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Instruction Manual

Active Inverted Magnetron Gauge

Description	Item Number
AIM-S-NW25	D146-41-000
AIM-SL-NW25	D146-44-000
AIM-X-NW25	D146-42-000
AIM-XL-NW25	D146-45-000

Original instructions

www.edwardsvacuum.com

Declaration of Conformity

We, Edwards Limited,
Crawley Business Quarter,
Manor Royal,
Crawley,
West Sussex, RH10 9LW, UK

declare under our sole responsibility, as manufacturer and person within the EU authorised to assemble the technical file, that the product(s)

- AIM-S-NW25 D146-41-000
- AIM-X-NW25 D146-42-000
- AIM-SL-NW25 D146-44-000
- AIM-XL-NW25 D146-45-000

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

EN61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use. General Requirements
EN61326-2-3: 2013 (Class B Emissions Industrial Immunity)	Electrical equipment for measurement, control and laboratory Use. EMC requirements. Particular requirements. Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
CAN/CSA-C22.2 No.61010-1-04	Safety requirements for electrical equipment for measurement, Control and laboratory use – Part 1: General requirements
UL61010-1, 2nd Edition	Safety requirements for electrical equipment for measurement, Control and laboratory use – Part 1: General requirements
EN50581: 2012	Technical Documentation for the Assessment of Electrical and Electronic Products with respect to the Restriction of Hazardous Substances

and fulfils all the relevant provisions of

2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE) Directive
2011/65/EU	Restriction of Certain Hazardous Substances (RoHS) Directive

Note: This declaration covers all product serial numbers from the date this Declaration was signed onwards.

L G Marini

Larry Marini, Senior Technical Manager

19.08.2015, Eastbourne

Date and Place

This product has been manufactured under a quality management system certified to ISO 9001:2008

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For return of equipment, complete the HS Forms at the end of this manual.

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1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards AIM Gauge (Active Inverted Magnetron Gauge). You must use the AIM Gauge as specified in this manual.

Read this manual before you install and operate the AIM Gauge. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

WARNING



Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment or process.

The units used throughout this manual conform to the SI international system of units of measurement.

The following warning symbol also appears on the product:



Edwards will offer European customers a recycling service.

1.2 Description

The AIM Gauge, shown in Figure 1, is an inverted magnetron gauge head and gauge controller in a single compact unit. The gauge operates as a cold cathode ionisation gauge, in which the pressure is measured indirectly as a function of the current which flows in a Townsend discharge maintained in the body tube.

Four versions of AIM Gauge are available; the 'S', 'SL', 'X' and 'XL' gauges. The 'X' and 'XL' gauges have an extended measurement range (see below) and a linear output characteristic. The 'SL' and 'XL' gauges have a very low external magnetic field and are suitable for use with sensitive analytical instrumentation.

The measurement range of the AIM-S and AIM-SL gauges is 1×10^{-8} to 1×10^{-2} mbar. The measurement range of the AIM-X and AIM-XL gauges is 1×10^{-9} to 1×10^{-2} mbar. The AIM gauge vacuum connection is an NW25 flange.

The AIM Gauge requires a 13.5 to 36 V d.c. power supply: it has a 2 to 10 V d.c. analogue output which is related to pressure. The AIM Gauge is compatible with all of the Edwards AGCs (Active Gauge Controllers) and with the appropriate versions of the Edwards AGDs (Active Gauge Displays).

Alternatively, you can use an independent power supply for the AIM Gauge and you can read the AIM Gauge output signal with a voltmeter or an analogue-to-digital converter.

We recommend that you do not operate the AIM Gauge unless the pressure in the vacuum system is 1×10^{-2} mbar or lower. A gauge enable signal is used to control the operation of the AIM Gauge; refer to Section 4.2 for more information.

An 8-way electrical connector socket on the AIM Gauge (Figure 1, item 6) is used to connect the AIM Gauge to your AGC, AGD or electrical supply and voltmeter. Electrical cables fitted with suitable connector plugs are available as accessories.

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A gauge identification signal is available on the electrical connector: this signal is used by Edwards AGCs to identify which type of Active Gauge is connected.

The AIM Gauge has a set-point facility; the set-point signal is an open-drain transistor (FET) output, which is on when the pressure measured by the Gauge is below a preset pressure. You can adjust the pressure at which the set-point output goes on: refer to Section 4.4. Note that, if you use a Edwards AGC Controller or AGD Display, the AIM Gauge set-point output signal is not used.

