Maintenance Guide

IM/AZ20M–EN Issue 1

Combustion Oxygen Monitor

Endura AZ20 Series Probe

ABB

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.

EN ISO 9001:2000

Cert. No. Q 05907

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.

0255

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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.

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 Symbols – CEI / IEC 61010-1:2001-2

One or more of the following symbols may appear on the equipment labelling:

	Protective earth (ground) terminal.
	Functional earth (ground) terminal.
	Direct current supply only.
	Alternating current supply only.
	Both direct and alternating current supply.
	The equipment is protected through double insulation.
	This symbol, when noted on a product, indicates a potential hazard that could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	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.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol indicates the presence of devices sensitive to electrostatic discharge and indicates that care must be taken to prevent damage to them.
	This symbol indicates the need for protective eye wear.
	This symbol indicates the need for protective hand wear.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	Products marked with this symbol indicates that the product contains toxic or hazardous substances or elements. The number inside the symbol indicates the environmental protection use period in years.

1.3 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.

1.4 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 applies to European customers only.

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 specified in this manual.

1.8 Safety Conventions

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

Caution. A caution is used to indicate a condition that, 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

Serviceable items are listed in Section 7, page 42 and Section 8, page 45. Maintenance and servicing of the instrument's components must be performed by authorized personnel only. 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 compliance of the instrument.

1.11 Potential Safety Hazards

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

- Electrical (line voltage)
- Probe weight

2 Introduction

This Maintenance Guide provides dismantling and reassembly procedures for AZ20 probes (both integral and remote versions) and AZ20/ZFG2 replacement probes. Kits containing all the parts required to complete a repair are identified in Section 7, page 42 (probe) and Section 8, page 45 (transmitter).

Warning.

- When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.
- Before undertaking maintenance procedures, identify and obtain the required spares / replacement items.
- After completing maintenance procedures, refer to the relevant user guides (transmitter User Guide IM/AZ20E–EN and probe User Guide IM/AZ20P–EN) to install, connect and configure the system.
- Install and use associated equipment in accordance with the relevant national and local standards.

3 Troubleshooting – Quick Checks

Troubleshooting diagnostics are displayed on the transmitter – refer to the transmitter User Guide (IM/AZ20E–EN). Where a diagnostic fault is traced to the probe, it may be possible to identify and rectify the fault. After any rectification, the system must be recalibrated.

The following checks can be used to troubleshoot the cause of probe failure quickly:

- checking heater resistance – refer to Section 3.3, page 7
- checking thermocouple / electrode assembly resistance – refer to Section 3.4, page 7
- checking cell isolation – refer to Section 3.5, page 8

3.1 Equipment Required

Digital multimeter (≥10 MΩ input impedance on mV ranges).

3.2 Pre-check Requirements

1. The probe does not function properly unless the correct reference air is applied – refer to the probe User Guide (IM/AZ20P–EN).
2. Isolate the probe / transmitter system from mains power before performing checks.

> **Warning.**
> Dangerous voltages are present in the probe head across the heater terminals (A) (brown and blue) – refer to Fig. 3.1.

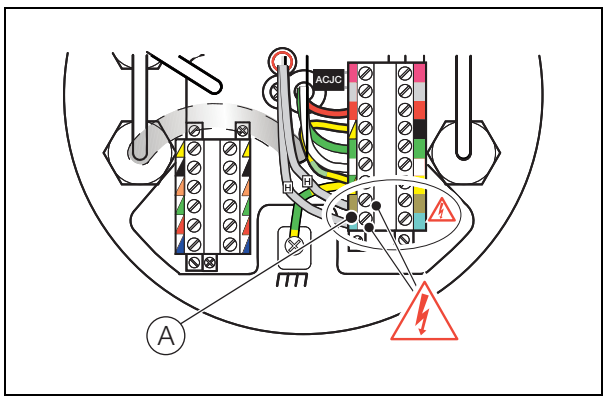


Fig. 3.1 Heater Terminals in Probe Head

Referring to Fig.3.2:

3. At the probe, unscrew and remove the end cap (A) and unplug the 9-way terminal plug (B) from the 9-way terminal block (C) by unscrewing the 2 x M3 plug retaining screws (D).

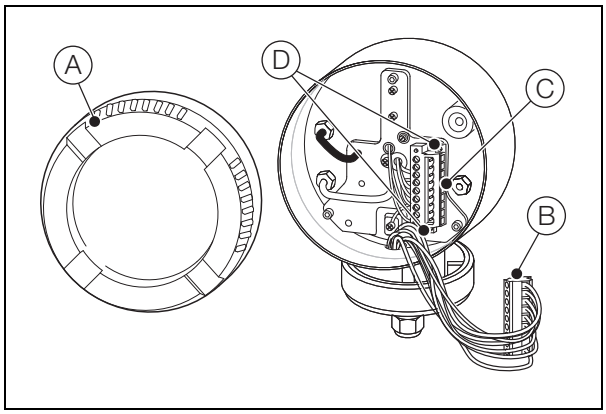


Fig. 3.2 Disconnecting the 9-way Terminal Plug

> **Note.** If the probe has AutoCal, a 6-way terminal block / plug (not shown) is fitted to the terminal plate. It is not necessary to unplug the 6-way terminal plug to perform initial checks.

4. Proceed to Section 3.3, page 7.

3.3 Checking the Heater Resistance

Referring to Fig. 3.3:

1. At the 9-way terminal block (A), measure the resistance across the heater leads (B) (brown and blue).

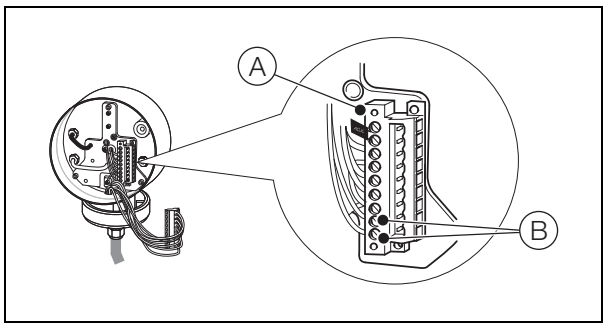


Fig. 3.3 Heater Connections

2. The measured resistance should be within the ranges shown in Table 3.1:

Probe Type	Resistance
AZ20 Standard Probes 0.5 to 4.0 m (1.64 to 13.12 ft)	185 to 220 Ω
AZ20/ZFG2 Version	25 to 37 Ω

Table 3.1 Heater Resistance by Probe Type

3. If the measured resistance is out of range, check the heater wiring and, if necessary, replace the heater assembly – refer to Section 5.9, page 24.

   If the measured resistance is within range, proceed to Section 3.4.

3.4 Checking the Thermocouple / Electrode Assembly Resistance

Referring to Fig. 3.4:

1. Ensure the probe is at ambient temperature (–20 to 70 °C [–4 to 158 F]).
2. At the 9-way terminal block (A), check the thermocouple / electrode assembly terminals (B) (TC+ green and TC– white) for open- or short-circuit.

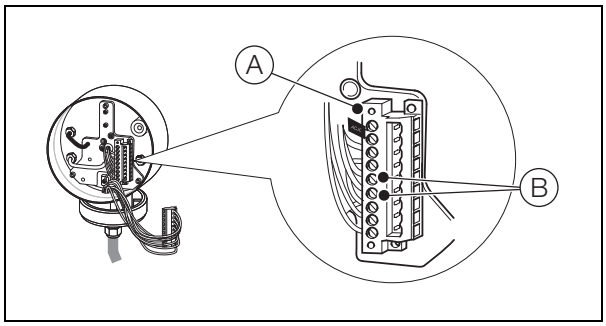


Fig. 3.4 Thermocouple / Electrode Assembly Connections

3. Check that the thermocouple / electrode assembly is isolated from the probe body earth. If it is not isolated, check for short-circuits to earth in the probe's internal wiring.
4. The resistance measured should be within the following range:

Probe Length	Resistance
0.5 to 2.0 m (1.64 to 6.6 ft)	10 to 17 Ω
2.5 to 4.0 m (8.2 to 13.1 ft)	17 to 23 Ω

Table 3.2 Thermocouple / Electrode Assembly Resistance by Probe Length

5. If the measured resistance is out of range, replace the thermocouple / electrode assembly – refer to Section 5.8, page 20.

   If the measured resistance is within range, proceed to Section 3.5.

3.5 Checking the Cell Isolation

Referring to Fig. 3.5:

1. At the 9-way terminal block (A), check the resistance from the probe's red (Cell +) connection (B) to the probe body (C).

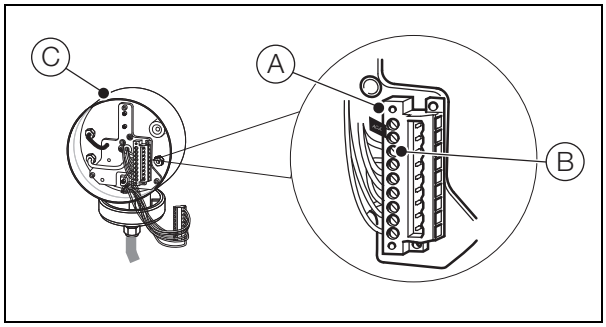


Fig. 3.5 Cell Isolation

2. Check that the cell + connection is isolated from the probe body earth. If it is not isolated, check for short-circuits to earth in the probe's internal wiring.
3. With the cell at ambient temperature, the measured resistance should be > 20 kΩ.

   If the measured resistance is within range, proceed to Section 3.6.

   If the measured resistance is out of range, replace the cell assembly – refer to Section 5.7, page 16.

3.6 Checking the ACJC Resistance (AZ20 Probe Only)

Referring to Fig. 3.6:

1. At the 9-way terminal block (A), check the resistance (related to ambient temperature) at the probe's ACJC (PT1000 temperature sensor) (B) across terminals (C).

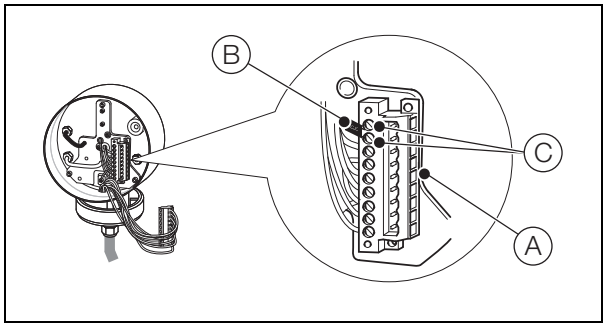


Fig. 3.6 Checking the ACJC Resistance

2. The measured resistance should be within the ranges shown in Table 3.3.
3. If the measured resistance is out of range, replace the PT1000 temperature sensor – refer to Section 5.12, page 35.

   If the measured resistance is within range, proceed to Section 4.

°C	0.0	–1.0	–2.0	–0	–4.0	–5.0	–6.0	–7.0	–8.0	–9.0
-20	921.6									
-10	960.9	956.9	953.0	949.1	945.2	941.2	937.3	933.4	929.5	925.5
0	1000.0	996.1	992.2	988.3	984.4	980.4	976.5	972.6	968.7	964.8
°C	**+0.0**	**+1.0**	**+2.0**	**+3.0**	**+4.0**	**+5.0**	**+6.0**	**+7.0**	**+8.0**	**+9.0**
0	1000.0	1003.9	1007.8	1011.7	1015.6	1019.5	1023.4	1027.3	1031.2	1035.1
10	1039.0	1042.9	1046.8	1050.7	1054.6	1058.5	1062.4	1066.3	1070.2	1074.0
20	1077.9	1081.8	1085.7	1089.6	1093.5	1097.3	1101.2	1105.1	1109.0	1112.8
30	1116.7	1120.6	1124.5	1128.3	1132.2	1136.1	1139.9	1143.8	1147.7	1151.5
40	1155.4	1159.3	1163.1	1167.0	1170.8	1174.7	1178.5	1182.4	1186.2	1190.1
50	1194.0	1197.8	1201.6	1205.5	1209.3	1213.2	1217.0	1220.9	1224.7	1228.6
60	1232.4	1236.2	1240.1	1243.9	1247.7	1251.6	1255.4	1259.2	1263.1	1266.9
70	1270.7									

Table 3.3 Resistance Values for PT1000 Element at Ambient Temperature (–20 to 70 °C [–4 to 158 °F])

4 Troubleshooting – Functional Checks

Warning. Due to the presence of high voltage heater terminals / wires (85 to 265 V) in the probe head the probe's functional checks, must be carried out by suitably trained personnel only – refer to (A) in Fig. 4.1.

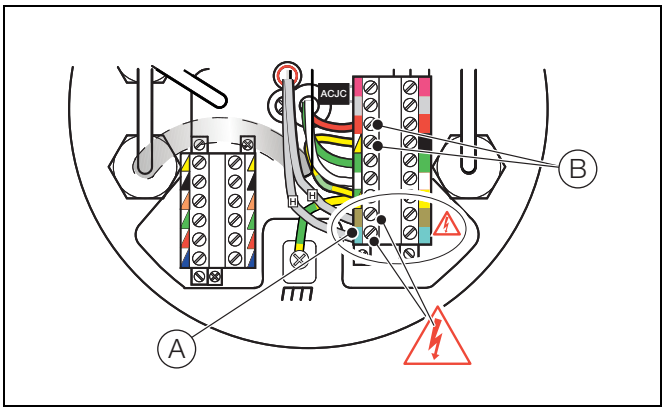


Fig. 4.1 Live Heater Terminals in Probe Head

Caution.

- Functional probe checks are made with the probe / transmitter system powered up.
- Before performing functional checks:
  - ensure the process temperature is within the limits 20 to 800 °C (68 to 1472 °F) and allow a minimum 30-minute warm-up period for the probe cell to stabilize at operating temperature
  - ensure reference air and test gases are applied as detailed in the probe User Guide (IM/AZ20P–EN).
- If precision accuracies are required, allow a 1-hour stabilization period.

4.1 Equipment Required

- AZ20 User Guides (transmitter User Guide IM/AZ20E–EN, and the probe User Guide IM/AZ20P–EN)
- digital multimeter (≥10 MΩ input impedance on mV ranges)
- earth continuity tester
- test gas 1 (typically within the range 10 to 21% O_2 in N_2)
- test gas 2 (not < 1 % O_2 in N_2)
- reference air supply (refer to the probe User Guide IM/AZ20P–EN)

4.2 Thermocouple / Electrode Assembly Functional Checks

Referring to Fig. 4.2:

1. Using either a mercury or digital thermometer, measure the ambient temperature at the thermocouple terminals (A) (TC+ green and TC– white).
2. Measure the voltage across the transmitter's thermocouple terminals (A) (TC+ green and TC– white).

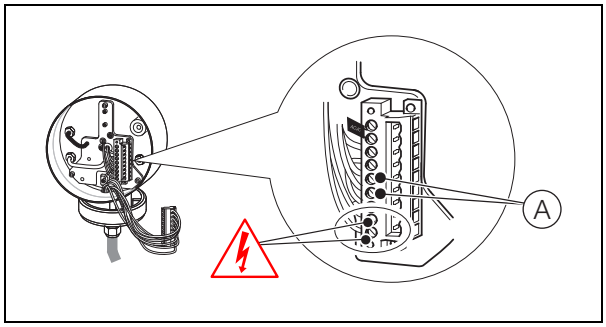


Fig. 4.2 Checking the Thermocouple / Electrode Assembly

Refer to Table 4.1 for the voltages that should be present at the thermocouple terminals, according to the temperature measured at step 1 when the probe temperature has stabilized.

Note.

- For flue temperatures up to 700 °C (1292 °F) the probe thermocouple is heater-maintained at 700 °C (1292 °F).
- For flue temperatures over 700 °C (1292 °F) the probe thermocouple and heater are the same as the flue temperature.
- For process temperatures between 700 and 800 °C, (1292 to 1472 °F) refer to K-type thermocouple tables for millivolt values.

3. If the thermocouple voltage is correct, remove the probe from the flue and replace the cell (refer to Section 5.7, page 16) and / or the thermocouple / electrode assembly (refer to Section 5.8, page 20).

Ambient Temp. °C (°F)	Millivolts	Ambient Temp. °C (°F)	Millivolts
50 (122)	27.106	24 (75.2)	28.168
49 (120.2)	27.147	23 (73.4)	28.209
48 (118.4)	27.188	22 (71.6)	28.249
47 (116.6)	27.229	21 (69.8)	28.29
46 (114.8)	27.27	20 (68)	28.33
45 (113)	27.311	19 (66.2)	28.37
44 (111.2)	27.352	18 (64.4)	28.41
43 (109.4)	27.394	17 (62.6)	28.451
42 (107.6)	27.435	16 (60.8)	28.491
41 (105.8)	27.476	15 (59)	28.531
40 (104)	27.527	14 (57.2)	28.571
39 (102.2)	27.558	13 (55.4)	28.611
38 (100.4)	27.599	12 (53.6)	28.651
37 (98.6)	27.639	11 (51.8)	28.691
36 (96.8)	27.68	10 (50)	28.731
35 (95)	27.721	9 (48.2)	28.771
34 (93.2)	27.762	8 (46.4)	28.811
33 (91.4)	28.803	7 (44.6)	28.851
32 (89.6)	28.843	6 (42.8)	28.89
31 (87.8)	28.884	5 (41)	28.93
30 (86)	27.925	4 (39.2)	28.97
29 (84.2)	27.966	3 (37.4)	29.009
28 (82.4)	28.006	2 (35.6)	29.049
27 (80.6)	28.047	1 (33.8)	29.089
26 (78.8)	28.087	0 (32)	29.128
25 (77)	28.128		

Table 4.1 Thermocouple v Ambient Temperature for Flue Temperatures up to 700 °C (1292 °F)

4.3 Checking Cell Output Voltage

In the following checks, test gas is applied to the probe and the cell output is measured to check if the cell is functioning to theoretical values in isolation from any associated transmitter.

The check can be performed using 1 test gas (for a functional check) or 2 test gases (for a detailed cell accuracy check). Using 2 test gases provides the most accurate result – both checks refer to the graph in Fig. 4.3:

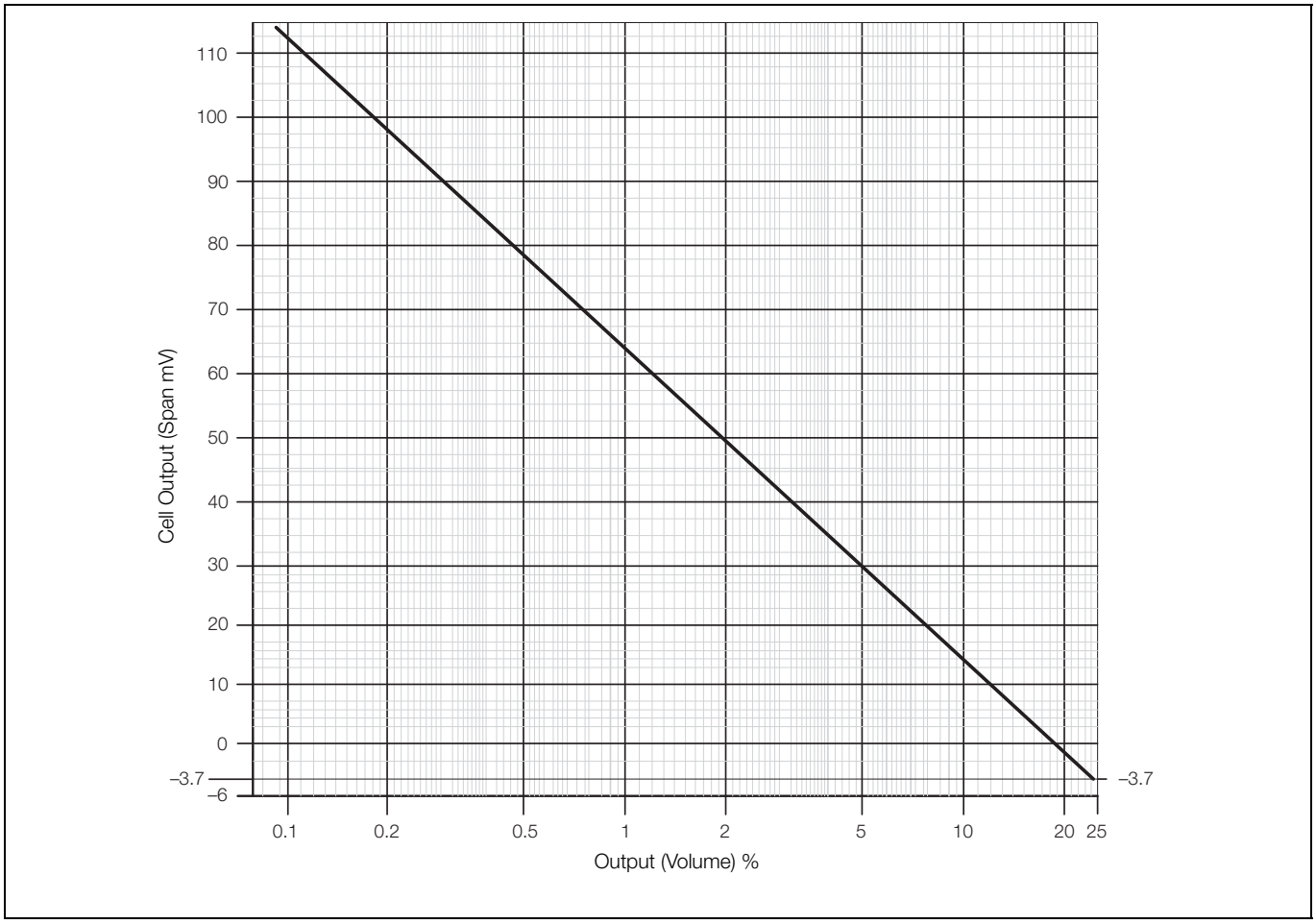


Fig. 4.3 Cell Output v Percentage Oxygen

4.3.1 Cell Function Check

Note. This check uses 1 test gas.

