pumped- or compressed-air supply is not required.

Minimal maintenance even in hostile environments
To comply with IMO standards and aid operators of small package boilers, Endura AZ10 has been designed to require absolutely minimal maintenance. The AZ10 probe cell is easily accessed and replaced. Simple maintenance can be performed in situ with basic tools and skills. The internal cell assembly kit is very easily removed.
Ideal for small package boilers

Cost-effective solution for precise monitoring of small boilers in hospitals and academia and manufacturing industries such as fertilizer production, paper manufacturing, food & beverage production and the chemical and pharmaceutical industries.

Flexibility and simplicity of installation, along with ease of operation, make the advanced AZ10 an ideal choice for OEMs and end-users. It provides an economical investment to minimize emissions and improve boiler efficiency and economy.

AZ10 has been designed for small industrial boilers commonly up to 27 t/h of steam capacity, 6 to 25 bar (87 to 362 psi), and generally ≤10 MW. Up to 3 oxygen measurement systems can be used in a boiler furnace or economizer outlets. A typical process is fueled by biomass, fuel oil, kerosene or gas and operates between 150 and 300 °C (300 and 570 °F), ±0.5 kPa and dust ≤1 g/Nm³.

Proven solution for Marine EGR

AZ10 performs a critical role in marine applications, enabling optimization of exhaust gas recirculation (EGR) technology in marine diesel engines. This helps ensure regulatory compliance with the International Maritime Organization (IMO) Annex VI regulation. Oxygen measurement also permits optimization of engine performance.

The EGR recirculates engine exhaust gases mixed with intake air back to the combustion chamber. By replacing oxygen with carbon dioxide, peak combustion temperatures are reduced, limiting NOx emissions. The oxygen content is monitored closely by the AZ10.

The AZ10 system has been used successfully in hundreds of marine EGR installations. ABB’s multi-layered electrode technology prolongs cell life even in hazardous marine diesel engine NOx emissions environment. Performance has been validated by marine industry extreme tests with type approval testing to Classification Society rules.

ENDURA AZ10 is marine certified:
- IACS E10 Rev. 5.0 2006 test specification for type approval
- ABS certificate 15-LD1262098-PDA
Endura AZ10 transmitter

The Endura AZ10 transmitter is equipped with HART communication as standard, supported by a full Device Type Manager (DTM) to enable remote access to the analyzer through a user-friendly graphical interface. The DTM provides full access to the transmitter setup, logged data and diagnostics information together with live data.

**Probe connections**
- Cell
- Thermocouple
- ACJC
- Heater

**AutoCal control**
- 2 x solenoid valve outputs
- 2 x test gas detection inputs

**HART communications**

**DTM Graphical Interface**

**Analog output**
- Galvanically isolated
- Programmable over 4 to 20 mA

**Relay outputs**
- 2 x relays
- Normally closed contacts
- 5 A @ 230 V AC, 30 V DC

**Analog output**
- Galvanically isolated
- Programmable over 4 to 20 mA

**Digital I/O**
- 2 (user-configurable as input or output)
- Input: volt-free contacts
- Output: 30 V DC @ 220 mA
Test gas and reference air supply configurations – non-AutoCal systems

If using the ABB-supplied test gas port with standard filter option, the test gas supply must be 3 to 3.5 l/min (6.354 to 7.413 scfh).

Test gas can be connected to the supplied sensor test gas connection or via customer’s manifold. If using customer’s manifold, flows may differ from values shown below.