1.3 Gas dependency

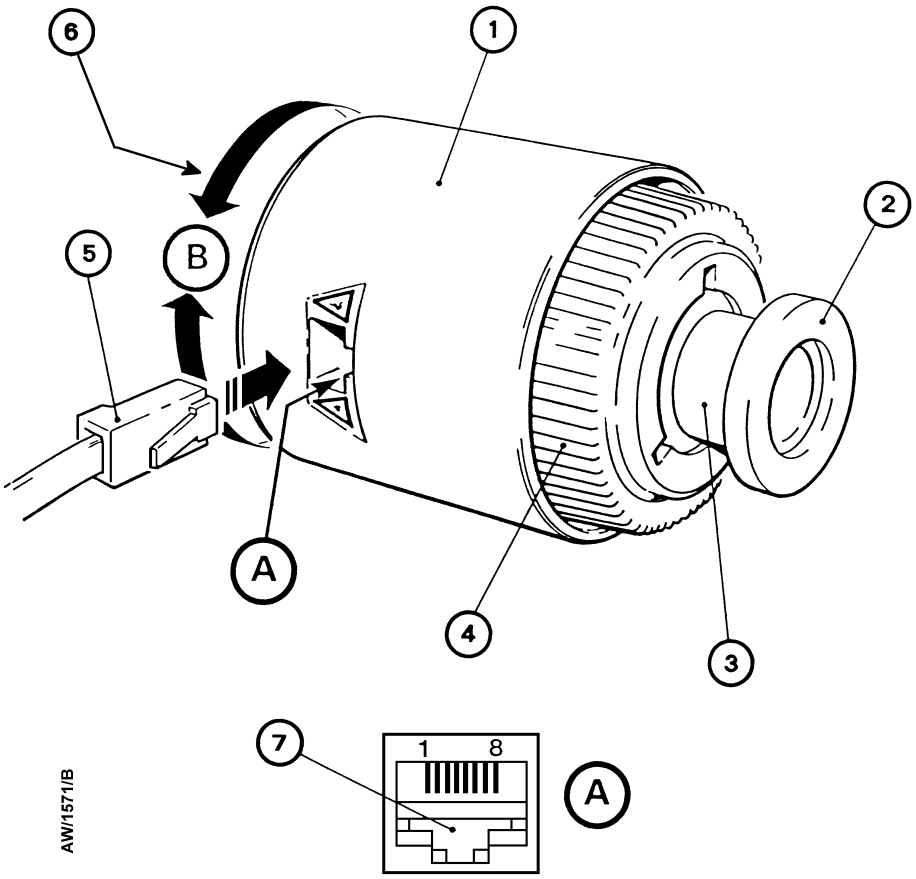
The ionisation of the gas in the vacuum system is dependent on both the pressure and the physical properties of the gas. Therefore, the output signal of the AIM Gauge is gas dependent.

The output signal voltage to pressure conversions in Table 2 apply for nitrogen and dry air.

Calibration graphs for use with argon, neon, krypton, helium and carbon dioxide are available on request; contact your supplier or Edwards.

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Figure 1 - General view of the AIM Gauge (showing the NW25 flange)



1. End-cap
2. Vacuum flange
3. Body tube
4. Magnet housing
5. Cable connector plug
6. Set-point potentiometer (on end of item 1)
7. AIM Gauge connector socket

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2 Technical data

2.1 Mechanical data

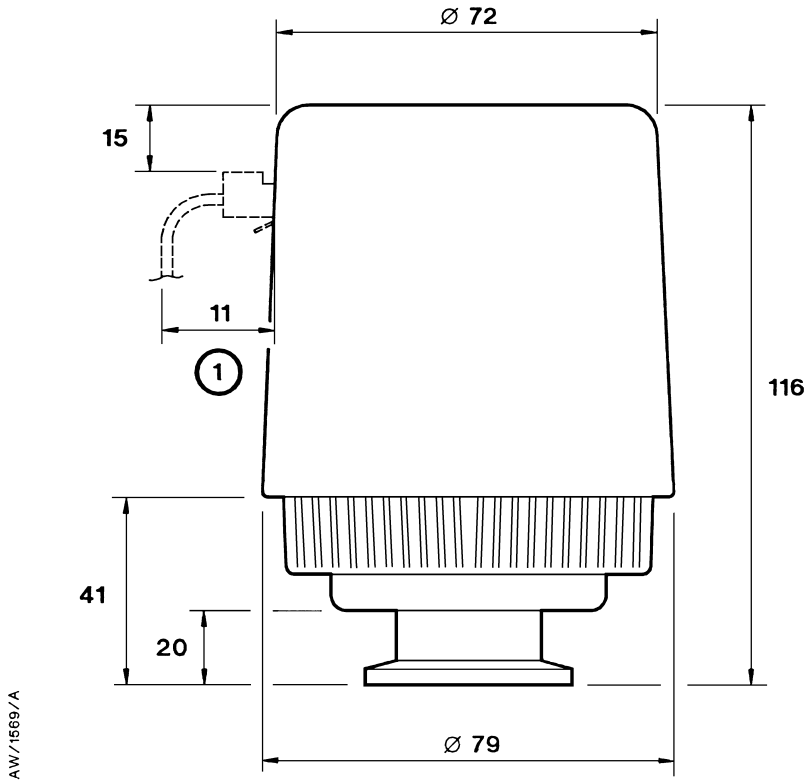
Dimensions	See Figure 2
Mass	
AIM-S/X-NW25	810 g
AIM-SL/XL-NW25	860 g
Volume of gauge tube	26 cm^3
Enclosure rating	IP40 (BS5490) and IP403 (IEC529)