Referring to Fig. 4.1:

1. Remove the leads to the cell terminals (B) (Cell+ red; Cell– black) and connect the digital multimeter (0 to 200 mV range) directly across the leads.
2. If AutoCal is fitted, open the test gas valve manually. If AutoCal is not fitted, apply the test gas directly to the test gas inlet and control it externally – refer to the probe User Guide (IM/AZ20P–EN).
3. Leave the test gas to run for a minimum of 3 minutes and record the reading on the digital multimeter.
4. Switch the test gas off.
5. The measured voltage should correspond to the oxygen volume percentage for the test gas used – refer to Fig. 4.3, page 10.
6. If this check has resulted in:
   a. **satisfactory readings**:
   the cell, heater and thermocouple are functioning correctly – incorrect readings at the transmitter may be due to transmitter calibration faults – refer to the transmitter User Guide (IM/AZ20E–EN)
   b. **unsatisfactory readings**:
   there is a difference of more than ±5 mV between the measured cell output voltage and the graph – refer to Fig. 4.3, page 10
   the thermocouple / electrode assembly may be faulty (check this first – refer to Section 4.2, page 9) or the cell may be faulty – refer to Section 5.7, page 16.

4.3.2 Detailed Cell Accuracy Check

Note. This detailed check uses 2 test gases – checking the isolated cell output voltage using 2 test gases provides the most accurate result.

The 2 test gases are:

- air (20.95 % O_2) to give a zero reading
- a second test gas not less than 1 % O_2

To perform this check, calculate the span mV value first then calculate the % O_2 value from the span mV value.

1. For millivolt readings and test gas management, refer to steps 1 to 4 from Section 4.3.1.
2. To calculate the span mV value:
   a. allow the probe to settle in air, or with test gas air for 5 minutes minimum to stabilize – note the millivolt reading which should be ≤ ±2 mV (if the cell is less than 1 year old), but may be up to ±5 mV on older cells
   b. calculate the span mV value as the **sum** of zero and test gas mV, for example:
   –1 mV zero + 62.77 test gas mV = 63.77 mV span
   +1 mV zero + 62.77 mV test gas mV = 61.77 mV span
3. Use the following formula to calculate the % O_2 from the span mV value:

$$\text{Cell mV} = 0.0496\ T\ (\log_{10} P_0 / P_1) + C \text{ mV},$$

where:

T = cell temperature °K =
(700 °C + 273.16) for process temperatures < 700 °C
or
(process temperature + 273.16) for process temperatures > 700 °C

P_0 = partial pressure ref. gas (20.95 % O_2)

P_1 = partial pressure measured gas

C = cell constant

The following examples show calculations for process temperatures <700 °C and >700 °C:

Example 1 – Process Temp. <700 °C
For test gas of 20.95 % 0_2 (air):
EmV = 0.0496 x (700 + 273.16) ($\log_{10}$ 20.95/20.95) ±CmV
EmV = 48.2608 ($\log_{10}$ 1)
EmV = CmV (cell constant)

Example 2 – Process Temp. <700 °C
For a certified test gas of 1 % 0_2:
EmV = 0.0496 x (700 + 273.16) ($\log_{10}$ 20.95/1) ±CmV
EmV = 48.2608 ($\log_{10}$ 20.95) ±CmV
EmV = 63.76 mV ±CmV

Example 3 – Process Temp. of 800 °C
For a certified test gas of 1 % 0_2:
EmV = 0.0496 x (800 + 273.16) ($\log_{10}$ 20.95/1) ±CmV
EmV = 48.2608 ($\log_{10}$ 20.95/1) ±CmV
EmV = 63.76 mV ±CmV

Note. Pure N_2 or any other inert gas cannot be used to calibrate a zirconia system 'gas zero' as this equates to an infinite cell output voltage. A gas with a known value close to zero (for example 1 % 0_2 in N_2) must be used for this purpose.

4.4 System Functional Check

This section checks the AZ20 probe and associated transmitter for system functionality and accuracy.

1. Perform a manual 2-point calibration using the 2 test gases selected – refer to the probe User Guide (IM/AZ20P–EN).
2. If this fails, check the transmitter calibration – refer to the transmitter User Guide (IM/AZ20E–EN).

5 Dismantling and Reassembly – Probe

5.1 Before Removing / Replacing the Probe

Warning.

- When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.
- Do not attempt to remove a probe unless the system it is used in has been shut down and isolated.
- Do not attempt to remove a probe without approval from authorized personnel.
- Before removing a probe from the flue, prepare the flue for probe removal in accordance with relevant safety and site regulations.
- Fit a blanking flange to the process if necessary.
- Use lifting equipment with a lifting capacity in excess of the total probe weight – refer to the probe User Guide (IM/AZ20P–EN) for probe weights.

Caution. Probe internal components are fragile – for ease of handling, ensure a minimum of 2 personnel are used when handling 2 to 4 m (6.6 to 13.1 ft.) probes and ensure support is provided along the complete length of the inner assembly.

5.2 Before Dismantling a Probe

Warning.

- Clean the outer surfaces of the probe thoroughly to prevent contamination of inner assemblies.
- If the probe has been in service, the parts exposed to the process gases may be contaminated with corrosive or hazardous substances. Check with the process operators for possible contaminants or request a CoSH sheet.
- Oil, grease, hand cream and even oily skin can contaminate the probe's internal structure causing poor stability and drifting readings. when handling any probe parts, beware of introducing contaminants.
- Do not bend the internal structure – the heater and thermocouple / electrode insulators are fragile and will be damaged or break if bent.
- Handle internal components carefully, keep them clean and ensure mating surfaces are not damaged during maintenance procedures.
- Do not subject the probe to blows from hammers or sharp objects.
- Do not reuse damaged parts, use new replacement parts only.

5.3 Preparation

The following equipment and working conditions are recommended to ensure the probe is maintained in a suitable environment:

- a clean, dry, moisture- and dust-free atmosphere
- a workbench of at least twice the probe length – for example, to maintain a 4.0 m (13.12 ft) probe, a workbench of at least 9.0 m (29.5 ft) is recommended
- support along the complete length of the internal assembly – a length of plastic guttering can be used to protect the ceramics and other components during removal / refitting, or extra personnel can be used

5.3.1 Tools Required

- M4 open-ended spanner (supplied with probe)
- 3 mm A/F Hex wrench
  (supplied with probe and restrictor kit)
- 2.5 mm A/F Hex wrench
  (supplied with restrictor kit)
- small hacksaw
- scalpel or similar small sharp blade
- small flat-bladed (terminal) screwdriver
- small pozi-drive (crosshead) screwdriver
- medium flat-bladed screwdriver
- small magnet
- A torque driver set to 4 cNm, fitted with a 3 mm hexagon wrench (or a 3 mm A/F hexagon wrench)

5.3.2 Replacement Kits and Spares

Refer to Section 7, page 42 and Section 8, page 45 for replacement kits.

5.4 Removing / Refitting an Integral Probe

Referring to Fig. 5.1:

1. Isolate the transmitter from mains power supplies and label the isolator to prevent power being reconnected accidently.
2. Isolate, identify and disconnect gas supplies.
3. Remove the transmitter terminal chamber cap (A).
4. Before disconnecting any of the field terminations, use the blank terminal block (B) in Fig. 5.1 to note the existing transmitter connections.
5. Disconnect the field terminations.
6. Loosen cable glands (C) (as required) and separate and insulate individual mains and signal cable terminations as a safety precaution.
7. Remove the probe from its mounting by reversing the installation procedure (refer to the probe User Guide [IM/AZ20P–EN] for original installation instructions), ensuring the probe is supported along the length of the body.
8. Move the probe to the maintenance area.
9. Proceed with the required maintenance procedure(s).
10. To refit the probe refer to the probe User Guide (IM/AZ20P–EN).

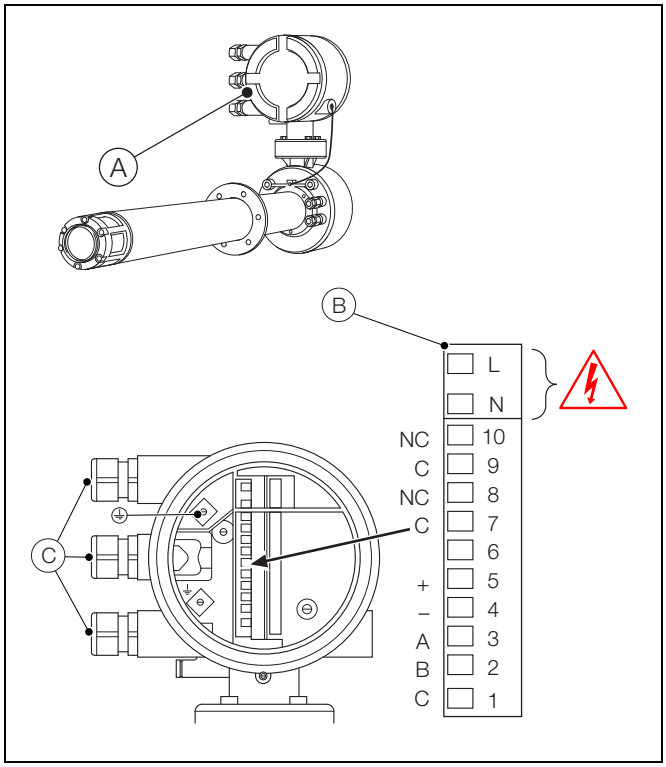


Fig. 5.1 Disconnecting an Integral Probe

5.5 Removing / Refitting a Remote Probe

1. Isolate the remote transmitter from mains power supplies and label the isolator to prevent power being reconnected accidently.
2. Isolate, identify and disconnect gas supplies.

Referring to Fig. 5.2:

3. Unscrew and remove probe cover (A).
4. Disconnect all wires to terminal block (B).
5. If AutoCal is fitted, disconnect all wires to terminal block (C).
6. Loosen cable gland (D) and carefully withdraw the cable from the probe.
7. Separate and insulate the individual heater and signal cable terminations as a safety precaution.
8. Remove the probe from its mounting by reversing the installation procedure (refer to the probe User Guide (IM/AZ20P–EN) for original installation instructions), ensure the probe is supported along the length of the body as it is withdrawn from the flue.
9. Move the probe to the maintenance area.
10. Proceed with the required maintenance procedure(s).
11. To refit the probe refer to the probe User Guide (IM/AZ20P–EN)..

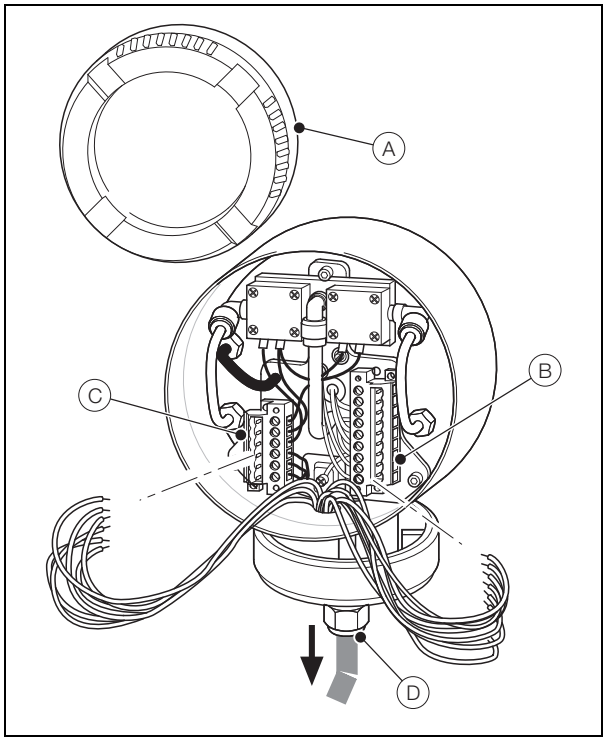


Fig. 5.2 Disconnecting a Remote Probe

5.6 Replacing the End Cap and Seal

Warning. If the end cap is replaced with the probe in situ, ensure the system it is used in has been shut down and isolated to prevent the risk of electrical shocks.

Before replacing the end cap:

1. If fitting new end cap, ensure the correct kit is available (and the correct version of the wiring label [AZ20 or ZFG2] is used) – refer to Section 7.5, page 43.
2. If necessary, remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).

5.6.1 Removing the End Cap

Referring to Fig. 5.3:

1. Unscrew and remove probe end cap (A).
2. Remove seal and discard O-ring (B).

5.6.2 Fitting a New End Cap

Referring to Fig. 5.3:

1. Fix the new wiring label (C) to the inside of the end cap.

   Caution. Ensure the correct wiring label is fixed in the end cap – AZ20 and AZ20/ZFG2 replacement probe connections are different – refer to Fig. 5.3.

2. Fit the new O-ring onto the end cap ensuring it is seated correctly.

3. Screw the new end cap onto the probe body until hand-tight.

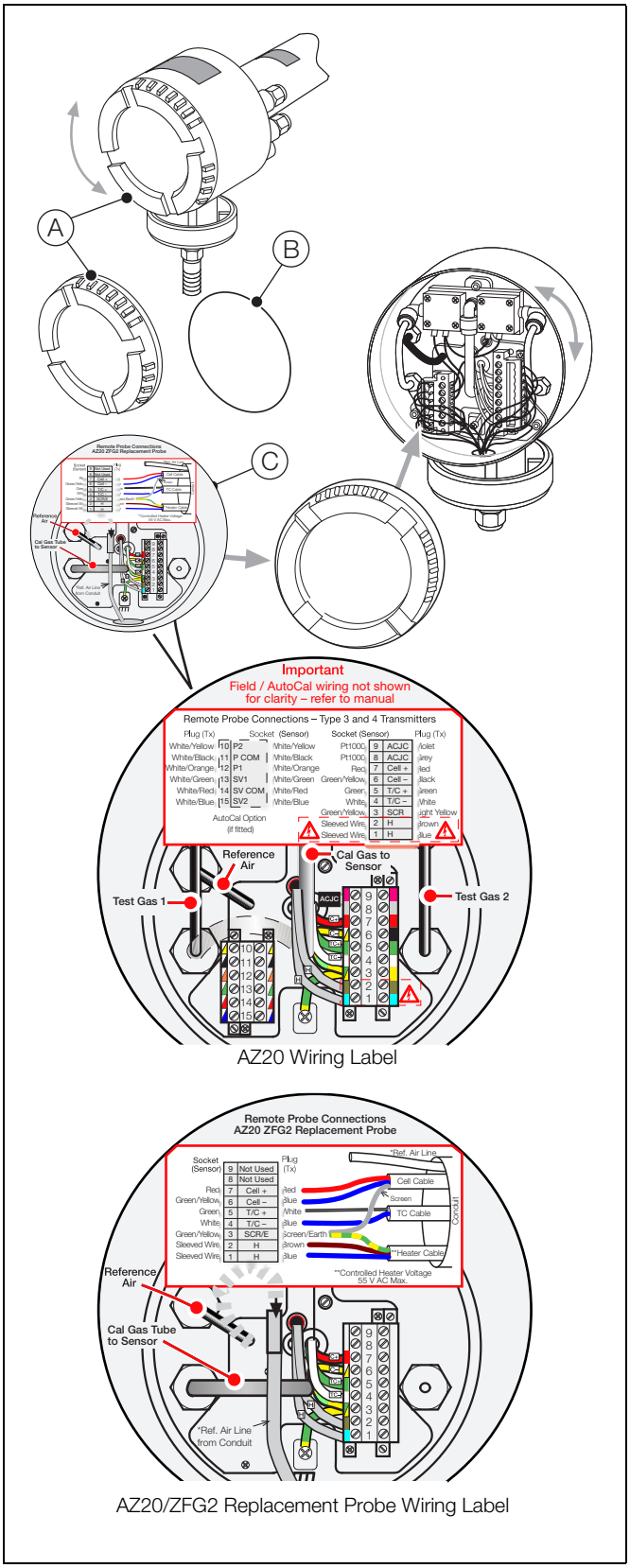


Fig. 5.3 Replacing the End Cap and Seal

5.7 Replacing the Diffuser Flame Arrestor and / or Cell

Warning. When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.

Note. Check all items for damage as they are removed. Do not re-use the nuts or bolts, always replace damaged items with new parts.

Before replacing the cell:

1. Ensure a replacement cell kit is available – refer to Section 7.1, page 43.

   Note. It is recommended that a replacement thermocouple / electrode assembly (refer to Section 7.7, page 44) is also available in case the existing assembly is damaged during cell replacement.

2. Remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).
3. Record the cell data printed on the existing cell label – refer to the probe User Guide (IM/AZ20P–EN) for label details.
4. Remove the probe end cap as detailed in Section 5.6.1, page 15.

5.7.1 Removing the Diffuser Flame Arrestor

Referring to Fig. 5.4:

1. At the probe head, disconnect the red (Cell +), green (TC+) and white (TC–) wires (A) from the inner terminal block connections and straighten the wires.

   Note. AutoCal versions only – if necessary, disconnect the test gas to sensor tube to enable access to the green (TC+), white (TC–) and red (Cell+) terminals.

2. Unscrew and remove M4 screw (C) to release the spring loading on the thermocouple / electrode assembly.
3. At the probe cell end, loosen the 6 M4 x 50 bolts (D) using an M4 spanner and 3 mm A/F hexagon wrench (supplied).

   If the bolts are seized, use a small hacksaw to cut the through the bolts at the recess between the diffuser flame arrestor and the probe end plate (E).

4. Remove the 6 M4 x 50 bolts.
5. Carefully withdraw the diffuser flame arrestor (F) while supporting the cell (G). If necessary, use a solvent, for example lighter fluid (petroleum ether) or alcohol (surgical spirits) to lubricate the joint between the diffuser flame arrestor and probe end.

   Caution. Do not use oil or release agents – these will damage the components.

6. Proceed to Section 5.7.2, to fit a new cell.

5.7.2 Removing the Cell and C-ring

Referring to Fig. 5.4:

1. Remove the test gas injection pipe (H) from the cell housing and retain for re-assembly.
2. Carefully attempt to withdraw the cell (I) from the cell housing using minimal force.
   - If the cell can be withdrawn freely, proceed to step 4.
   - If the cell does not move (is stuck in the probe body), use a spanner on the 2 flats to rock it sideways gently until loose – **do not rotate more than 2 to 3 mm (0.08 to 0.12 in.)**. If this action frees the cell proceed to step 4.
   - If the cell cannot be withdrawn freely and is welded to the thermocouple / electrode contact assembly, proceed to step 3.
3. If the cell is welded to the helical contact at the end of the thermocouple / electrode assembly, carefully withdraw the cell and thermocouple / electrode contact assembly until the cell tip (J) is visible.

   Use a sharp blade to cut between the wire nest and cell tip and separate the 2 items (K). Take extreme care not to damage either item.

4. Remove and discard 'C-ring (L).

   If the C-ring is stuck, insert a small screwdriver blade in the hollow of the C-ring (M) and gently prise it in several places until free.

   Caution. Do not touch the sealing face or ID of the probe recess with the screwdriver blade. The surface finish must be undamaged to maintain the C-ring's sealing properties.

5. Proceed to Section 5.7.3, page 18 to fit a new cell.

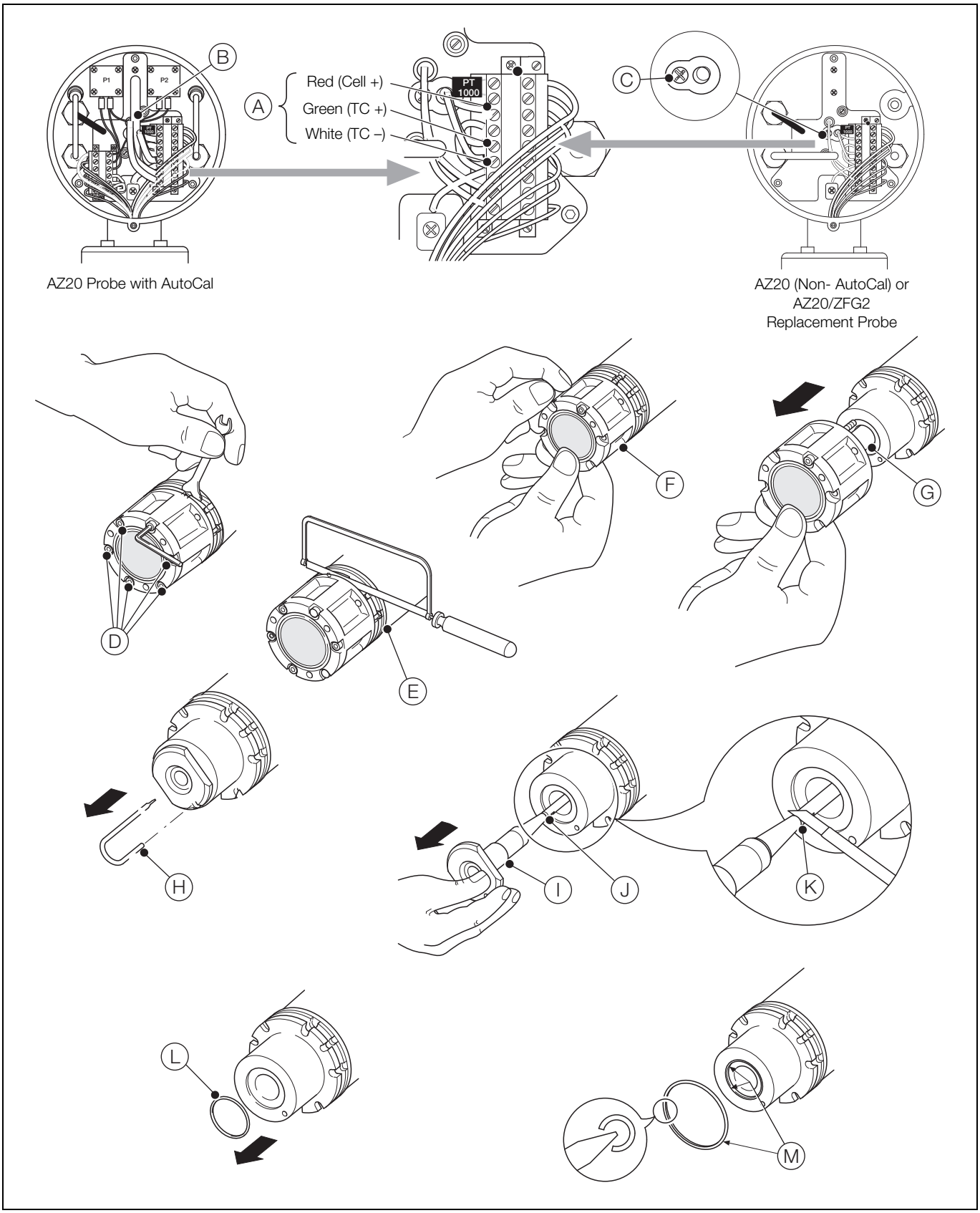


Fig. 5.4 Removing the Cell and C-ring

5.7.3 Fitting a New C-ring and Cell

Referring to Fig. 5.5:

1. Transfer the alteration details onto the new Commissioning Label (A) supplied with the new cell and fix the new Commissioning Label to the probe body.