System using air as test gas 1 and bottled gas as (optional) test gas 2

System using 2 bottled test gases
Test gas and reference air supply configurations – AutoCal systems with restrictors

System using air as test gas 1 and bottled gas as (optional) test gas 2

AZ10 AutoCal unit
- Test gas supply:
  - restrictor in AutoCal unit limits flow to 2.2 l/min (4.662 scfh) at 1 bar (15 psi)

System using 2 bottled test gases

AZ10 AutoCal unit
- Test gas supply:
  - restrictor in AutoCal unit limits flow to 2.2 l/min (4.662 scfh) at 1 bar (15 psi)
Test gas and reference air supply configurations – AutoCal systems without restrictors

**System using air as test gas 1 and bottled gas as (optional) test gas 2**

**AZ10 AutoCal unit**
- Test gas supply:
  - 1 l/min (2.118 scfh)

**System using 2 bottled test gases**

**AZ10 AutoCal unit**
- Test gas supply:
  - 1 l/min (2.118 scfh)
## Dimensions

### Probe
Dimensions in mm (in)

- ø127 (5)
- ø95 (3.7)
- 270 (10.63)
- 13 (0.5)
- 34 (1.34)
- Nominal insertion length
  - 200, 350 or 650 (7.87, 13.78 or 25.6)
- Mounting adaptor
  - 2 in NPT or 2 in BSPT taper thread
- ø1.25 in NPS SCH5
  - (ø42.16 mm)

### Transmitter (standard gland shown)
Dimensions in mm (in)

- 98 (3.9)
- 150 (5.9)
- R3.2 (0.1)
- 179 (7.0)
- 71 (2.8)

- Panel preparer – 143 (5.63)
...Dimensions

Auto-calibration unit

Dimensions in mm (in)

- Wall-mount arrangement
  2 x M8 fixings through bracket

- Pipe-mount arrangement using U-bolt / pipe clamp
  Min. clamping dia. 42 (1.65)
  Max. clamping dia. 60 (2.36)

- Use only ABB-supplied bolts – M8 x 1.25 pitch x 35 mm (SS hex. head)

- Wall-/Pipe-mount bracket (includes M8 fixings)

- Dimensions:
  - Ø 8.5 (0.33)
  - 70 (2.76)
  - 125 (4.9)
  - 203 (8.0)
  - 303 (11.9)
  - 135 (5.3)

- R39 (1.5)
## Probe flanges (all probe lengths) and mounting plates for standard probe flanges

Dimensions in mm (in).

### 4-hole probe flange types and dimensions

<table>
<thead>
<tr>
<th>Flange type</th>
<th>A</th>
<th>B</th>
<th>C (Ø)</th>
<th>D (PCD)</th>
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<tbody>
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<td>ANSI 2.5 in 150</td>
<td>177.8 (7.00)</td>
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<td>ANSI 3 in 150</td>
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<td>12 (0.47)</td>
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<td>152.4 (6.00)</td>
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<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>
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</table>

### 8-hole probe flange types and dimensions

<table>
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<th>Flange type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G (PCD)</th>
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<tbody>
<tr>
<td>DIN 80 PN16</td>
<td>200 (7.87)</td>
<td>12 (0.47)</td>
<td>18 (0.70)</td>
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</table>

### 2 in NPT/BSP mounting adaptor and dimensions

<table>
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<th>Flange type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
<tr>
<td>ABB standard</td>
<td>160 (6.3)</td>
<td>160 (6.3)</td>
<td>7 (0.27)</td>
<td>16 (0.63)</td>
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</table>

Comprising: mounting plate, gasket, 6 each: M6/M10 shakeproof washers, plain washers and nuts.

### ABB standard mounting plate

6 M6 studs equispaced on 80 (3.15) PCD.
Electrical connections
AZ10 probe to AZ10 transmitter (non-AutoCal systems only)

- Connect screen 1 and 2 drains from 14-core cable to internal earth stud only.
- Screen 1 and 2 drains (twisted pair) – cut back to ≤40 mm (1.57 in) after being passed into sensor head.