2.2 Performance, operating and storage conditions

Ambient temperature	
operation	5 to 60 °C
storage	0 to 70 °C
Ambient humidity (operation)	10 to 90% (non-condensing)
Maximum operating altitude	2000 m Indoor use only
Maximum internal pressure	10 bar absolute (9 bar gauge)
Pressure measurement range	
AIM-S/SL-NW25	1 x 10^{-8} to 1 x 10^{-2} mbar
AIM-X/XL-NW25	1 x 10^{-9} to 1 x 10^{-2} mbar
Pollution degree	2

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Figure 2 - Dimensions (mm)



1. Clearance required for electrical cable

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2.3 Electrical data

Electrical supply	
Voltage	+13.5 to +36 V d.c.
Max voltage ripple	1 V peak to peak
Max source resistance	50 Ω
Maximum power consumption	2 W
Electrical connector	FCC68/RJ45 type, 8-way
Pressure output signal	
Range	2 ≤ output ≤ 10 V d.c.
Error range	output < 2 V d.c. or output > 10 V d.c.
Impedance	0.1 Ω
Min load impedance	10 kΩ
Max current source	1 mA
Gauge enable	
Control sense	Active low
Active level	< 1.3 V
Control impedance	12 kΩ pull-up to positive supply
Set-point output external load rating	40 V d.c., 100 mA max
Set-point trip level	
Range	1.8 to 10.0 V
Minimum load impedance	200 kΩ
Hysteresis	500 mV
Back EMF suppression diode *	
Min. surge rating	1 A
Min. reverse voltage rating	100 V
Gauge identification resistance	
AIM-S/SL-NW25	100 kΩ + 2%
AIM-X/XL-NW25	110 kΩ + 2%

* *Required when you use an external d.c. Relay connected to the set-point output.*

2.4 Error monitoring

The set-point output is switched off:

- For 0.5 seconds during gauge switch-on
- When pressure output signal voltage < 1.8 V.

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2.5 Materials exposed to vacuum

- Stainless steel (AISI 304 and 306).
- Fluoroelastomer.
- Soda lime glass.

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3 Installation

3.1 Unpack and inspect

Remove all packing materials and protective covers and check the AIM Gauge.

If the AIM Gauge is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the AIM Gauge together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the AIM Gauge if it is damaged.

If the AIM Gauge is not to be used immediately, replace the protective covers. Store the AIM Gauge in suitable conditions as described in Section 6.

3.2 Fit the AIM Gauge to the vacuum system

The AIM Gauge can be mounted in any orientation. To avoid the build-up of debris or condensable material in the body tube of the AIM Gauge (which will probably cause pressure measurement errors), we recommend that you install the AIM Gauge vertically as shown in Figure 2.

Use an 'O' ring/centring ring or Co-Seal and clamp to connect the NW25 flange of the AIM Gauge to a similar flange on your vacuum system.

If required, you can turn the end-cap (relative to the magnet housing) so that the electrical connection socket is in a convenient position on your system; refer to Figure 1 and use the following procedure: hold the magnet housing (4) and turn the end-cap (1) in a clockwise or anticlockwise direction (arrow B) until the electrical connection socket (6) is in the required position.

3.3 Electrical connections

WARNING

If the AIM Gauge malfunctions, the AIM Gauge pressure output may be incorrect. If such a failure could cause injury to people or damage equipment, you must install a suitable control system to indicate the failure and, if necessary, to close down your process system.