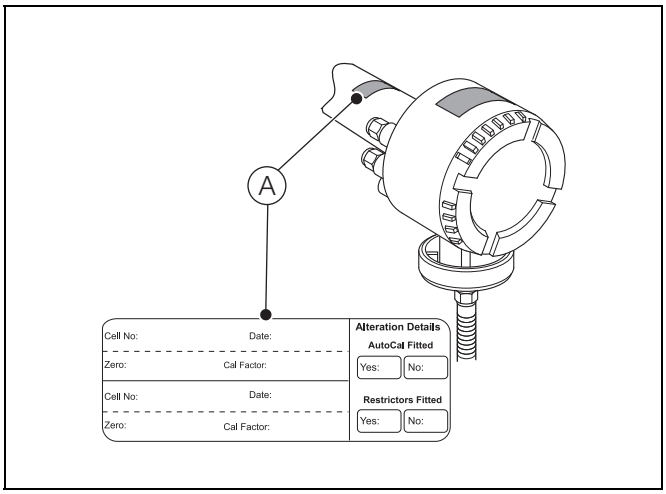


Fig. 5.5 Commissioning Label Details and Location on Probe

Referring to Fig. 5.6:

2. Check the cell mounting area for damage and ensure it is clean and dry. Clean by hand only using a non-metallic pan scourer – do not use any other abrasives.
3. Position a new 'C-ring (A) into recess (B).
4. Locate the cell (C) and use a small screwdriver to align it with the test gas injection pipe hole (D) in the probe body end plate.
5. Carefully slide the cell into the probe body end plate. Do not rotate the cell once it has engaged with the helical contact at the end of the thermocouple / electrode assembly.
6. Refit the test gas injection pipe (E) ensuring the short end is fitted into the test gas injection pipe hole (D).
7. Proceed to Section 5.7.4 to fit the diffuser flame arrestor.

5.7.4 Fitting the Diffuser Flame Arrestor

Referring to Fig. 5.6:

1. Locate the diffuser flame arrestor (F) by aligning the internal notch (G) with the test gas pipe.
2. Locate the 6 M4 x 50 bolts (H) and fit nuts (I).
3. Tighten the 6 M4 x 50 nuts and bolts using an M4 spanner and 3 mm A/F hexagon wrench (supplied), Tighten opposing bolts evenly to a torque of 4 cNm (5.66 ozf/in).

> **Note.** A small amount of anti-seize grease or oil can be used on these nuts only to assist assembly. Do not use anti-seize grease or oil on any other probe fixings.

4. At the probe head, press the thermocouple / electrode assembly spring locator (J) in and refit and tighten the M4 retaining screw (K).
5. Re-connect the red (Cell+), green (TC+) and white (TC–) wires (L) to the inner terminal block connections.

> **Note.** AutoCal versions only – if the test gas to sensor tube (M) was disconnected at step 1, Section 5.7.1, page 16, reconnect it.

6. Refit the probe end cap – refer to Section 5.6.2, page 15.
7. Re-install the probe as detailed in the probe User Guide (IM/AZ20P–EN).
8. Make gas supplies to the probe and electrical supplies to the transmitter – refer to the transmitter User Guide IM/AZ20P–EN and probe User Guide (IM/AZ20E–EN).
9. Use the new cell's Zero and Cal. Factor data on the Commissioning Label to commission and calibrate the probe – refer to the transmitter User Guide (IM/AZ20E–EN) for calibration details.

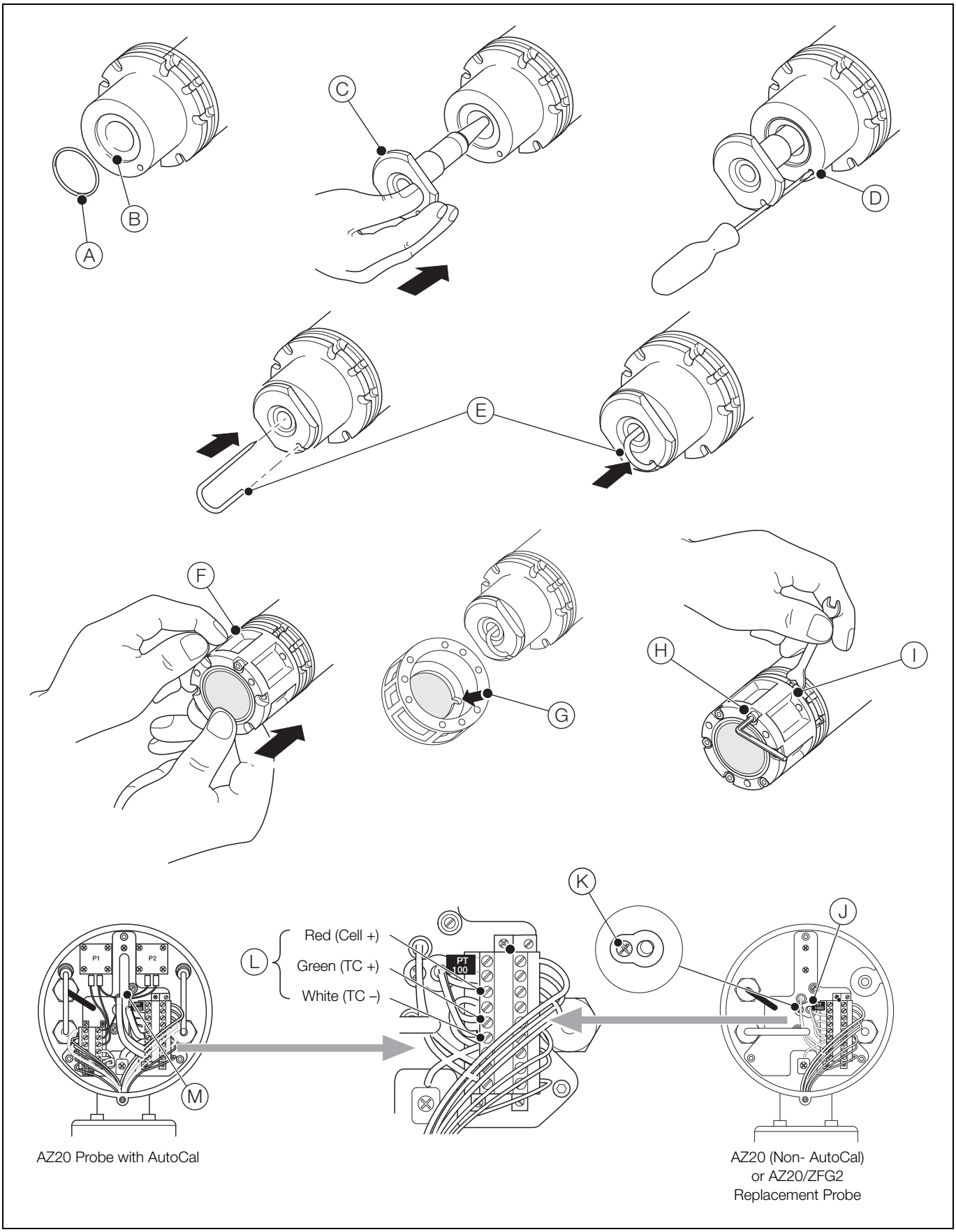


Fig. 5.6 Fitting a New C-ring and Cell

5.8 Replacing the Thermocouple / Electrode Assembly

Note. Check all items including the extension insulators for damage as they are removed. Keep items for reuse in a clean safe place. Replace any damaged items with new replacements. Never reuse damaged insulators.

Before replacing the thermocouple and electrode assembly:

1. Ensure replacement thermocouple and electrode assembly and C-ring kits are available – refer to Section 7.7, page 44.
2. Remove the probe from its mounting – refer to Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).
3. Remove the probe end cap as detailed in Section 5.6.1, page 15.

5.8.1 Removing the Thermocouple / Electrode Assembly

Referring to Fig. 5.7:

1. At the probe head, disconnect the red (Cell +), green (TC+) and white (TC–) sleeved wires (A) from the inner terminal block connections.

   Caution. AutoCal versions only – if necessary, disconnect the test gas to sensor tube (B) to allow access to the terminal connectors.

2. Unscrew and remove M4 screw (C).
3. Check if the cell is welded to the electrode tip by gently pulling the white and green sleeved wires (D).

   Caution. Do not pull the Cell + (red sleeve) wire (E) to check for thermocouple / electrode assembly play.

4. If resistance is felt, check if cell is welded to the helical contact at the end of the thermocouple / electrode assembly – refer to Section 5.7.2, page 16 (step 3). When the cell has been released / removed, proceed to step 5.
5. The thermocouple / electrode assembly is very fragile, so withdraw the thermocouple / electrode assembly (F) from the probe body carefully, providing support (G) along the length of the assembly and keeping it straight.
6. Lay the thermocouple / electrode assembly on a long **clean** flat surface.
7. Proceed to Section 5.8.2, page 22 to fit a new thermocouple / electrode assembly.

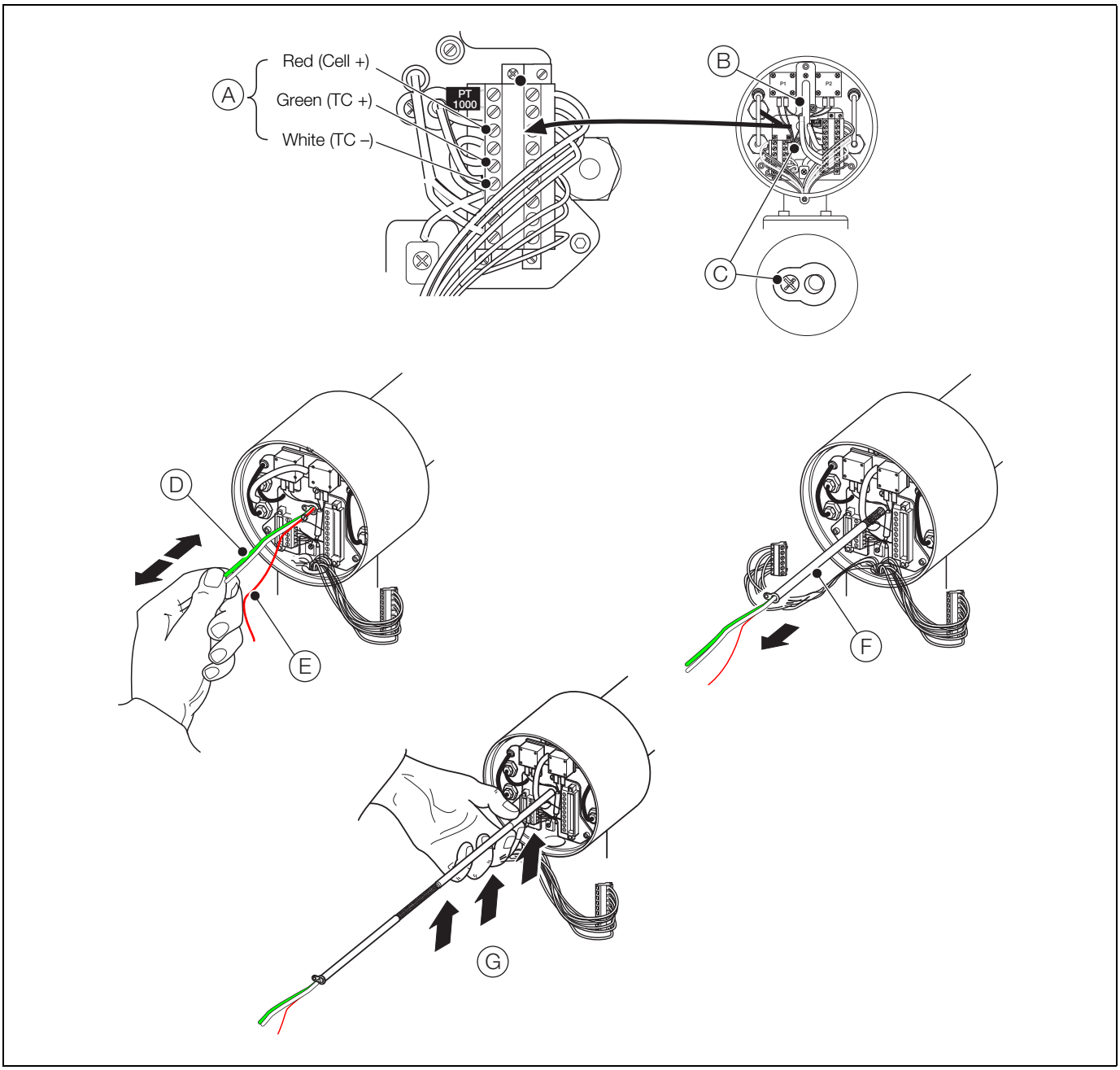


Fig. 5.7 Removing the Thermocouple / Electrode Assembly

5.8.2 Fitting a New Thermocouple / Electrode Assembly

Referring to Fig. 5.8:

1. Remove the existing spring locator (A) from the old assembly.
2. Lay the new assembly (B) out at the end of a long work surface and carefully uncoil the electrode wires, one at a time.

> **Note.** To retain the uncoiled lead ends during fitting, use a clamping block (C) constructed from a wooden board and 3 bulldog clips or use 3 weights.

> **Caution.** Do not kink the wires during fitting as they will not feed through the insulators if kinked.

3. Fit the 500 mm (19.7 in.) long insulator(s) (D) supplied – refer to Table 5.1 for insulator quantities for each probe length.

   Thread each insulator onto the extension wires one by one. Ensure wires are not crossed in the insulator channels. Do not attempt to thread more than half the insulator length onto a wire at one time and ensure insulators butt together correctly at the joints.

Insertion Length m (ft.)	No. of Insulators	Insertion Length m (ft.)	No. of Insulators
0. 5 (1.7)	0	2.5 (8.2)	4
1.0 (3.3)	1	3.0 (9.9)	5
1.5 (5.0)	2	3.5 (11.5)	6
2.0 (6.6)	3	4.0 (13.1)	7

Table 5.1 500 mm (19.7in.) Insulator Requirements by Probe Length

4. Next fit the (short) 148 mm (5.8 in.) insulator (E).
5. Identify the thermocouple negative wire (TC–) (F) (magnetically attractive). The thermocouple positive (TC+) (G) is the same wire diameter as the thermocouple negative (TC –) (F). The thinnest wire is the cell positive (Cell+) (H).
6. Using the correct PTFE colored sleeving (supplied), slide each sleeve onto the wire ends (I):
   - Green (TC+), thick wire, non-magnetic (G)
   - White (TC–), thick wire, magnetic (F)
   - Red (Cell+), thin wire (H)
7. Pass 100 mm (4 in.) of sleeving into the last (short) insulator (E).

> **Caution** Do not trim the sleeves – they must pass into the last insulator by 100 mm (4 in.) to ensure that the wires cannot short out when operating at very high process temperatures due to thermal expansion differences.

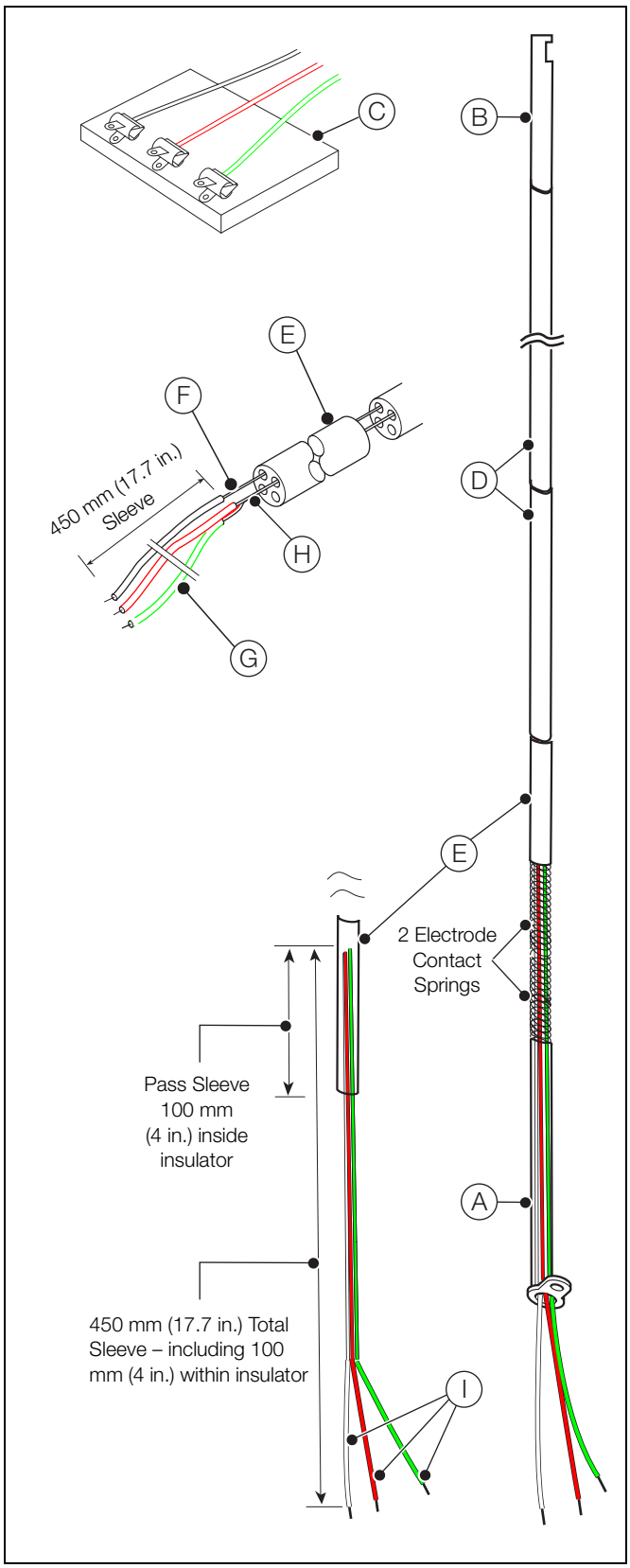


Fig. 5.8 Disassembling the Thermocouple / Electrode Assembly and Fitting New Insulators

Referring to Fig. 5.9:

8. Slide the 2 electrode contact springs (J) and the new spring locator (K) over the sleeved wires and slide them along until the springs butt up to the insulator.
9. Cut the sleeved wires from the end of the short insulator (L) to leave a length of 340 mm (13.4 in.).

   DO NOT cut the sleeves.
10. Position the sleeves to leave 10 mm (0.4 in.) of bare wire, (M) then bend the wire over by approximately 5 mm (0.2 in.) to retain the PTFE sleeves.
11. Refit the cell assembly as described in Section 5.7, page 16.
12. Carefully slide the assembled thermocouple / electrode assembly (N) into position in the probe body, supporting the insulators to prevent damage.
13. Locate the M4 spring locator retaining screw (O) to secure the assembly.
14. Reconnect the red (Cell +), green (TC+) and white (TC–) sleeved wires (P) to the inner terminal block connections.

    The 3 PTFE sleeved wires (TC+, TC– and Cell+) must be free to slide within the spring locator by up to 30 mm (1.2 in.) to allow for thermal expansion of the probe body during probe operation.
15. **AutoCal versions only** – if the Test Gas to Sensor tube (Q) was disconnected at step 1, in Section 5.8.1, page 20, reconnect it.
16. Refit the probe end cap – refer to Section 5.6.2, page 15.
17. Re-install the probe – refer to the probe User Guide (IM/AZ20P–EN).
18. Make gas supplies to the probe and electrical supplies to the transmitter.
19. If a new cell has been fitted, re-calibrate the probe – refer to the transmitter User Guide (IM/AZ20E-EN).