**Connecting Diagram:**
- AZ10 probe
  - TC+ (Green)
  - ACJC (Violet)
  - ACJC (Grey)
  - Cell + (Red)
  - Cell – (Black)

- AZ10 transmitter
  - H1 (Blue)
  - H2 (Brown)
  - Cell + (Red)
  - Cell – (Black)

- Heater connections at transmitter
  - H (Brown)
  - H (Blue)

- AutoCal terminals at transmitter
  - not used

- Screen 1 and 2 drains from 14-core cable are connected to the transmitter internal earth stud only – do not connect the drains to the transmitter SCN connector or the transmitter external earth.
AZ10 probe to AZ10 AutoCal unit
(AutoCal systems only)

Factory-made (internal) connections

- TC+ (Green)
- TC- (White)
- ACJC (Violet)
- ACJC (Grey)
- Cell + (Red)
- Cell – (Black)

Probes heater connections and internal earth connection wire from earth stud

Screen 1 and 2 drains (twisted pair) – cut back to ≤40 mm (1.57 in) after being passed into sensor head

14-core probe to AutoCal unit cable

See page 14 for AutoCal connections

AZ10 probe

AZ10 AutoCal unit

14-core probe to AutoCal unit cable

See page 14 for transmitter connections

Earth (green wire from probe earth stud)

H1 (Blue)

H2 (Brown)

ACJC (Violet)

ACJC (Grey)

Cell + (Red)

Cell – (Black)

T/C + (Green)

T/C – (White)

SCN (Screen)

Heater H2 (brown)

Heater H1 (blue)
...Electrical connections

AZ10 AutoCal unit to AZ10 transmitter
(AutoCal systems only)

* Screen 2 (drain) is connected to the AutoCal unit’s outer SCN connector only
System specification

Measurement performance

Range: 0.01 to 100 % O2

Test gas response time
• Initial dead time 3 seconds
• T90 < 15 seconds

System accuracy
< ±1 % of reading or 0.05 % O2, whichever is the greater,
based on a nominal range of 0.01 to 25 % O2

Drift
• < ±1 % maximum % O2 range value per month
  (without calibration)
• < ±0.2 % typical

Error due to flue wall temperature changes
0.017 % of reading/°C (0.008 % of reading/°F)
(based on a 2-point calibration against certified test gases)

Environmental data

Ambient operating temperature
• Transmitter –20 to 55 °C (–4 to 131 °F)
• Probe –20 to 70 °C (–4 to 158 °F)

Storage temperature
–40 to 85 °C (–40 to 185 °F)

Operating humidity
Up to 95 % RH, non-condensing

Sunlight
Store and operate out of direct sunlight

Ingress protection
• Probe (excludes remote/integral transmitter): IP66 (NEMA 4X)
• Electronics enclosures – remote and integral: IP66 (NEMA 4X)

Power supply
AC power supply
100 to 240 V AC ±10 % (90 V min. to 264 V max.) 50/60 Hz
Electronics
< 10 W
Probe heater
< 100 W

EMC
Emissions and immunity
Conforms to EN61326-1

Safety
General safety
Conforms to EN61010-1
Approvals and safety certification
CE mark

Probe specification

Physical

Process connection
• ANSI B16.5 150 lb
• 2.5, 3 in
• DIN2501 Part 1
• 65, 80 mm
• 2 in NPT, 2 in BSP
  (flange pressure ratings do not apply)
• ABB standard flange

Probe body material
316L stainless steel

Mounting angle
Horizontal to vertically down

Process conditions

Standard process temperature
–20 to 800 °C (–4 to 1472 °F)

Process pressure
Designed to withstand 35 kPa (5.1 psi) – positive or negative
(pressure compensation required above 5 kPa
(0.7 psi) – transmitter can apply fixed pressure compensation)

Operating requirements

Test gas
User-selectable, 100 to 0.1 % O2 balance N2 and / or air
(air is recommended as one of the test gases)
• AutoCal with restrictors 1 bar (15 psi) – flowmeters not required
  as restrictors preset flow to 2.2 l/min
  (4.662 scfh)
• AutoCal without restrictors 1 bar (15 psi) – flowmeters required,
  set to 2.2 l/min (4.662 scfh) flow
• No AutoCal 1 bar (15 psi) – flowmeter required

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

Automatic calibration unit

AutoCal hardware
• Built-in solenoid valves for control of test gas flow
• Built-in pressure switches to detect presence of test gases

Heater operational requirements

Probe
Nominally 190 Ω, 70 W at 115 V AC – power is limited to
70 W max. by transmitter over an 85 to 265 V AC range
Transmitter specification