When using a cable longer than 30 m, full compliance with European Standards requires an in-line surge suppressor (please refer to Section 7.3)

3.3.1 Connect to Edwards controllers or AGD display

Connect the AIM Gauge to the controller or display with a cable which is terminated in suitable connectors. Suitable cables are available from Edwards (refer to Section 7).

3.3.2 Connect to your own supply and control equipment

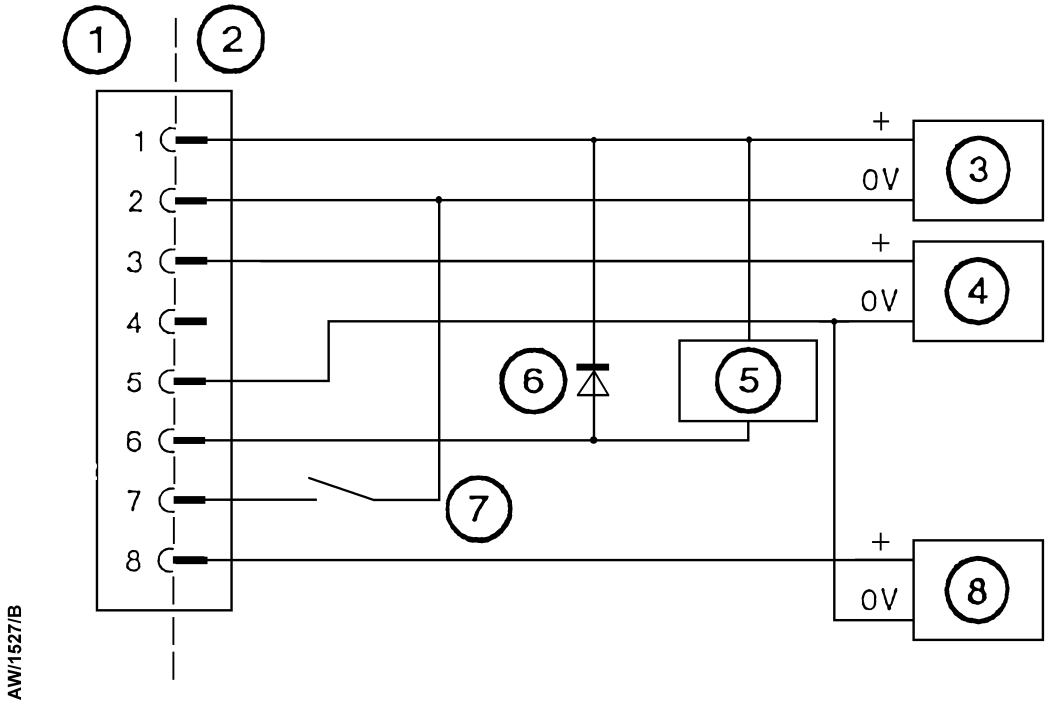
Note: *Do not connect the electrical supply common (pin 2) to the signal common (pin 5). If you do, the AIM Gauge pressure output signal will be inaccurate.*

A schematic diagram of the recommended electrical connections to the AIM Gauge is shown in Figure 3.

The pins on the AIM Gauge electrical connection socket are used as shown in Table 1. The specification of the electrical supply, d.c. relay and back EMF suppression diode are given in Section 2.

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Figure 3 - Schematic diagram of typical electrical connections



1. AIM Gauge electrical connector socket
2. Cable electrical connector plug
3. Electrical supply
4. Voltmeter (pressure signal)
5. D.C. relay (optional)
6. Back EMF suppression diode (optional)
7. Gauge enable switch
8. Voltmeter (set-point trip level)

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Table 1 - Pins on the AIM Gauge electrical connector socket

Pin Number	Use
1	Electrical supply positive voltage
2	Electrical supply common
3	Pressure measurement output signal
4	Gauge identification signal
5	Signal common
6	Set-point output signal
7	Gauge enable
8	Set-point trip level

The connection to pin 6 is optional. Make the connection to pin 6 if you want to connect the set-point output signal to a d.c. relay: you must connect a suppression diode between pins 1 and 6 to protect the AIM Gauge from transient voltages generated when the d.c. relay is switched off.

You can connect a voltmeter between pins 5 and 8 to measure the set-point trip level (that is, the voltage at which the set-point output will go on): see Figure 3.

Connect a switch between pins 2 and 7 to enable and disable the gauge (refer to Section 4.2). If you want to measure the gauge identification signal (which identifies the AIM Gauge), measure the resistance between pins 4 and 5.