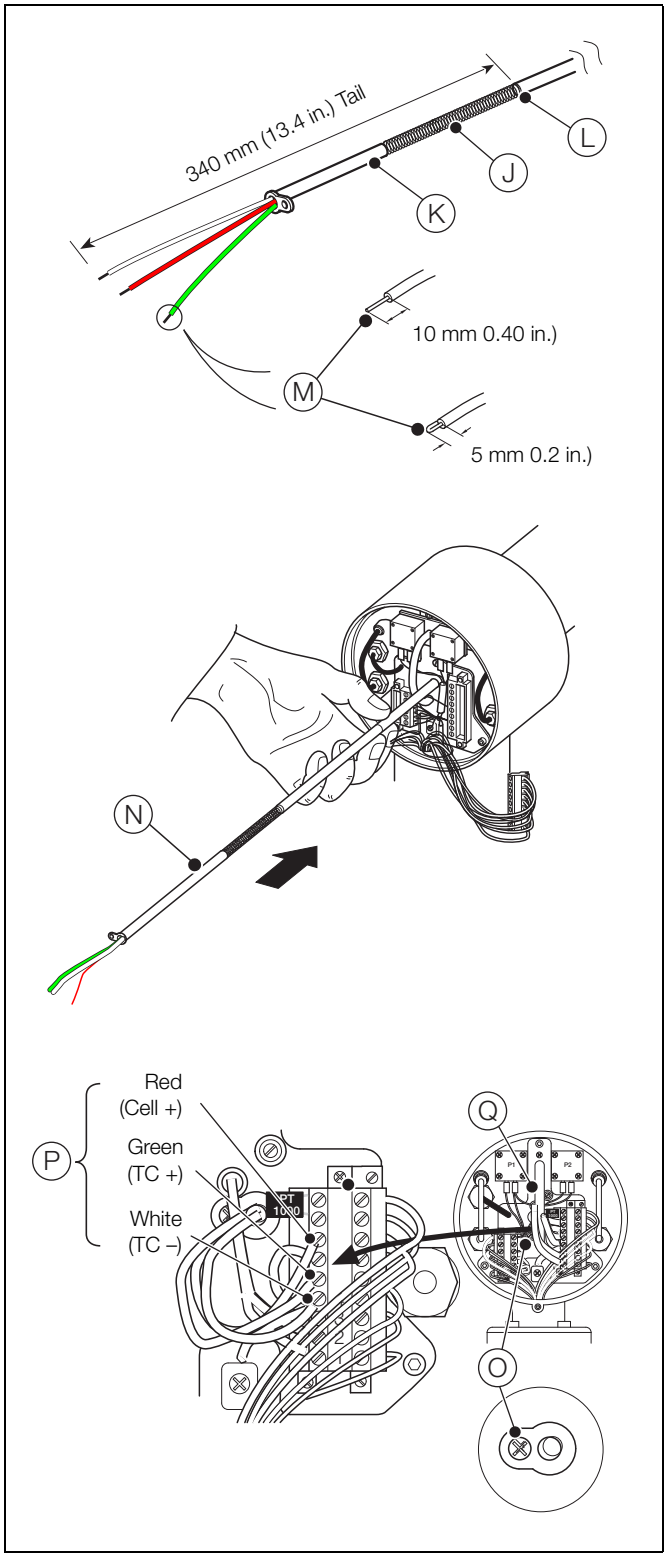


Fig. 5.9 Fitting a New Thermocouple / Electrode Assembly

5.9 Replacing the Heater Assembly

Note. Check all items for damage as they are removed. Keep items for reuse in a clean safe place. Replace all insulators with the new ones supplied in the kit. Do not reuse damaged insulators.

Before replacing the heater assembly:

1. Ensure replacement heater and C-ring kits are available – refer to Section 7.6, page 44.
2. Remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).
3. Remove the probe end cap as detailed in Section 5.6.1, page 15.
4. Remove the thermocouple / electrode assembly as detailed in Section 5.8.1, page 20.

Note. Do not remove the heater assembly until the thermocouple / electrode assembly has been removed.

5.9.1 Removing the Heater Assembly

Referring to Fig. 5.10:

1. Disconnect the internal earth connection (A).
2. If AutoCal is fitted, disconnect Test Gas 1 and 2 tubes (B) from the AutoCal manifold by pressing blue release ring (C) in and pulling the tube out.

   Note. If resistance is felt, press and hold the blue release ring and push the tube into the connector then withdraw it. Do not damage the Test Gas 1 and 2 tubes – damaged tubes may not seal when re-connected and could result in permanent damage to the fitting.

3. **AZ20 Probes only** – disconnect the internal Reference Air tube (D) from the connection on the probe body.

   AZ20/ZFG2 Replacement Probes only – disconnect the internal Reference Air tube (E) (connected to the internal conduit) from the connection on the probe body.
4. Disconnect the Test Gas to Sensor tube (F) at the centre connection.
5. Disconnect heater wires (G) from the terminal block (blue) and (brown) connections.
6. If transmitter wires are present, unscrew the terminal plug retaining screws (H) from terminal block(s) (I) and remove terminal plug(s) (J) from the socket(s).
7. Remove the 3 internal structure mounting plate M4 screws (K) using the 3 mm A/F hexagon wrench (supplied).
8. Carefully withdraw the inner assembly (L), supporting it along its length as it is withdrawn and place it on a flat clean surface.

   Note. If resistance is felt, rotate the probe body through 45 ° to 90 ° to free the inner assembly.

9. Proceed to Section 5.9.2, page 26 to dismantle the existing heater assembly.

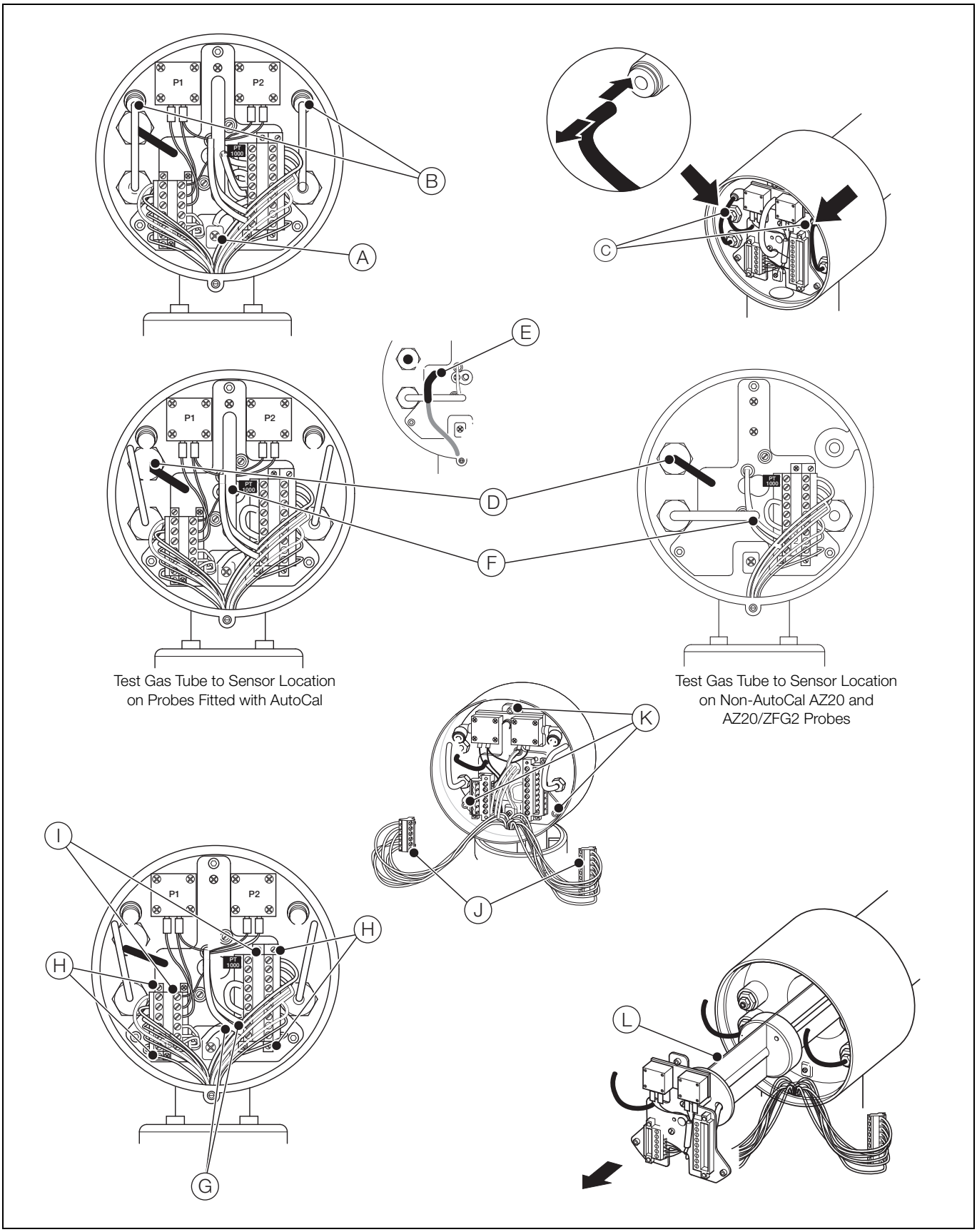


Fig. 5.10 Removing the Heater Assembly

5.9.2 Dismantling the Heater Assembly

Referring to Fig. 5.11:

1. Remove the red tube (A) and pull the sleeved heater wires (B) through the internal structure mounting plate / end plate (C).
2. Remove and discard the wire (D) holding the 2 thermal barrier sections (E) together and retain the barrier sections for re-assembly.
3. Fold the insulator retaining tabs (F) back just enough to free the insulators along the complete length of the inner assembly.
4. Remove each insulator (G) by sliding it over the heater wires.
5. Release the heater assembly (H) from the inner assembly support column(s) (I) by folding the 4 tabs (J) on the heater assembly end plate back.
6. Separate the heater assembly (H) from the inner support sections (I).
7. Discard the heater assembly (H) and insulators (G).
8. Proceed to Section 5.9.3, page 27 to assemble the new heater assembly.

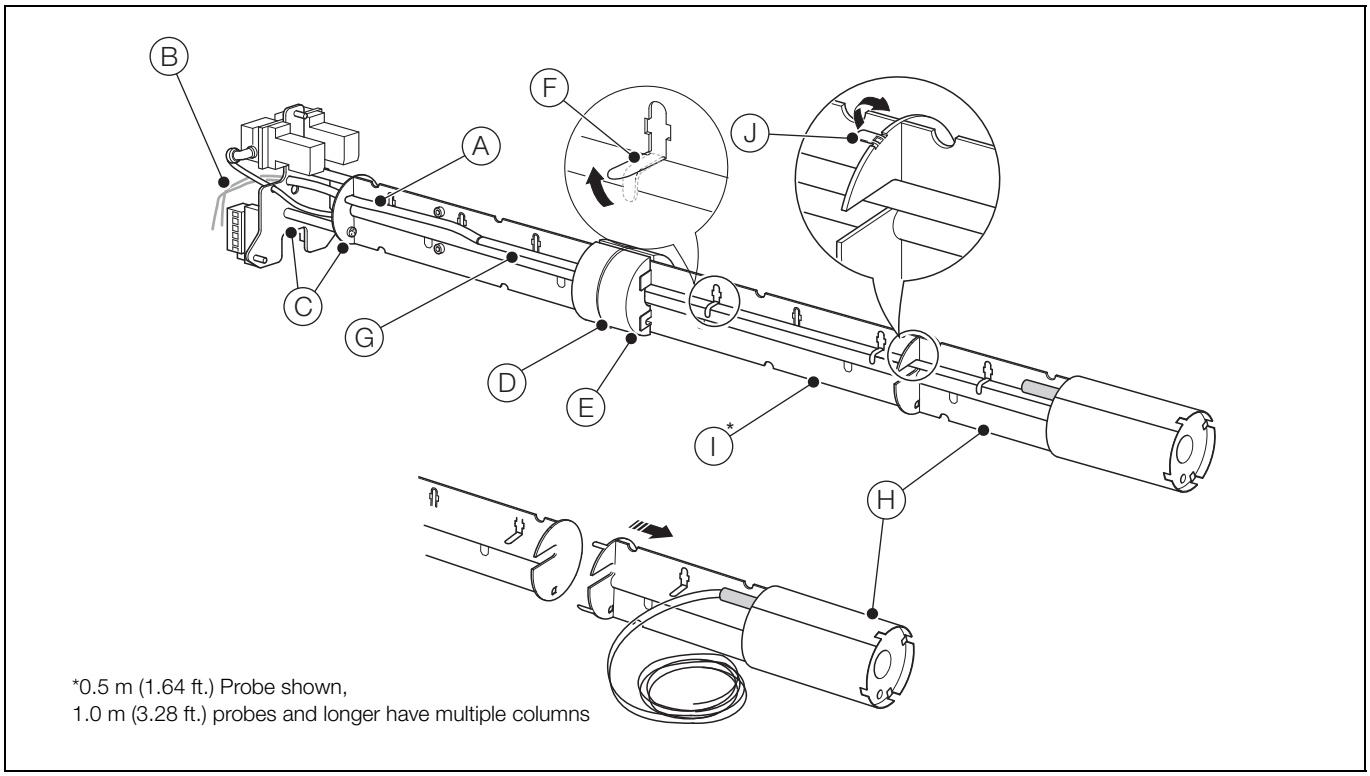


Fig. 5.11 Dismantling the Existing Heater Assembly

5.9.3 Assembling the New Heater Assembly

Referring to Fig. 5.12:

1. Join the heater assembly end plate (A) and the inner assembly support column end plate (B) and secure the end plates to each other by carefully folding the 4 heater assembly end plate tabs (C) down.
2. Slide the first insulator (D) over the heater wires and position it in the slot (E).
3. Fold the insulator retaining tabs (F) down to secure the first insulator to the extension support column.

   Note. If tabs break, use the spare unused tabs (G). Avoid folding tabs within 20 mm (0.8 in.) of insulator joints.

4. For 1.0 m (3.28 ft.) probes and longer, slide the remaining insulators along the heater wires. Ensure wires are not crossed in the insulator channels and position the insulators between the slots in each column. Ensure each insulator butts up to the previous insulator.

   Note. To prevent the oven leads from shorting to the metalwork of the inner column(s) at elevated process temperatures, all insulator joints should be spaced 100 mm (4 in.) or more from the slots (E) in each inner assembly support column.

   Secure each insulator by folding alternate insulator retaining tabs down on each section of the inner support assembly.
5. Refit the 2 parts of the thermal barrier sections (H) and secure them using the length of wire (I) (supplied). Wind 2 turns and twist the ends together.

   Caution. DO NOT use tape, this section operates at temperatures up to 400 °C (750 °F).
6. Pass the 2 heater wires (J) through the openings in the internal structure mounting plate / end plate (K).
7. Slide the red sleeve (L) over the heater wires until it butts up to the last insulator.
8. Prepare the heater wires (M) for re-connection by cutting back approximately 4 mm (0.2 in.) of heatshrink sleeve from each wire. Do not cut the heater wires
9. Proceed to Section 5.9.4, page 28 to refit the inner assembly.

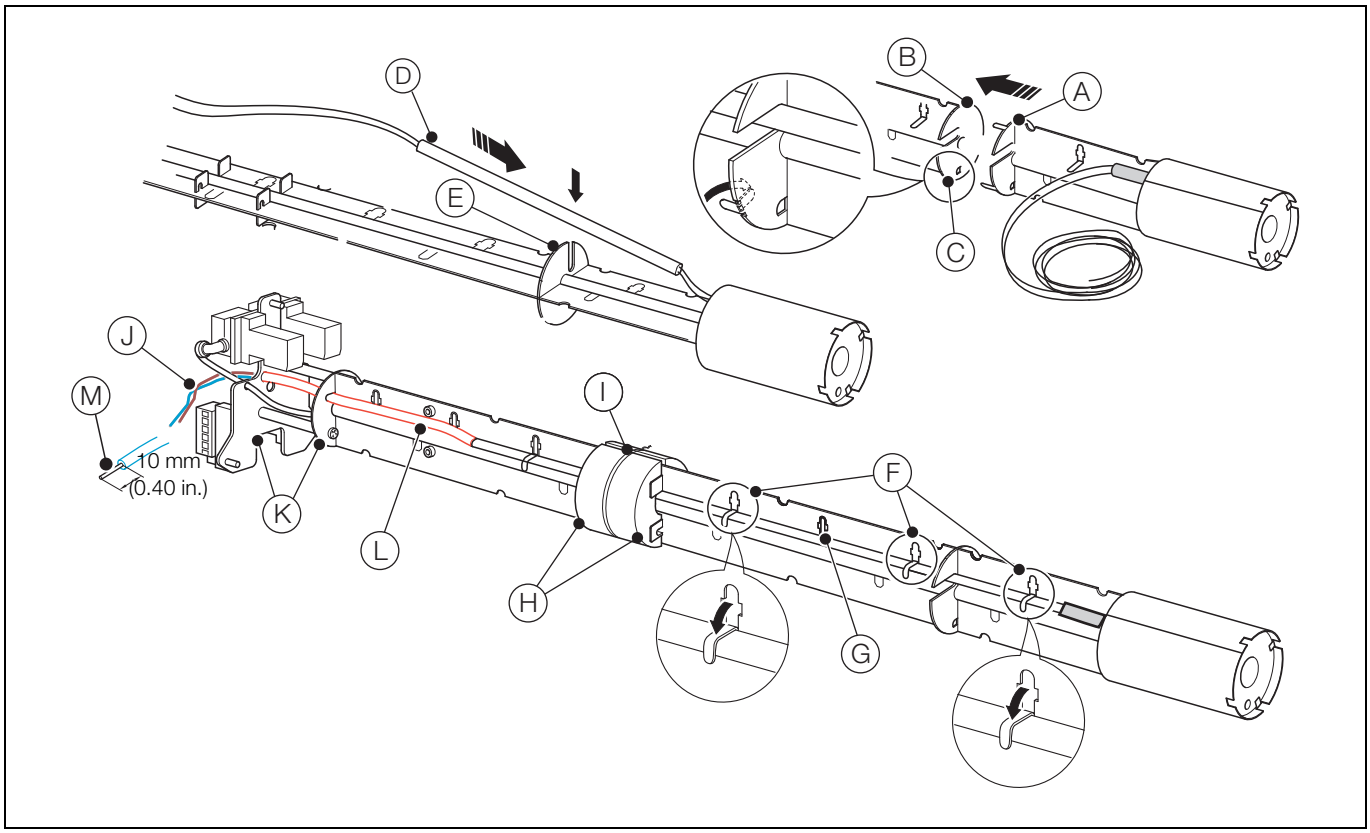


Fig. 5.12 Assembling the New Heater Assembly – 0.5 m (1.64 ft.) probe shown

5.9.4 Fitting the New Heater Assembly

Referring to Fig. 5.13:

1. Ensure the test gas tube (A) is clean and free of blockages. If necessary, clear it using an airline.
2. If the cell was removed, replace / renew the cell – refer to Section 5.7.3, page 18.

> **Caution.** Do not attempt to replace the inner assembly unless a cell is already fitted.

3. Ensure the inner assembly (B) is supported along its entire length and position the heater test gas hole (C) over the test gas tube (A) in the probe body.

   Keep the assembly straight while positioning the oven in the probe body and ensure the test gas hole is not blocked with oven insulation. To clear blockages, use an air line from the cell end.
4. Carefully slide the inner assembly (B) into the probe body until the end of the test gas tube (D) is visible through the internal structure mounting plate.

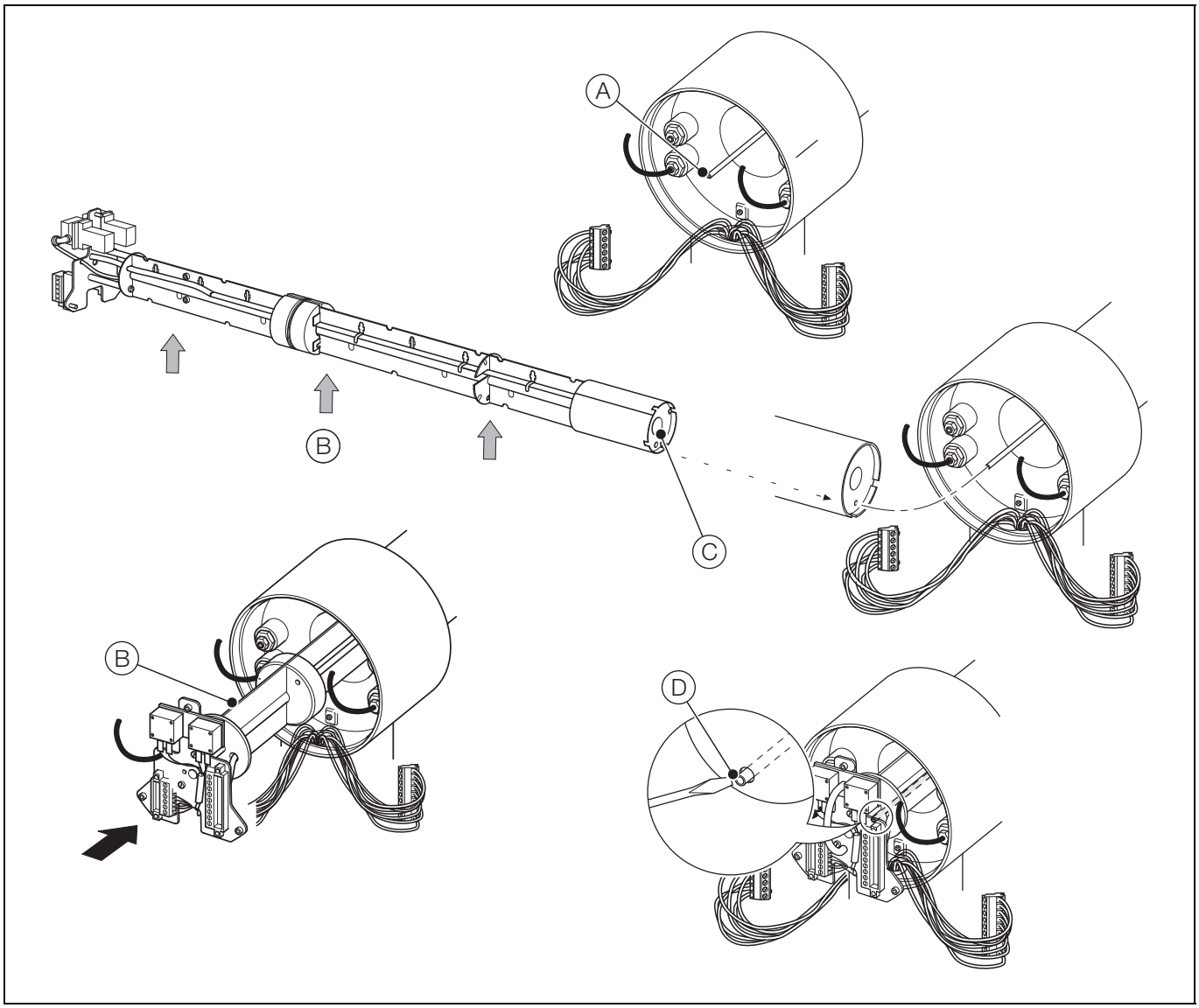


Fig. 5.13 Fitting the Inner Assembly into the Probe Body

Referring to Fig. 5.14:

5. Fit and tighten the 3 internal structure mounting plate M4 screws (A) using the 3 mm A/F hexagon wrench (supplied).
6. Refit the thermocouple / electrode assembly – refer to Section 5.8.2, page 22.
7. Connect heater wires (B) to the terminal block (blue) and terminal block (brown) connections.
8. If transmitter wires are present, fit terminal plug(s) (C) into their sockets) and screw the terminal plug retaining screws (D) into the terminal block(s) (E).
9. Connect the Test Gas to Sensor tube (F) at the centre connection.
10. **AZ20 Probes only** – disconnect the internal Reference Air tube (G) from the connection on the probe body.