Transmitter enclosures
Remote
Wall-mounted
4 gland entries
Optional ½ in NPT, M20

Automatic calibration
AutoCal hardware
- Isolated solenoid valve control as standard, 24 V @ 2 W per valve*
- Dedicated isolated digital inputs to monitor pressure switch contacts as standard – voltage-free, normally closed with gas present

Display and switches
Display type
Graphical 128 x 64 pixel LCD
Display backlight
Green LED
Operator switches
4 capacitive switches (operated through the front glass)

Relay outputs
Number
2 standard
Type
Normally closed, 5 A @ 230 V AC
or 30 V DC (non-inductive)
Functions
User-configurable – can be activated by one or more of the following signals:
- Process alarm 1, 2, 3, 4
- Calibration in progress
- Calibration failed
- Out of test gas 1, 2
- Test gas 1 valve control
- Test gas 2 valve control
- Failure diagnostic
- Out-of-specification diagnostic
- Maintenance required diagnostic
- Function check diagnostic

Analog outputs
Standard
- 1 isolated current output
- Programmable to retransmit oxygen (linear or logarithmic) or temperature
- Programmable over 4 to 20 mA
- Over-range capability to indicate system failure programmable from 4 to 22 mA

Optional
- 1 isolated current output
- Programmable to retransmit oxygen (linear or logarithmic) or temperature
- Programmable over 0 to 20 mA
- Over-range capability to indicate system failure programmable from 0 to 22 mA

*For driving internal automatic calibration (AutoCal) probes or can be used to drive external calibration units on remote transmitters only.
Digital I/O
Number of digital I/Os
  2
I/O configuration
  User-configurable as either input or output
Input type
  Volt-free contact
Output
  Transistor switch capable of sinking 220 mA, low output, < 2 V DC, switch voltage 30 V DC maximum
Isolation
  Not isolated from each other or from the microprocessor circuitry
Input functions
  • Automatic calibration start on falling edge (when a volt-free switch is closed)
  • Automatic calibration start on rising edge (when a volt-free switch is open)
  • Automatic calibration stop on falling edge (when a volt-free switch is closed)
  • Automatic calibration stop on rising edge (when a volt-free switch is open)
  • Automatic calibration start / stop – starts auto-calibration on falling edge (volt-free switch is closed) and stops auto-calibration on rising edge (volt-free switch is open)
  • Select 1-point / 2-point calibration type – high level (volt-free switch is open) selects 1-point, low level (volt-free switch is closed) selects 2-point
Output functions
  • Process alarm 1, 2, 3, 4
  • Calibration in progress
  • Calibration failed
  • Out of test gas 1
  • Out of test gas 2
  • Test gas 1 valve control
  • Test gas 2 valve control
  • Failure diagnostic
  • Out-of-specification diagnostic
  • Maintenance required diagnostic
  • Function check diagnostic

Hart communications
Version
  5.7 as standard
Integration
  • Device Type Manager (DTM) and Electronic Device Description (EDD)
  • Provide online / offline device configuration, online monitoring of measurement values and diagnostic states
  • FDT v1.2.1 compliant
  • Works with FDT framework packages (for example, ABB Asset Vision Basic)
EDD
  Compliant with suitable framework tools (for example, SDC 625 and Simatic PDM tools)
Languages
  English
Calibration
Manual calibration
  • 1 point (offset)
  • 1 point (factor)
  • 2 point (offset + factor)
Automatic calibration
  • 1 point (offset)
  • 2 point (offset + factor)
Calibration control
  • Front panel controls
  • Digital inputs
  • HART commands
  • User-defined schedule
Calibration scheduler
  User-defined schedule enables automatic calibration frequency to be set from 1 day to 12 months
Ordering information

The Endura AZ10 system comprises a codeable transmitter and sensor. The system can be optimized to suit local requirements by selection of optional accessories:

- Probe flange mounting plate
- Sample guide tube
- Probe to transmitter cable
- Auto-calibration system
- Auto-calibration cable

Sample guide tubes are available in lengths of 200, 350, 500 and 650 mm (7.9, 13.8, 19.7 and 25.6 in). To ensure a reliable supply of sample to the sensor, guide tubes longer than 650 mm (25.6 in) are not recommended.