    AZ20/ZFG2 Replacement Probes only – disconnect the internal Reference Air tube (H) (connected to the internal conduit) from the connection on the probe body.
11. If AutoCal is fitted, connect Test Gas 1 and 2 tubes (I) to the AutoCal manifold by pressing blue release ring (J) and connecting the tube.
12. Connect the internal earth connection (K).
13. Re-install the probe – refer to the probe User Guide (IM/AZ20P–EN).
14. Make gas supplies to the probe (refer to the probe User Guide [IM/AZ20E-EN] and electrical supplies to the transmitter (refer to the transmitter User Guide [IM/AZ20E-EN]).
15. If a new cell has been fitted, re-calibrate the probe – refer to the transmitter User Guide (IM/AZ20E-EN).

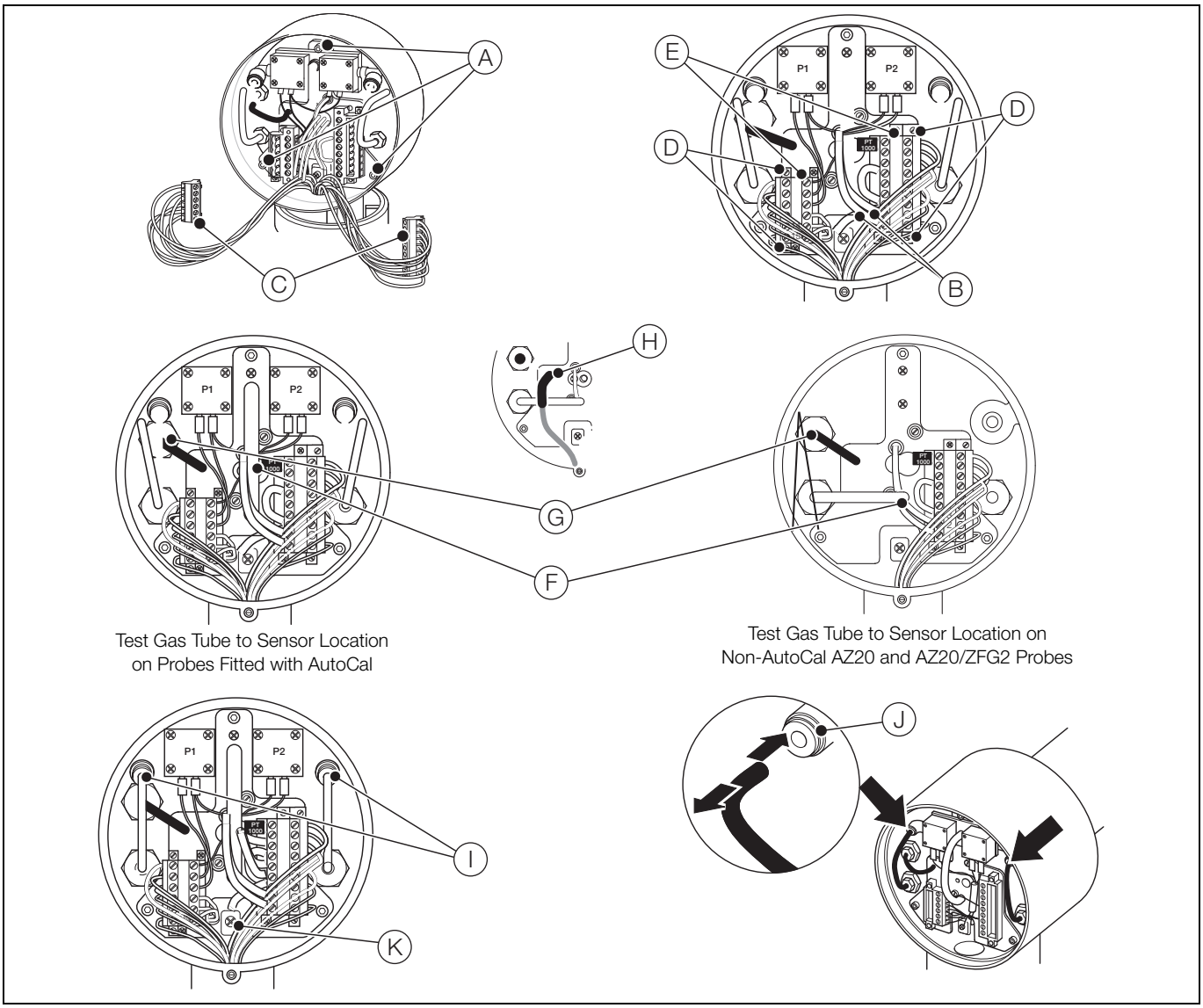


Fig. 5.14 Securing the Heater Assembly and Making Connections

5.10 Fitting AutoCal as an Upgrade

Note. This procedure upgrades a standard AZ20 probe to provide AutoCal capability (not applicable to AZ20/ZFG2 replacement probes). Refer to Appendix B.3 to B.5, pages 49 to 50 for further information.

Before fitting the AutoCal assembly:

1. Ensure AutoCal upgrade and C-ring replacement kits are available – refer to Section 7, page 42.
2. Remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).
3. Remove the probe end cap as detailed in Section 5.6.1, page 15.
4. **Integral probes only** – check that the AutoCal connection wires are available at the probe head; these should be accessible as an unconnected bundle – refer to the probe User Guide (IM/AZ20P–EN) for cable details.

5.10.1 Accessing the AutoCal Mounting Plate

Caution. Check if the cell is welded to the end of the thermocouple / electrode assembly – refer to Section 5.8, page 20.

Referring to Fig. 5.15:

1. Unscrew the 2 x 9-way terminal plug retaining screws (A) from terminal block (B) and remove terminal plug (C) from the socket.
2. Disconnect the reference air tube (D) by pressing the blue release ring in and pulling the tube out. If resistance is felt, press and hold the blue release ring and push the tube into the connector then withdraw it.
3. Disconnect test gas tube (E) from the centre connection.
4. Check that the thermocouple / electrode assembly is not welded to the cell – refer to Section 5.8.1, steps 1 to 4.
5. Disconnect earth wire (G).
6. Remove the 3 internal structure mounting plate M4 screws (H) using the 3 mm A/F hexagon wrench (supplied).
7. Carefully withdraw the inner assembly enough to allow access to both sides of the internal structure mounting plate (I).

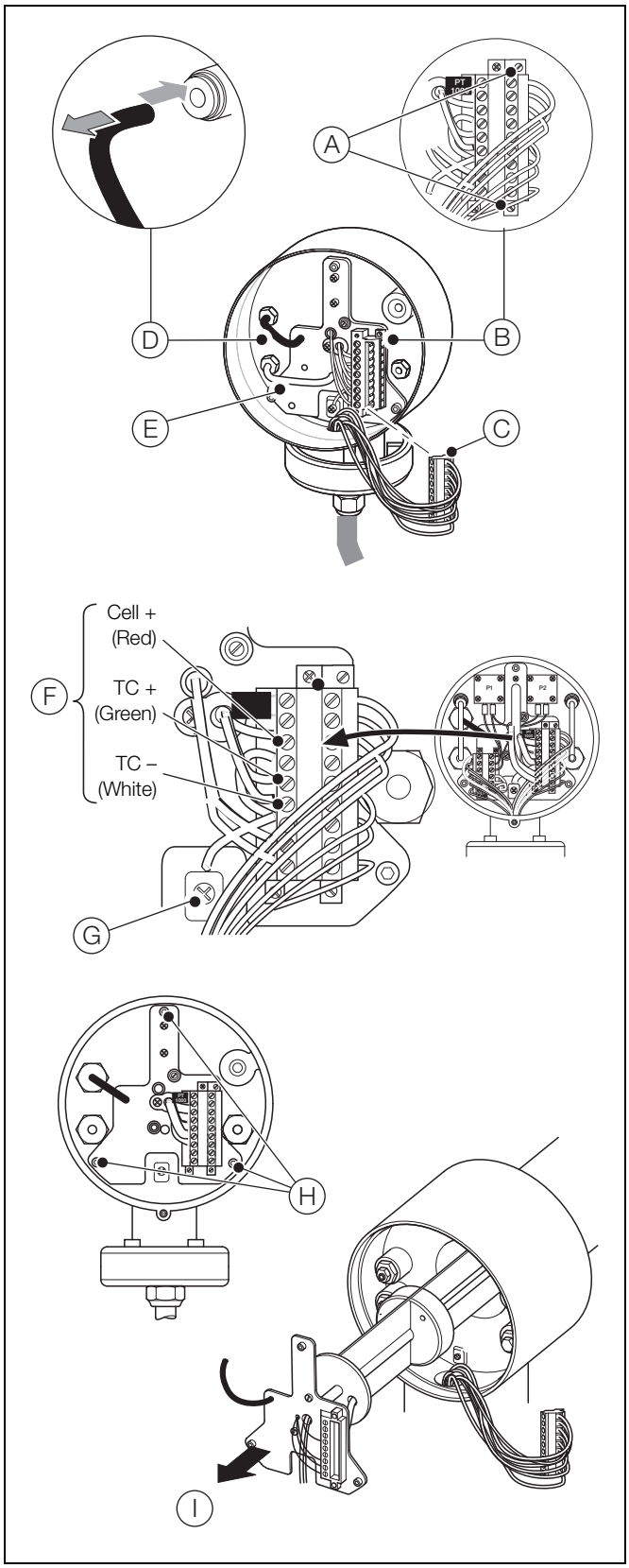


Fig. 5.15 Accessing the AutoCal Mounting Plate

5.10.2 Fitting an AutoCal Assembly

Note. Refer to Appendix B.4, page 50 for AutoCal manifold block orientation details.

Referring to Fig. 5.16:

1. Locate the AutoCal manifold (A) on the internal mounting plate with the pressure switches (PS1 and PS2) at the front of the plate (the same side as the 9-way terminal block). Secure the manifold using the 2 M3 screws (B) (supplied).
2. On remote probes, locate the 6-way AutoCal terminal block / plug (C) and secure it using the 2 M3 screws (D) (supplied). On integral probes, the terminal block is already fitted and the terminal plug cable connections are already made.
3. If not already fitted, push the Pressure Switch loom connections onto the Pressure Switch terminals (E) as follows:
   - White / Orange (PS1)
   - White / Black (PS COM)
   - White / Yellow (PS2)
   - White / Black (PS2 COM to PS1 COM terminal)
4. If not already fitted, push the Solenoid Valve loom connections onto the Solenoid Valve terminals (F) as follows:
   - White / Red (SV2 COM to SV1 COM terminal)
   - White / Blue (SV2)
   - White / Red (SV1 COM)
   - White / Green (SV1)
5. Make Pressure Switch loom connections to the (inner) terminal block terminals (G).
6. Feed the Solenoid Valve loom wires under the internal structure mounting plate and make Solenoid Valve loom connections to the (inner) terminal block terminals (H).

   Route the wires clear of the thermocouple / electrode assembly insulators and away from the mounting plate fixing points to ensure the do not become trapped.
7. If the cell was removed for checking / replacement in Section 5.7.2 page 16, ensure it is fitted before proceeding – refer to Section 5.7.3, page 18.

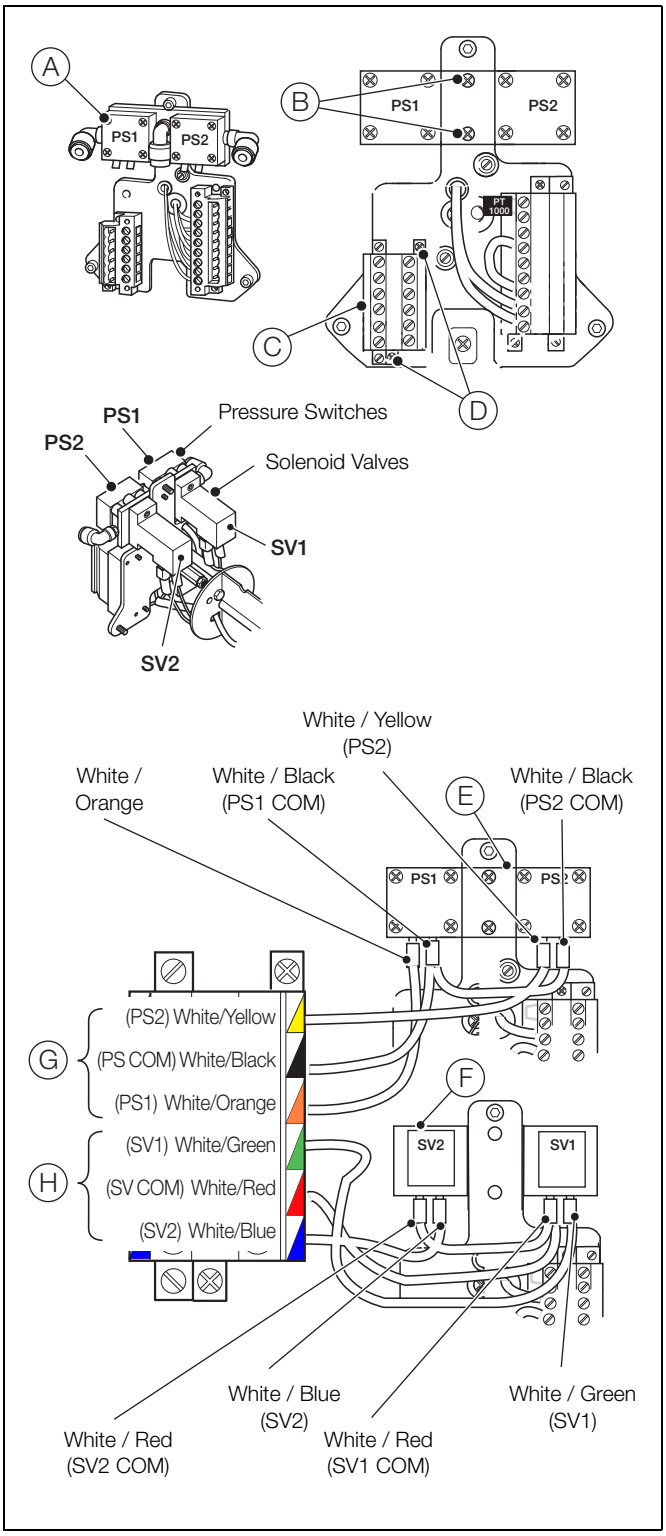


Fig. 5.16 Fitting the AutoCal Manifold and Making Terminal Block Connections

Referring to Fig. 5.17:

8. Withdraw the thermocouple / electrode assembly out of the inner assembly by approximately 50 to 70 mm (2 to 2.8 in.).
9. Carefully slide the inner assembly (G) into position.
10. Re-position the thermocouple / electrode assembly and secure it in position – refer to Section 5.8.2, steps 13 and 14, page 22.
11. Secure the internal mounting plate to the probe body using the 3 M4 screws (H) using the 3 mm A/F hexagon wrench (supplied).
12. Remove the 2 barbed test gas connectors (I) and replace them with the 2 connectors and seals supplied. If necessary, use PTFE tape to ensure a leak-tight joint.

> **Caution.** Test gas is applied to the probe continuously on AutoCal models. All connections through to the AutoCal assembly inside the probe must be leak-tight to prevent loss of test gas and contamination of reference air within the probe which could result in incorrect reading.

13. Re-connect the thermocouple / electrode assembly wires to the 9-way terminal block (J) (inner terminals) as shown in Table 5.2:

Terminal / Cable Color	Type	Tx Connection
Red	Cell +	Oxygen Input (+ve)
Green	T/C+	Thermocouple (+ve)
White	T/C –	Thermocouple (–ve)

Table 5.2 Thermocouple / Electrode Assembly Terminal Block Connections

14. Connect the screen from terminal SCN connection to the internal earth connection (K).
15. Make AutoCal cable connections to the 6-way terminal plug (L) as shown in Table 5.3:

Terminal / Cable Color	Tag ID	AutoCal Connection
White / Yellow	PS2	Pressure Switch Gas 2
White / Black	PS COM	Pressure Switch COM
White / Orange	PS1	Pressure Switch Gas 1
White / Green	SV1	Solenoid Valve Gas 1
White / Red	SV COM	Solenoid Valve COM
White / Blue	SV2	Solenoid Valve Gas 2

Table 5.3 AutoCal Terminal Plug Connections

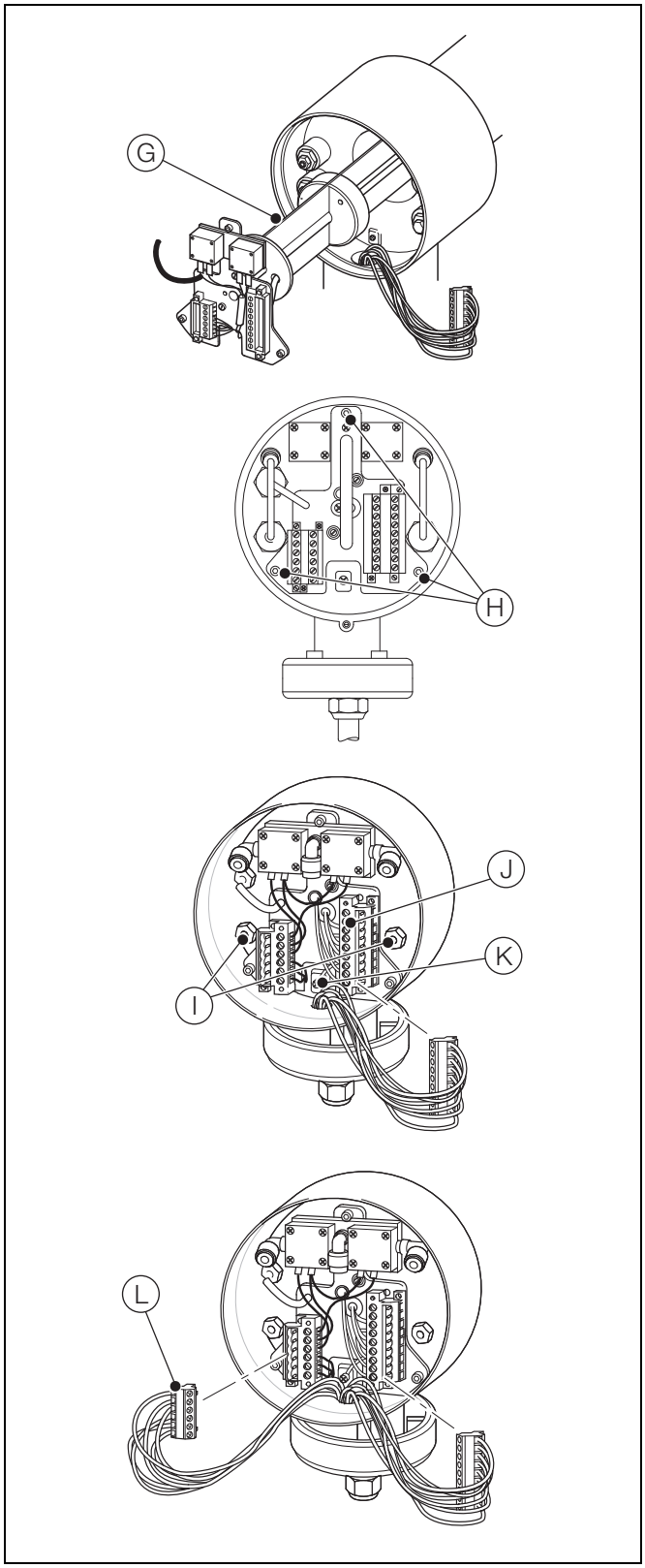


Fig. 5.17 Re-positioning the Inner Assembly and Making Terminal Plug Connections

Referring to Fig. 5.18:

16. Fit test gas to sensor tube (M) and reference air tube (N).
17. Fit test gas 1 and 2 tubes (O).
18. Push the 2 terminal plugs (P) into the terminal blocks and locate / tighten the terminal plug M3 retaining screws (Q).
19. Refit the probe end cap.
20. Record AutoCal upgrade details on the existing Commissioning Label (R).

    If a new cell has been fitted, record the AutoCal upgrade details and the new cell data details on the **new** Commissioning Label and re-calibrate the probe using the new cell data – refer to the transmitter User Guide (IM/AZ20E-EN)
21. Re-install the probe as detailed in the probe User Guide (IM/AZ20P–EN).
22. At the transmitter, set the 'Calibrate / AutoCal Hardware / Hardware Type' to 'Internal' – refer to the transmitter User Guide (IM/AZ20E–EN).
23. Make gas supplies to the probe and electrical supplies to the transmitter – refer to the transmitter User Guide (IM/AZ20E–EN) for electrical supplies and the probe User Guide (IM/AZ20P–EN) for gas and reference air supplies.

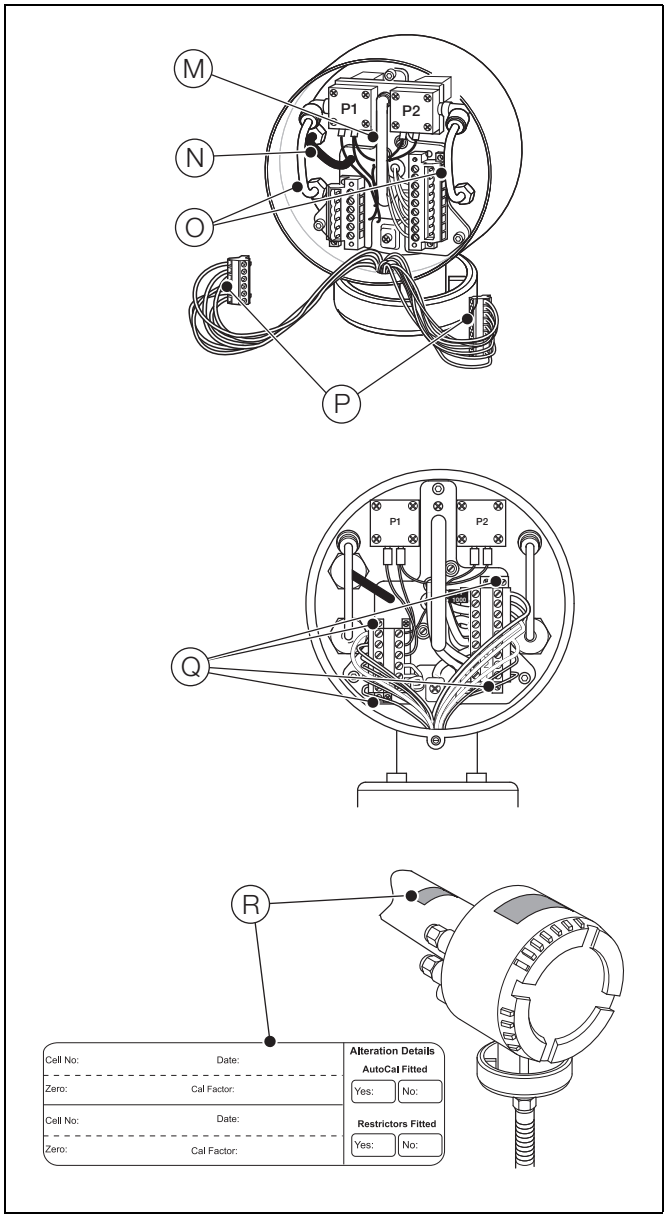


Fig. 5.18 Connecting the Gas / Air Tubes and Recording Commissioning Details

5.11 Replacing / Fitting Restrictors

Note. The restrictors have extremely small orifices so ensure this procedure is performed in a clean area.

Before proceeding:

- Ensure a restrictor kit is available – refer to Section 7.8, page 44.
- Remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).

Referring to Fig. 5.19:

1. Remove the reference air (Ref. Air) fitting (A) and external test gas (TG1, TG2) fittings (B) from the probe body inlets (C) using a 14 mm A/F spanner (not supplied).
2. If fitted, remove existing filter pads (D) from the probe body TG1, TG2 and Ref. Air inlets.
3. If fitted, remove existing test gas restrictors (E) from the probe body TG1 and TG2 inlets using the 3 mm A/F hexagon key supplied in the toolkit with the probe.
4. If fitted, remove the reference air restrictor (F) from the probe body (Ref. Air) inlet using the 2.5 mm A/F hexagon key supplied with the restrictor kit.
5. Remove any O-rings from the new restrictors and discard (the seal between the restrictors and probe body inlets is made by the metal-to-metal faces of the restrictors / inlets).
6. Fit the 2 new (larger) test gas restrictors (G) into the TG1 and TG2 inlets on the casting and tighten fully using the 3 mm A/F hexagon key.

   Do not use thread sealant (the metal to metal seal is sufficient).
7. Fit the new (smaller) reference air restrictor (H) into the Ref. Air inlet and tighten fully using the 2.5 mm A/F wrench supplied.

   Do not use thread sealant (the metal to metal seal is sufficient).
8. Fit new filter pads (I) in front of each restrictor.
9. Refit the reference air (Ref. Air) fitting (A) and external test gas (TG1, TG2) fittings (B) fitting using a 14 mm A/F spanner.

   Ensure fittings are leak-tight, use PTFE tape on the threads if necessary.
10. Mark the Commissioning label (J) on the probe to show that restrictors are fitted.
11. Re-install the probe as detailed in the probe User Guide (IM/AZ20P–EN).
12. Make gas supplies to the probe and electrical supplies to the transmitter – refer to the transmitter User Guide (IM/AZ20E–EN) for electrical supplies and the probe User Guide (IM/AZ20P–EN) for gas and reference air supplies.

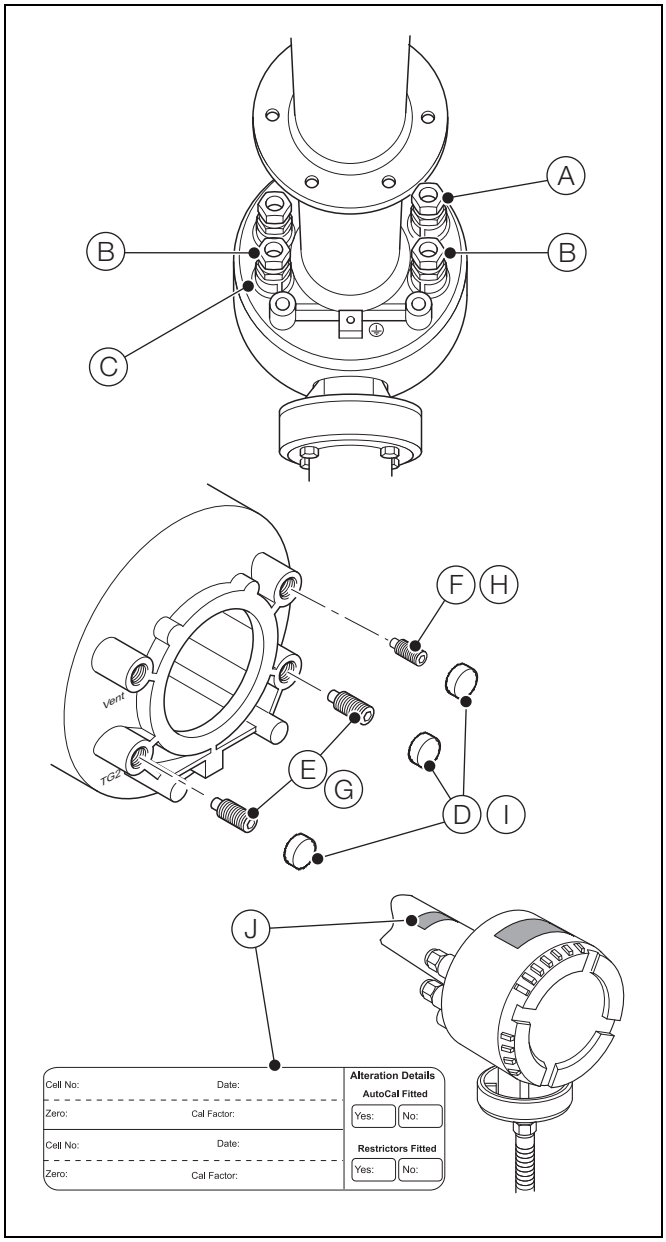


Fig. 5.19 Replacing / Fitting Restrictors

5.12 Replacing the PT1000 Temperature Sensor

Before fitting the PT1000 sensor:

- Ensure a PT1000 sensor is available – refer to Section 7.8, page 44.
- Remove the probe from its mounting as detailed in Section 5.4, page 14 (integral probe) or Section 5.5, page 14 (remote probe).
- Remove the probe end cap as detailed in Section 5.6.1, page 15.

Referring to Fig. 5.20:

1. Loosen the 2 ACJC connection terminal block screws (A) (violet and grey terminal label) and remove existing PT1000 sensor (B).
2. Connect the new PT1000 to the terminal block and tighten the 2 ACJC terminal block screws (A).
3. Refit the probe end cap – refer to Section 5.6.2, page 15.
4. Re-install the probe as detailed in the probe User Guide (IM/AZ20P–EN).

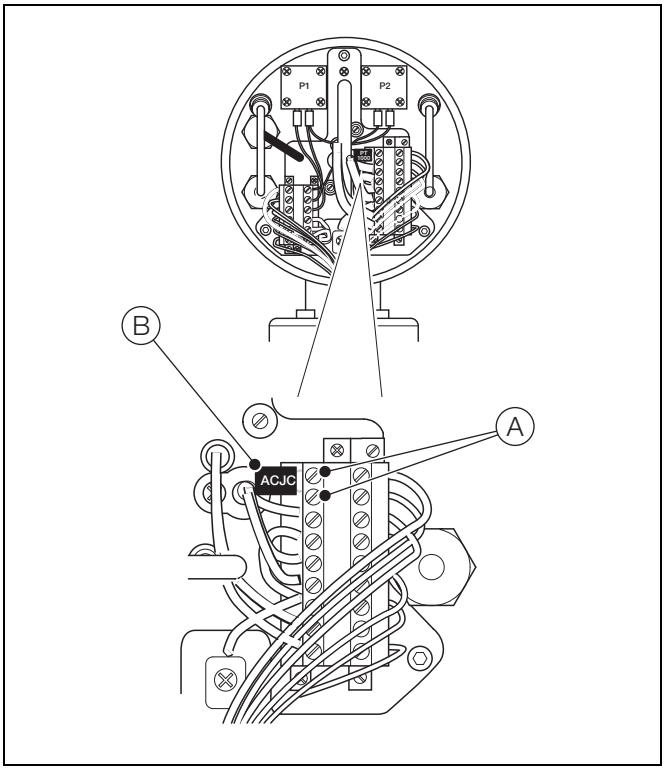


Fig. 5.20 Removing / Replacing the PT1000 Sensor

6 Dismantling and Reassembly – Transmitter

Warning.

- Before dismantling the transmitter, clean the outer surfaces of the transmitter thoroughly.
- Handle internal components carefully, keep them clean and ensure mating surfaces are not damaged during maintenance procedures.
- Do not subject the transmitter to blows from hammers or sharp objects.
- Do not reuse damaged parts, use new replacement parts only.

6.1 Replacing the Transmitter Cartridge

6.1.1 Replacing the Remote Transmitter Cartridge

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on.

Referring to Fig. 6.1:

1. Unscrew the 4 (captive) transmitter cover retaining screws (A).
2. Remove the transmitter cover (B).
3. Confirm that the power indicator LED (C) on the backplane is **not** lit.

   Warning. If the power indicator LED (C) is lit, the transmitter is still powered-up. Isolate the transmitter from the power supply before continuing.
4. Slacken the 3 cartridge retaining screws (D), lift the cartridge (E) away from the housing and discard the cartridge.
5. Position a new cartridge over the backplane (F), align the cartridge retaining screws (D) with the 3 backplane screw access holes (G) and push the cartridge in gently to engage the connectors.
6. Tighten the 3 cartridge retaining screws (D) to secure the cartridge (E) to the backplane (F).
7. Locate the transmitter cover (B) and tighten the 4 transmitter cover retaining screws (A).
8. Refer to the transmitter User Guide (IM/AZ20E–EN) to re-configure the transmitter

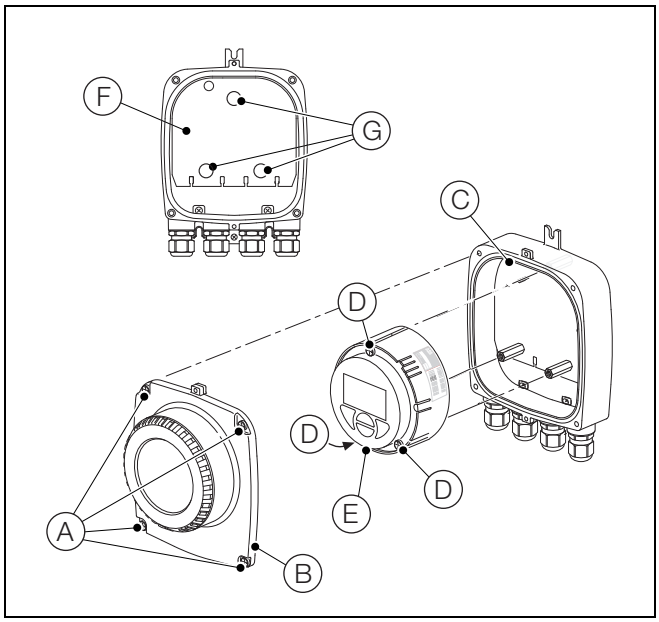


Fig. 6.1 Replacing the Cartridge on a Remote Transmitter

6.1.2 Replacing the Integral Transmitter Cartridge

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on.

1. Ensure a replacement cartridge of the correct type is available – refer to Section 8.1, page 45 for cartridge options.

Referring to Fig. 6.2:

2. Screw security pin (A) in (clockwise) to enable the cover to be removed.
3. Unscrew the transmitter cover (B) by twisting it anti-clockwise.
4. Slacken the 3 cartridge retaining screws (C), lift the cartridge (D) away from the housing and discard the cartridge – refer to the probe User Guide (IM/AZ20P–EN) for recommended disposal procedures.
5. Position a new cartridge over the backplane (E), align the cartridge retaining screws (C) with the 3 backplane screw access holes (F) and push the cartridge in gently to engage the connectors.
6. Tighten the 3 cartridge retaining screws (C) to secure the cartridge (D) to the backplane (E).
7. Refit the transmitter cover (B) by screwing it in place and unscrew security pin (A) to lock the cover.
8. Refer to the transmitter User Guide (IM/AZ20E–EN) to re-configure the transmitter

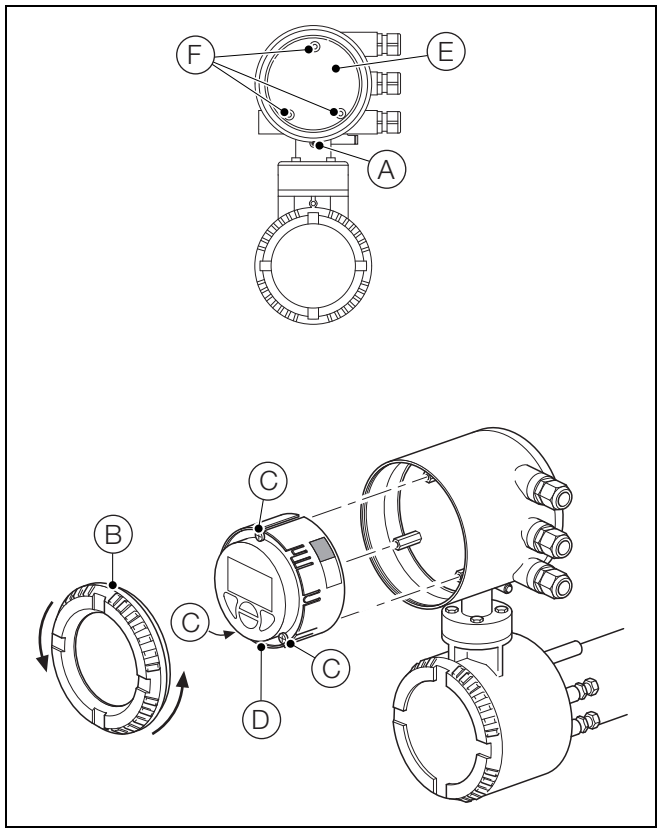


Fig. 6.2 Replacing the Cartridge on an Integral Transmitter

6.2 Replacing the Integral Transmitter Backplane

6.2.1 Removing the Backplane

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on.

1. Remove the transmitter cover and cartridge as detailed in Section 6.1.2, page 37, steps 2 to 4.

Referring to Fig. 6.3:

2. Unplug the probe signal connectors (A).
3. Unscrew and remove the 3 backplane retaining screws (B).
4. Lift the backboard (C) out of the probe transmitter housing (D) and discard the backboard – refer to the transmitter User Guide (IM/AZ20E–EN) for disposal recommendations.
5. Proceed to Section 6.2.2, page 38 to fit a new backplane.

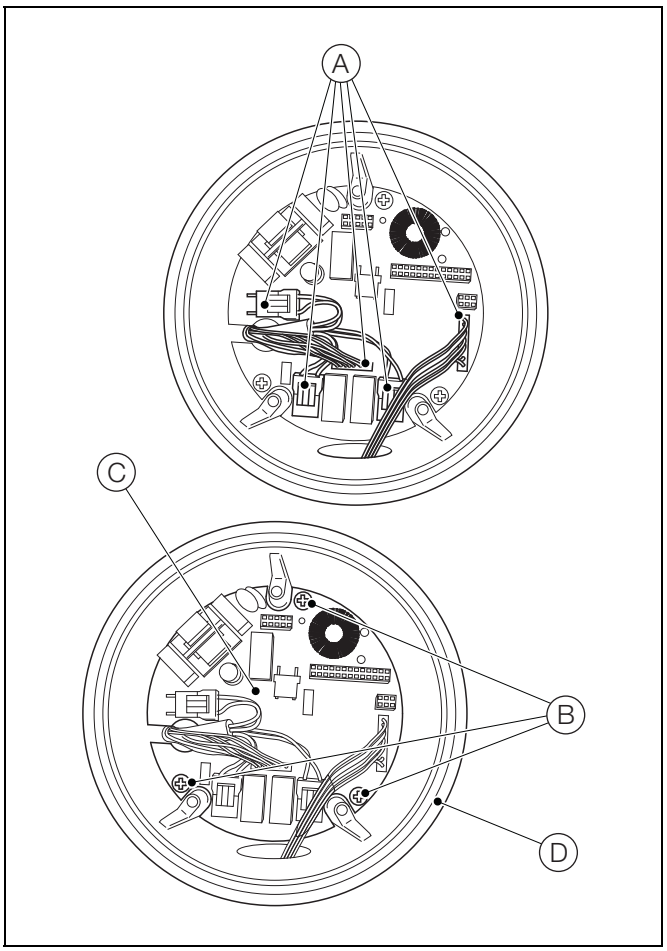


Fig. 6.3 Removing the Backplane from an Integral Transmitter

6.2.2 Fitting a New Backplane

Referring to Fig. 6.4:

1. Position the new backboard (A) in the probe's transmitter housing (B).
2. Tighten the 3 backplane retaining screws (C) to secure the backplane (A) to the probe's transmitter housing (B).
3. Reconnect the probe's signal connectors (D), ensuring they are plugged into the correct terminations.
4. Proceed to Section 6.1.2, page 37, steps 5 to 8 to refit the cartridge (the refitting procedure is the same for both existing and new cartridges).

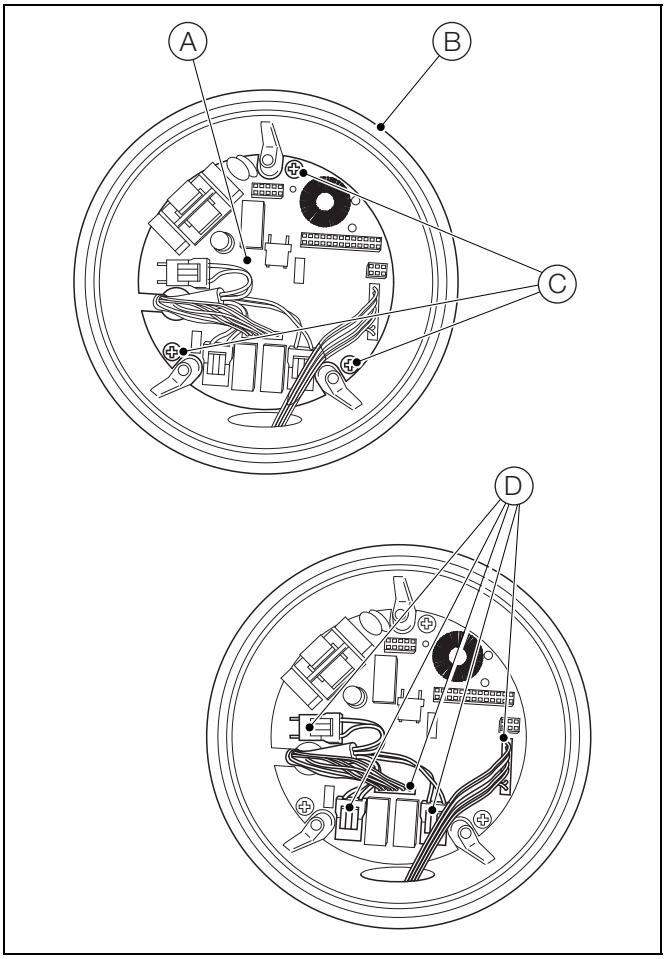


Fig. 6.4 Fitting a New Backplane to an Integral Transmitter

6.3 Replacing the Remote Transmitter Backplane

6.3.1 Removing the Backplane

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on..

1. Remove the transmitter cover and cartridge as detailed in Section 6.1.1, page 36, steps 1 to 4.

Referring to Fig. 6.5:

2. Disconnect the existing power and signal connections to terminal blocks (A) and insulate individual mains cable terminations as a safety precaution.
3. Unscrew and remove the 3 backplane retaining pillars / screws (B) using a 7 mm A/F socket.
4. Lift the backboard (C) out of the probe transmitter housing (D) and discard the backboard – refer to the transmitter User Guide (IM/AZ20P–EN) for disposal recommendations.
5. Proceed to Section 6.3.2 to fit a new backplane.

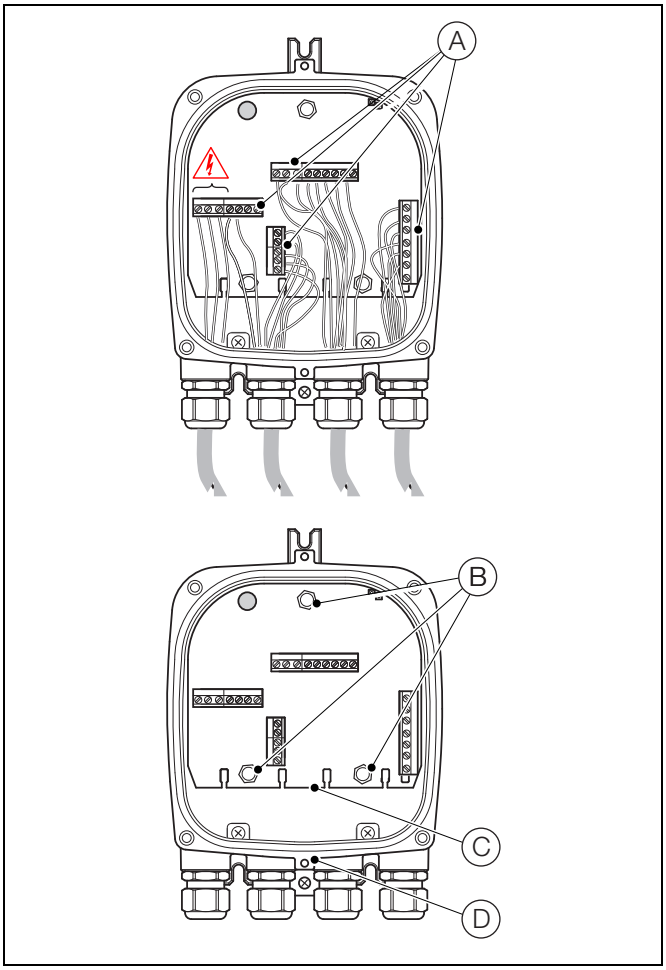


Fig. 6.5 Removing the Backplane from a Remote Transmitter

6.3.2 Fitting a New Backplane

Referring to Fig. 6.6:

1. Position the new backboard (A) in the transmitter housing (B).
2. Tighten the 3 backplane retaining screws (C) to secure the backplane (A) to the transmitter housing (B).
3. Proceed to Section 6.3.3, page 40 to make probe cable connections.