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*Backwards compatible (to suit AZ100 system)
## Accessories

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ200141</td>
<td>Sensor and auto-cal cable (standard): 5 m (16.4 ft)</td>
</tr>
<tr>
<td>AZ200142</td>
<td>10 m (32.8 ft)</td>
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<tr>
<td>AZ200143</td>
<td>25 m (49.2 ft)</td>
</tr>
<tr>
<td>AZ200144</td>
<td>50 m (164.0 ft)</td>
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<tr>
<td>AZ200145</td>
<td>75 m (213.2 ft)</td>
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<tr>
<td>AZ200146</td>
<td>100 m (328.0 ft)</td>
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<tr>
<td>AZ200431</td>
<td>Sensor and auto-cal cable (CSA-approved): 5 m (16.4 ft)</td>
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<tr>
<td>AZ200432</td>
<td>10 m (32.8 ft)</td>
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<tr>
<td>AZ200433</td>
<td>25 m (49.2 ft)</td>
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<td>AZ200434</td>
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<td>AZ200435</td>
<td>75 m (213.2 ft)</td>
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<tr>
<td>AZ200436</td>
<td>100 m (328.0 ft)</td>
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<tr>
<td>AZ100078</td>
<td>Sample guide tube: 200 mm (9.84 in)</td>
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<tr>
<td>AZ100079</td>
<td>350 mm (15.75 in)</td>
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<tr>
<td>AZ100080</td>
<td>500 mm (21.65 in)</td>
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<tr>
<td>AZ100081</td>
<td>650 mm (27.56 in)</td>
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<tr>
<td>AZ100092</td>
<td>Flange adaptor: 2.5 in ANSI</td>
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<tr>
<td>AZ100093</td>
<td>3 in ANSI</td>
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<tr>
<td>AZ100094</td>
<td>DIN 65</td>
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<td>AZ100095</td>
<td>DIN 80</td>
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<tr>
<td>AZ100096</td>
<td>Adaptor: 2 in NPT</td>
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<td>AZ100097</td>
<td>2 in BSP</td>
</tr>
<tr>
<td>AZ100098</td>
<td>Mounting plates for ABB standard flange</td>
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<tr>
<td>AZ250098</td>
<td>Endura AZ10 AutoCal unit (without test gas restrictors): BSP</td>
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<tr>
<td>AZ250096</td>
<td>NPT</td>
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<td>AZ250099</td>
<td>Endura AZ10 AutoCal unit (with test gas restrictors): BSP</td>
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<td>NPT</td>
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## Spares

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
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<tbody>
<tr>
<td>AZ200 750</td>
<td>AZ20 Transmitter cartridge: Standard</td>
</tr>
<tr>
<td>AZ200 751</td>
<td>Standard + analog O/P</td>
</tr>
<tr>
<td>AZ200 752</td>
<td>Standard + digital O/P</td>
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<tr>
<td>AZ200758</td>
<td>Remote (type 4) transmitter backplane</td>
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<tr>
<td>AZ200724</td>
<td>Probe heater circuit fuse</td>
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<tr>
<td>AZ200725</td>
<td>PT1000 cold junction compensation</td>
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<tr>
<td>AZ100056</td>
<td>Cell assembly kit</td>
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<tr>
<td>AZ100065</td>
<td>Seals and fixings kit</td>
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<tr>
<td>AZ100068</td>
<td>Lid assembly spares kit</td>
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<tr>
<td>AZ100256</td>
<td>Probe terminal PCB</td>
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<tr>
<td>AZ100069</td>
<td>Probe filter kit</td>
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<tr>
<td>AZ100057</td>
<td>M20 gland large bore kit</td>
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<tr>
<td>AZ100070</td>
<td>½ in NPT gland large bore kit</td>
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</tbody>
</table>

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**Acknowledgements**

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