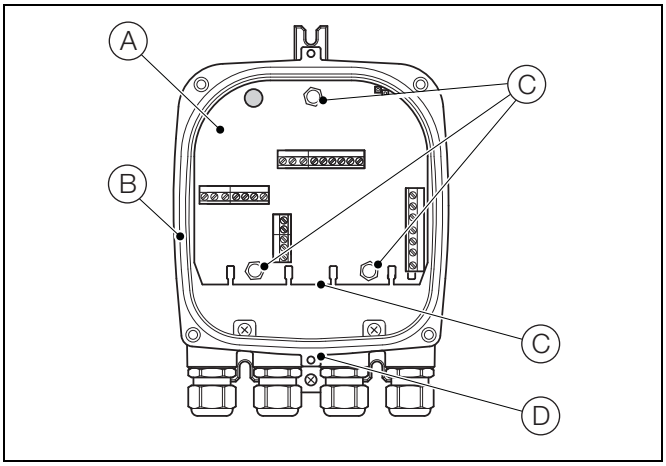


Fig. 6.6 Fitting a New Backplane to a Remote Transmitter

6.3.3 Probe Cable Connections to Remote Transmitter

Referring to Fig. 6.7:

1. Feed the probe cable through cable gland (A) and tighten the gland.
2. Make probe cable connections (B) at the probe as detailed in Appendix B, page 48.
3. Make probe cable connections at the transmitter terminal blocks (C) as shown in Table 6.1.
4. Proceed to Section 6.3.4, page 41 to make probe power and signal connections.

Terminal Number	Tag ID	Connection Type	Cable Color
1	H	Heater	Brown
2	H	Heater	Blue
3	SCN	Screen	Screens
4	T/C –	Thermocouple (–ve)	White
5	T/C+	Thermocouple (+ve)	Green
6	ACJC	PT1000 Cold Junction Compensation	Grey
7	ACJC	PT1000 Cold Junction Compensation	Violet
8	CELL –	Oxygen Input (–ve)	Black
9	CELL +	Oxygen Input (+ve)	Red
10	PS2	Pressure Switch – Gas 2	White / Yellow
11	P COM	Pressure Switch – Common	White / Black
12	PS1	Pressure Switch – Gas 1	White / Orange
13	SV2	Solenoid Valve – Gas 2	White / Blue
14	SV COM	Solenoid Valve – Common	White / Red
15	SV1	Solenoid Valve – Gas 1	White / Green

Table 6.1 Probe Cable Terminal Connections at Remote Transmitter

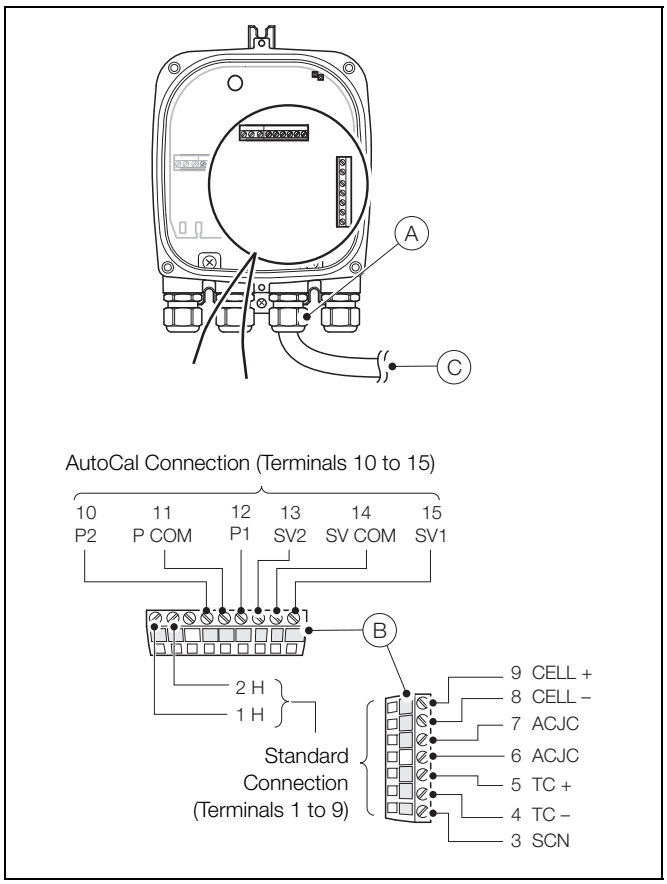


Fig. 6.7 Probe Cable Connections at Transmitter Terminals

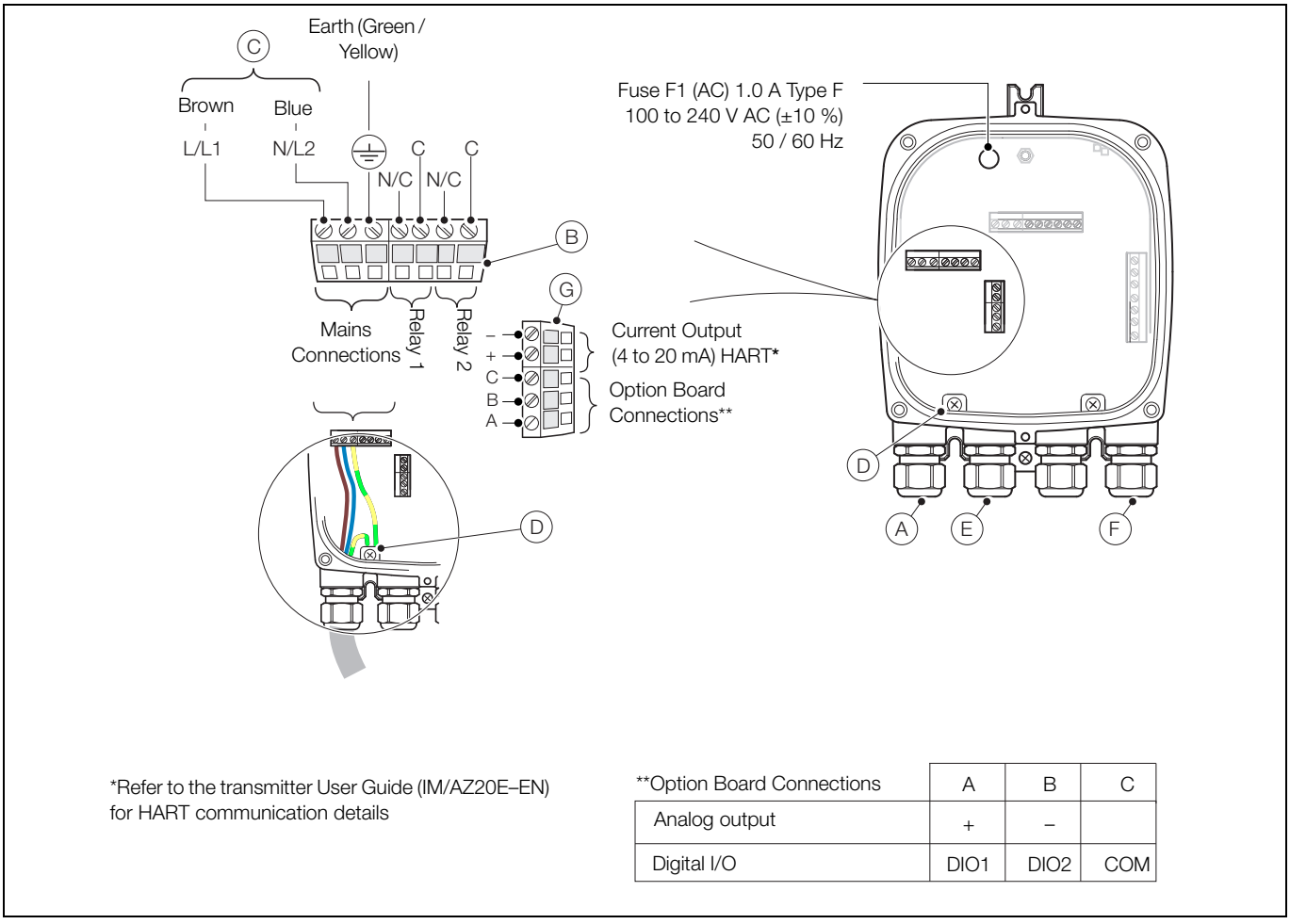
6.3.4 Power Supply and Output Connections to Remote Transmitter

Warning.

- The transmitter must be earthed.
- Isolate the incoming mains power supply cable before making connections at the transmitter or the probe.

To make power supply and output connections:

1. Feed the incoming AC power supply cable through cable gland (A).
2. At terminal block (B), make connections to the AC power supply line (brown) and neutral (blue) terminals (C).
3. Connect the incoming AC power supply earth wire to internal earth connection (D).
4. Feed the signal cable(s) through cable gland(s) (E) and (F) and make connections to the relay outputs (terminal block (B)) and current output and option board terminals (terminal block (G)) as required.
5. Refer to Section 6.1.1, page 36, steps 5 to 8 to refit the cartridge and transmitter cover.

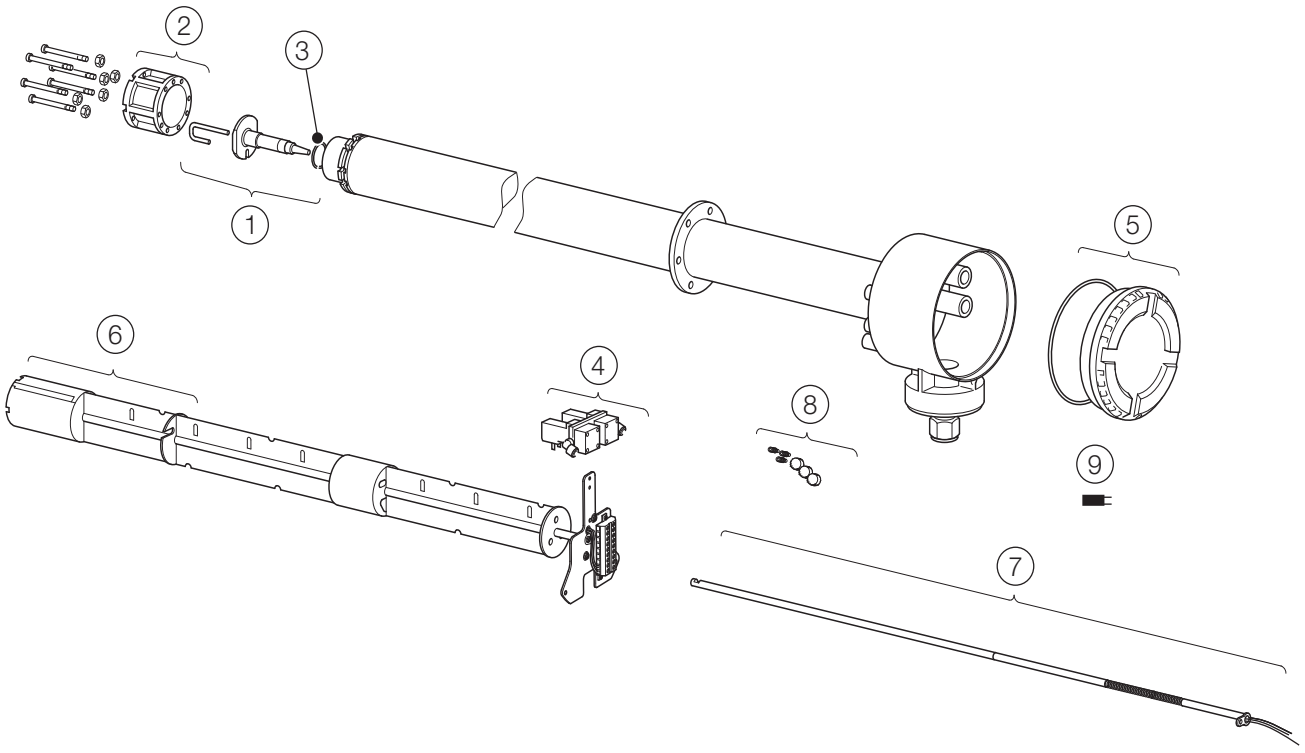


*Refer to the transmitter User Guide (IM/AZ20E–EN) for HART communication details

**Option Board Connections	A	B	C
Analog output	+	–	
Digital I/O	DIO1	DIO2	COM

Fig. 6.8 Remote Transmitter – Power Supply and Output Connections

7 Illustrated Parts List – Probe



Item	Description	Kit Components	Replacement Procedure
①	Cell assembly	Table 7.1, page 43	Refer to Section 5.7, page 16
②	Diffuser flame arrestor	Table 7.2, page 43	Refer to Section 5.7.4, page 18
③	C-ring	Table 7.3, page 43	Refer to Section 5.7.3, page 18
④	AutoCal assembly AutoCal upgrade assembly AutoCal refurbishment kit	 Table 7.4, page 43 Table 7.5, page 43	Refer to Section 5.10, page 30
⑤	AZ20 and AZ20/ZFG2 end cap	Table 7.6, page 43	Refer to Section 5.6, page 15
⑥	Heater assembly (includes insulators) AZ20 heater assembly (includes insulators) AZ20/ZFG2 replacement probe heater assembly (includes insulators)	 Table 7.7, page 44 Table 7.8, page 44	Refer to Section 5.9, page 24
⑦	Thermocouple / electrode assembly (includes insulators)	Table 7.9, page 44	Refer to Section 5.8, page 20
⑧	Restrictor kit	Table 7.10, page 44	Refer to Section 5.11, page 34
⑨	PT1000 temperature sensor	Table 7.11, page 44	Refer to Section 5.12, page 35

Fig. 7.1 AZ20 Probe Replacement Kits

7.1 Cell Assembly

Item	Quantity
Cell	1
M4 x 50 cap head screws	6
M4 nuts	6
C-ring	1
Commissioning label	1

Table 7.1 Cell Replacement Kit – Part No. AZ200 700

7.2 Diffuser Flame Arrestor

Item	Quantity
Diffuser Flame Arrestor	1
M4 x 50 cap head bolts	6
M4 nuts	6
C-ring	1

Table 7.2 Diffuser Flame Arrestor Replacement Kit – Part No. AZ200 729

7.3 C-ring Kit

Item	Quantity
C-ring	1
M4 x 50 cap head bolts	6
M4 nuts	6

Table 7.3 C-ring Replacement Kit – Part No. AZ200 726

7.4 AutoCal Assembly

7.4.1 AutoCal Upgrade Assembly

Note. This kit **upgrades** a non-AutoCal AZ20 probe to full AutoCal functionality – not applicable to AZ20/ZFG2 replacement probes.

Item	Quantity
AutoCal manifold assembly	1
AutoCal connection loom	1
6-Way terminal block with plug (required for remote probes)	1
M3 bolts (2 manifold, 2 terminal block)	4
Internal test gas connectors with air-tight seals	2
Test gas tube (test gas 1 and test gas 2)	2
Test gas tube to sensor	1
Commissioning label	1

Table 7.4 AutoCal Upgrade Kit – Part No. AZ200 730

7.4.2 AutoCal Refurbishment Kit

Note. This kit replaces the **existing** AutoCal assembly fitted to an AZ20 AutoCal probe – not applicable to AZ20/ZFG2 replacement probes.

Item	Quantity
AutoCal manifold assembly	1
AutoCal connection loom	1
M3 bolts (manifold)	2
Test gas tube (test gas 1 and test gas 2)	2
Test gas tube to sensor	1
Commissioning label	1

Table 7.5 AutoCal Refurbishment Kit – Part No. AZ200 734

7.5 AZ20 and AZ20/ZFG2 End Cap Replacement Kit

Note. Wiring labels are provided for both AZ20 and AZ20/ZFG2 replacement probe types. When fixing the label inside the end cap, ensure the label matches the probe type. To identify the probe type, refer to the external probe label.

Item	Quantity
End cap	1
End Cap seal	1
AZ20 Wiring label	1
AZ20/ZFG2 Wiring label	1

Table 7.6 AZ20 End Cap Replacement Kit – Part No. AZ200 728

7.6 Heater Assembly

Note. The heater and heater support column is supplied as an assembled unit for all kits.

7.6.1 AZ20 Probe Heater (190 Ω)

Note. AZ20 (190 Ω) heater kits cannot be used with AZ20/ZFG2 replacement probes.

Item	Quantity
AZ20 heater kit comprises: heater / heater support assembly (1 per kit) red outer sleeve (1 per kit) inner support assembly (1 per kit) thermal barrier retaining wire (1 per kit) Heater wire / insulator kits comprise: 0.5 m (1.64 ft.) – kit part no. AZ200 710 1.0 m (3.28 ft.) – kit part no. AZ200 711 1.5 m (4.92 ft.) – kit part no. AZ200 712 2.0 m (6.56 ft.) – kit part no. AZ200 713 2.5 m (8.20 ft.) – kit part no. AZ200 714 3.0 m (9.84 ft.) – kit part no. AZ200 715 3.5 m (11.48 ft.) – kit part no. AZ200 716 4.0 m (13.12 ft.) – kit part no. AZ200 717	1

Table 7.7 AZ20 Heater Assembly Replacement Kits

7.6.2 AZ20/ZFG2 Replacement Probe Heater (25 Ω)

Note. AZ20/ZFG2 replacement probe (25 Ω) heater kits cannot be used with AZ20 probes.

Item	Quantity
AZ20/ZFG2 heater kit comprises: heater / heater support assembly (1 per kit) red outer sleeve (1 per kit) inner support assembly (1 per kit) thermal barrier retaining wire (1 per kit) Heater wire / insulator kits comprise: 0.5 m (1.64 ft.) – kit part no. AZ200 720 1.0 m (3.28 ft.) – kit part no. AZ200 721 1.5 m (4.92 ft.) – kit part no. AZ200 722 2.0 m (6.56 ft.) – kit part no. AZ200 723	1

Table 7.8 AZ20/ZFG2 Heater Assembly Replacement Kits

7.7 Thermocouple / Electrode Assembly

Note. Kits for probe lengths 0.5 to 2.0 m (1.64 to 6.56 ft.) can be used with AZ20 and AZ20/ZFG2 replacement probes. Kits for probe lengths in excess of 2 m (6.56 ft.) can be used only with AZ20 probes.

Item	Quantity
Thermocouple / electrode assembly kit comprises: cell contact sub-assembly – as probe insertion length (1 per kit) springs (2 per kit) 500 mm (19.7 in.) long insulators (refer to Table 5.1, page 22 for quantities by insertion length) 148 mm (5.8 in.) long T/C and electrode insulator (1 per kit) red, white and green color-coded 0.45 m (17.7 in.) sleeves for wires (1 sleeve for each wire, 3 sleeves per kit) Thermocouple / electrode kit part numbers comprise: 0.5 m (1.64 ft.) – kit part no. AZ200 701 1.0 m (3.28 ft.) – kit part no. AZ200 702 1.5 m (4.92 ft.) – kit part no. AZ200 703 2.0 m (6.56 ft.) – kit part no. AZ200 704 2.5 m (8.20 ft.) – kit part no. AZ200 705 3.0 m (9.84 ft.) – kit part no. AZ200 706 3.5 m (11.48 ft.) – kit part no. AZ200 707 4.0 m (13.12 ft.) – kit part no. AZ200 708	1

Table 7.9 Thermocouple / Electrode Assembly Replacement Kit

7.8 Restrictor Kit

Item	Quantity
Restrictor (large) M6	2
Restrictor (small) M5	1
Filter	3
Commissioning label	1
Hex wrench – 3.0 mm A/F	1
Hex wrench – 2.5 mm A/F	1

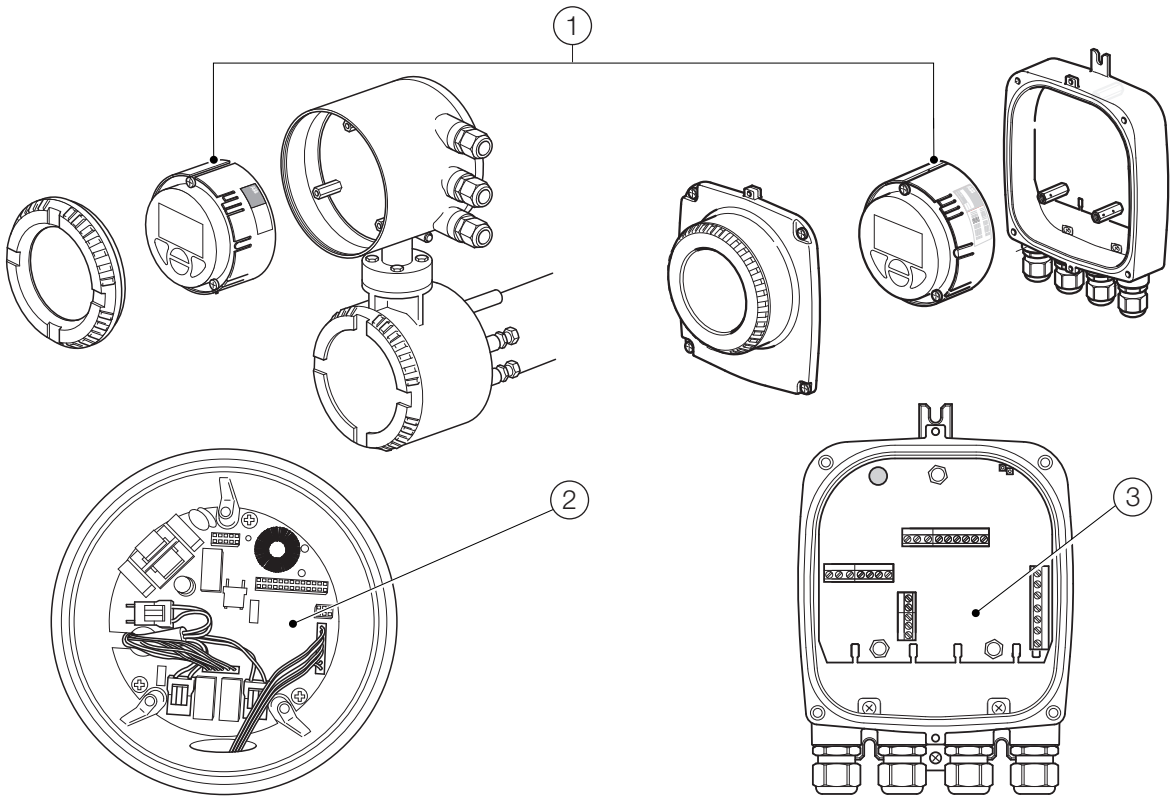
Table 7.10 Restrictor Kit – Part No. AZ200 727

7.9 PT1000 Temperature Sensor

Item	Quantity
PT1000 temperature sensor	1

Table 7.11 PT1000 Temperature Sensor – Part No. AZ200 725

8 Illustrated Parts List – Transmitter



Item	Description	Kit Components	Replacement Procedure
(1)	Cartridge	Table 8.1	Refer to Section 6.1, page 36
(2)	Integral (Type 3) probe backplane	Table 8.2	Refer to Section 6.2, page 38
(3)	Remote (Type 4) probe backplane	Table 8.3	Refer to Section 6.3, page 39

Fig. 8.1 AZ20 Transmitter Replacement Kits

8.1 Cartridge

Item	Quantity
Replacement cartridge.	1
Replacement cartridge options comprise:	
Standard cartridge (kit part no. AZ200 750)	
Standard cartridge, plus analog outputs (kit part no. AZ200 751)	
Standard cartridge, plus digital input / output (kit part no. AZ200 752)	

Table 8.1 Cartridge Replacement Kit

8.2 AZ20 Integral (Type 3) Probe Backplane

Item	Quantity
AZ20 integral (Type 3) probe backplane	1

Table 8.2 AZ20 Integral (Type 3) Probe Backplane Replacement Kit – Part No. AZ200 757

8.3 AZ20 Remote (Type 4) Probe Backplane

Item	Quantity
AZ20 remote (Type 4) probe backplane	1

Table 8.3 AZ20 Remote (Type 4) Probe Backplane Replacement Kit – Part No. AZ200 758

Appendix A – Connection Diagrams

A.1 AZ20 Integral Probe

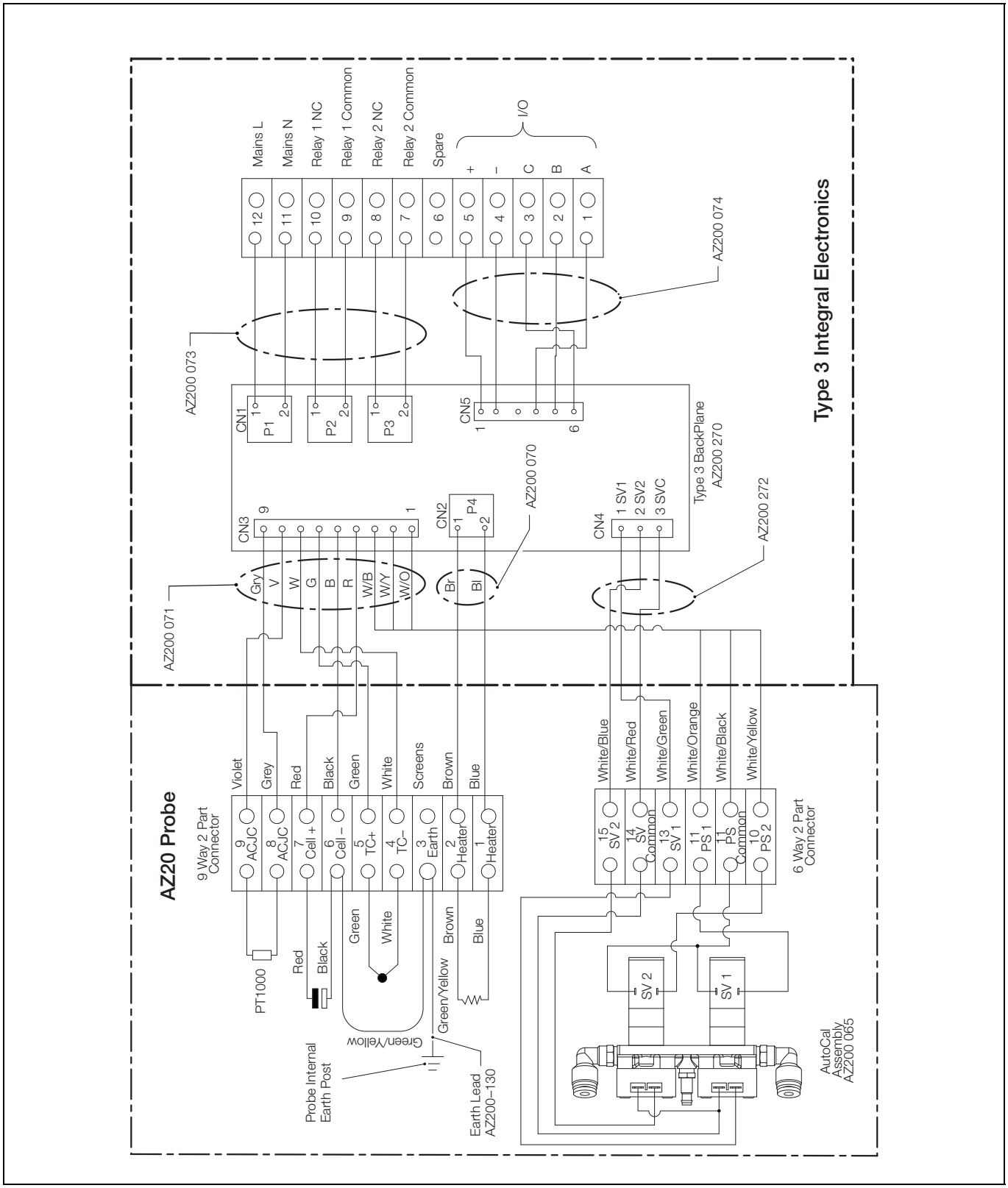


Fig. A.1 AZ20 Integral Probe – Connection Diagram

A.2 AZ20 Remote Probe

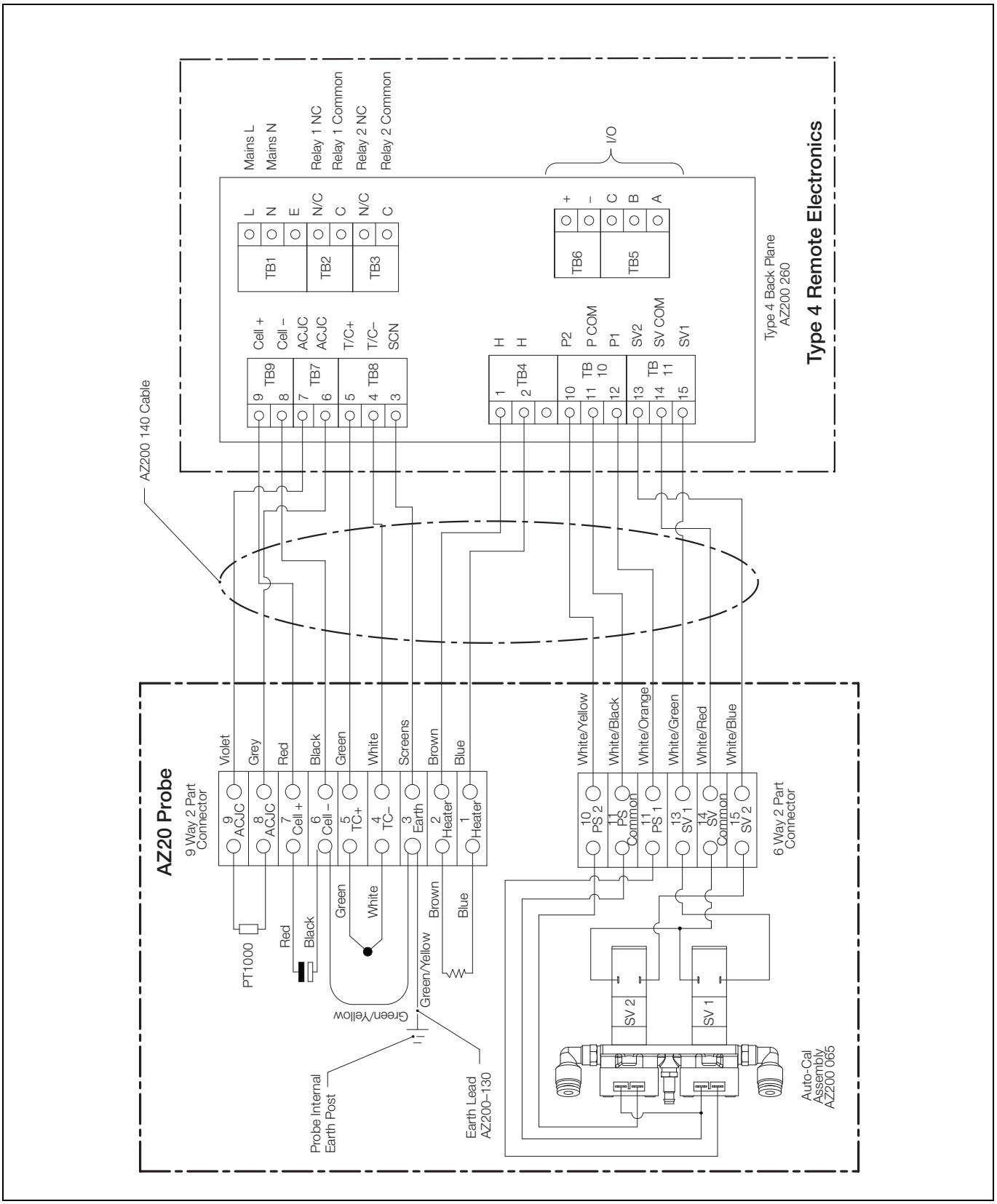


Fig. A.2 AZ20 Remote Probe – Connection Diagram

Appendix B – Probe Electrical Connections

B.1 AZ20 Probe Transmitter Cable Connections

Note. Non-AutoCal probes are not fitted with the 6-way AutoCal terminal block or pressure switch / solenoid valve option.

Terminal / Cable Color	Tag ID	Tx Connection
Violet	ACJC	Pt1000 Cold Junction Compensation
Grey	ACJC	Pt1000 Cold Junction Compensation
Red	Cell +	Oxygen Input (+ve)
Black	Cell –	Oxygen Input (–ve)
Green	T / C+	Thermocouple (+ve)
White	T / C –	Thermocouple (–ve)
Light Yellow	SCN	Screen
Brown	H	Heater
Blue	H	Heater

Table B.1 Probe Transmitter Cable Connections

B.2 AZ20/ZFG2 Replacement Probe Transmitter Cable Connections

Terminal / Cable Color	Tag ID	Tx Connection
Violet	Not Used	
Grey		
Red	Cell +	Oxygen Input (+ve)
Black	Cell –	Oxygen Input (–ve)
Green	T / C+	Thermocouple (+ve)
White	T / C –	Thermocouple (–ve)
Light Yellow	SCN	Screen
Brown	H	Heater
Blue	H	Heater

Table B.2 Probe Transmitter Cable Connections

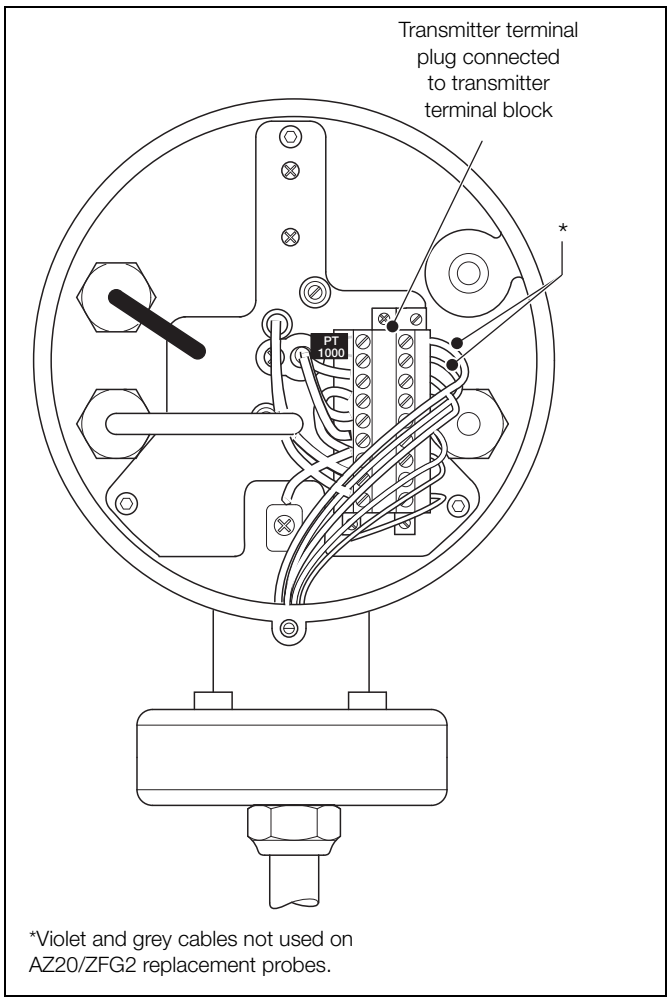


Fig. B.1 Probe Transmitter Cable Connections

B.3 AutoCal Connections at AZ20 Probe

Terminal / Cable Color	Tag ID	AutoCal Connection
White / Yellow	PS2	Pressure Switch Gas 2
White / Black	PS COM	Pressure Switch Common
White / Orange	PS1	Pressure Switch Gas 1
White / Green	SV1	Solenoid Valve Gas 1
White / Red	SV COM	Solenoid Valve Common
White / Blue	SV2	Solenoid Valve Gas 2

Table B.3 AutoCal Connections at Probe

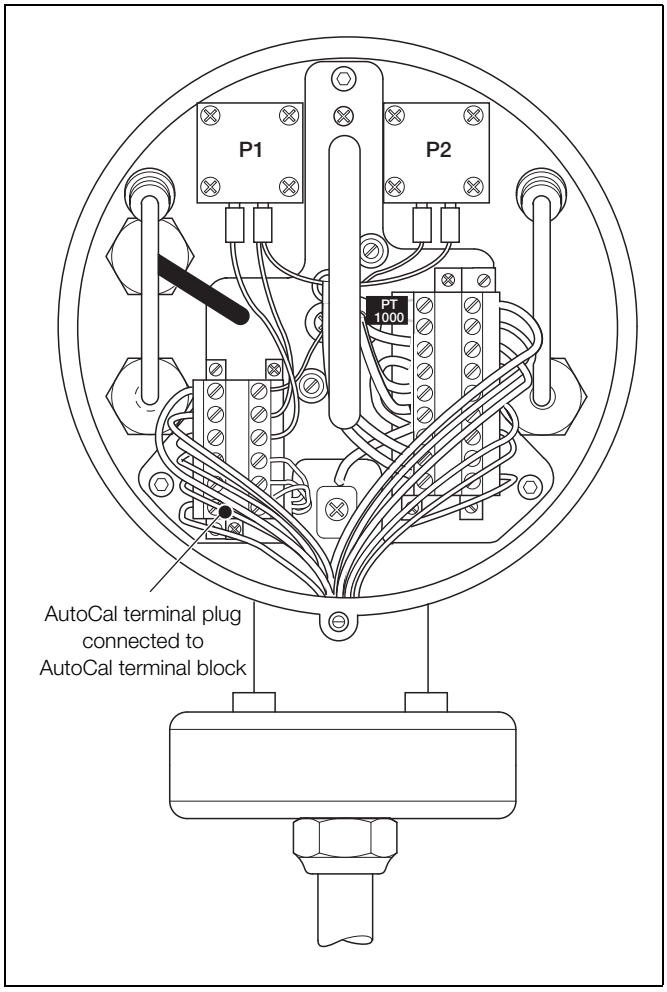


Fig. B.2 AutoCal Connections at AZ20 Probe

B.4 AutoCal Pressure Switch Connections

Notes.

- Refer to Table B.3, page 49 for pressure switch terminal connections.
- Pressure switches are voltage-free.

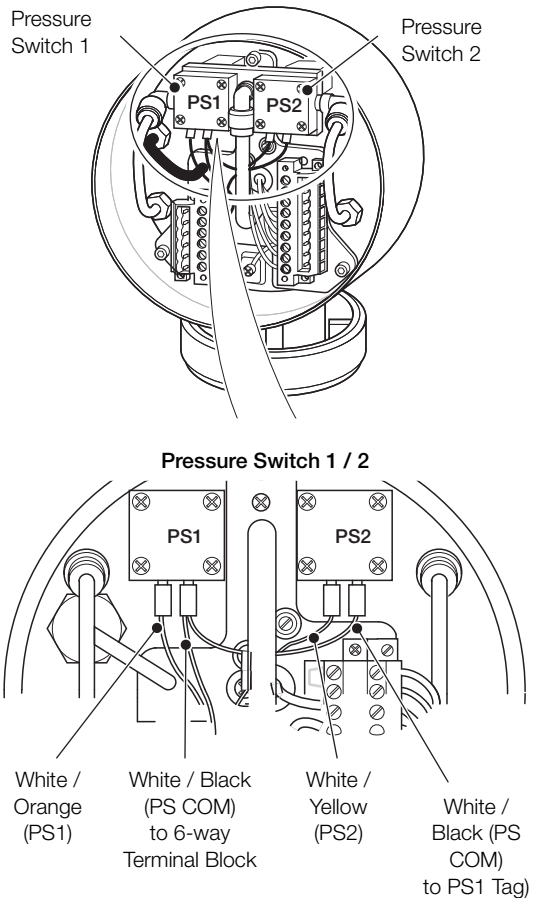


Fig. B.3 AutoCal Pressure Switch Connections

B.5 AutoCal Solenoid Valve Terminal Connections

Notes.

- Refer to Table B.3, page 49 for solenoid valve terminal connections.
- Solenoid valves have a maximum output of 100 mA @ 24 V DC (protection and inline fuses are required if using external automatic calibration panels).

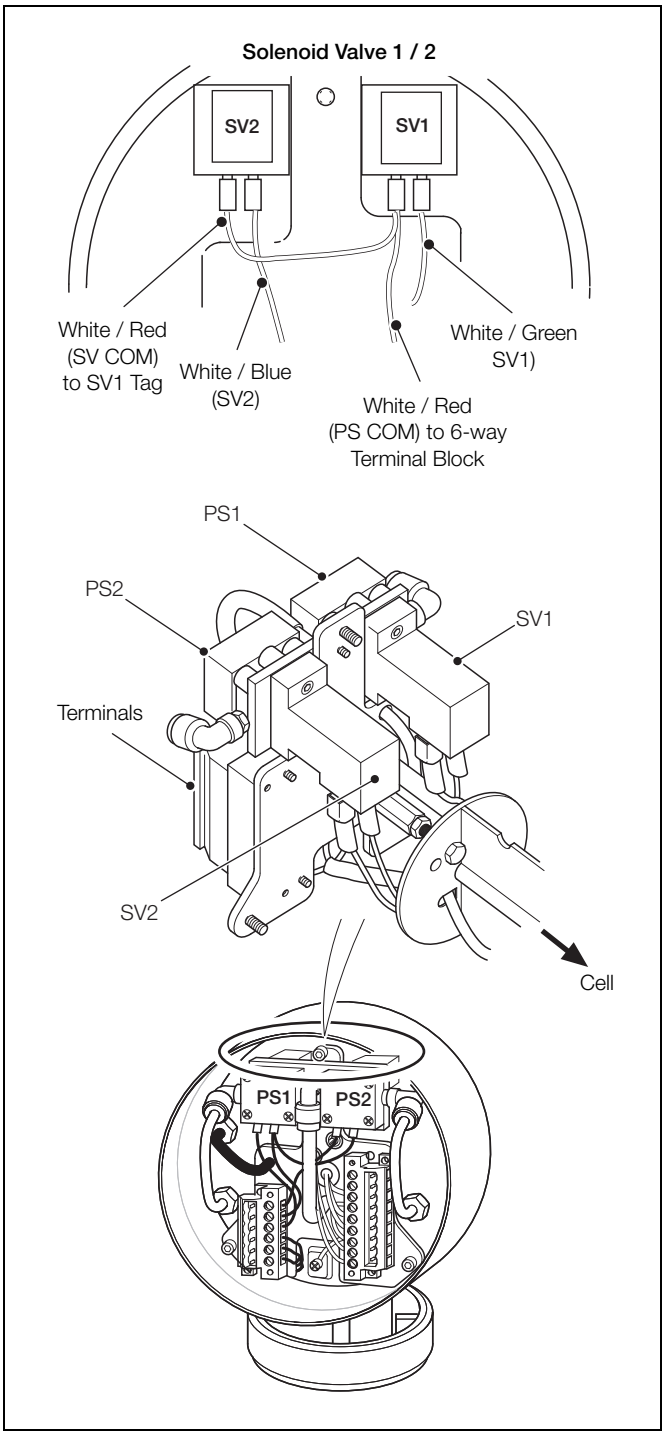


Fig. B.4 AutoCal Solenoid Valve Connections

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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 storage, installation, operating and maintenance records relating to the alleged faulty unit.

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