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4 Operation

4.1 Safety

WARNING



Do not use the AIM Gauge to measure the pressure of explosive or flammable gases or mixtures.

WARNING



Never operate the AIM Gauge when it is disconnected from the vacuum system or when there are explosive or flammable gases in the surrounding atmosphere or the vacuum system. High voltages (up to 3 kV) are generated inside the body tube of the AIM Gauge; these could cause injury to people or could be a source of ignition.

WARNING



The AIM Gauge incorporates magnets. Keep away from Heart Pacemakers, Computers, Credit Cards and any other magnetically sensitive devices.

4.2 Enable and disable the AIM Gauge

CAUTION

Do not operate the AIM Gauge for long periods when the system pressure is above 1 x10^{-2} mbar. If you do, the anode pin can be damaged and the AIM Gauge can be severely contaminated.

We recommend that you only enable the gauge when the system pressure is lower than 1 x 10^{-2} mbar and that you disable the gauge when the system pressure is 1 x 10^{-2} mbar or higher.

If you have connected the AIM Gauge to an AGC or AGD, refer to the corresponding instruction manual for details of how to enable (switch on) and disable (switch off) the AIM Gauge.

Otherwise, to enable (switch on) the AIM Gauge, connect pin 7 to pin 2 (or to ground). To disable (switch off) the AIM Gauge, disconnect pin 7 from pin 2 (or from ground).

4.3 Pressure measurement

If you connected the AIM Gauge to a Edwards AGC controller or AGD display, the pressure measured by the AIM Gauge is shown on the display.

If you connected the signal output of the AIM Gauge to a voltmeter, convert the measured voltage to the corresponding pressure value: for AIM-S and AIM-SL gauges, refer to Table 2; for AIM-X and AIM-XL gauges, use the equation:

$P = 10^{(7/8 V - 10.75)}$

where P is the pressure in mbar, and V is the measured voltage.

If necessary, adjust the pressure reading to compensate for the RMM of the gas in your vacuum system (refer to Section 1.3).

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Table 2 - Pressure and voltage characteristics for nitrogen and dry air: AIM-S and AIM-SL Gauges

Pressure (mbar)	Output voltage (V)	Pressure (torr)
1.0×10^{-8}	2.00	7.5×10^{-9}
2.4×10^{-8}	2.50	1.8×10^{-8}
5.8×10^{-8}	3.00	4.4×10^{-8}
8.1×10^{-8}	3.20	6.1×10^{-8}
1.1×10^{-7}	3.40	8.3×10^{-8}
1.5×10^{-7}	3.60	1.1×10^{-7}
2.1×10^{-7}	3.80	1.6×10^{-7}
2.9×10^{-7}	4.00	2.2×10^{-7}
4.0×10^{-7}	4.20	3.0×10^{-7}
5.4×10^{-7}	4.40	4.1×10^{-7}
7.3×10^{-7}	4.60	5.5×10^{-7}
9.8×10^{-7}	4.80	7.4×10^{-7}
1.3×10^{-6}	5.00	9.8×10^{-7}
1.7×10^{-6}	5.20	1.3×10^{-6}
2.2×10^{-6}	5.40	1.7×10^{-6}
2.8×10^{-6}	5.60	2.1×10^{-6}
3.6×10^{-6}	5.80	2.7×10^{-6}
4.5×10^{-6}	6.00	3.4×10^{-6}
5.6×10^{-6}	6.20	4.2×10^{-6}

Pressure (mbar)	Output voltage (V)	Pressure (torr)
6.9×10^{-6}	6.40	5.2×10^{-6}
8.4×10^{-6}	6.60	6.3×10^{-6}
1.0×10^{-5}	6.80	7.5×10^{-6}
1.2×10^{-5}	7.00	9.0×10^{-6}
1.4×10^{-5}	7.20	1.1×10^{-5}
1.7×10^{-5}	7.40	1.3×10^{-5}
2.0×10^{-5}	7.60	1.5×10^{-5}
2.4×10^{-5}	7.80	1.8×10^{-5}
2.9×10^{-5}	8.00	2.2×10^{-5}
3.5×10^{-5}	8.20	2.6×10^{-5}
4.3×10^{-5}	8.40	3.2×10^{-5}
5.7×10^{-5}	8.60	4.3×10^{-5}
7.9×10^{-5}	8.80	5.9×10^{-5}
1.2×10^{-4}	9.00	9.0×10^{-5}
1.9×10^{-4}	9.20	1.4×10^{-4}
3.3×10^{-4}	9.40	2.5×10^{-4}
6.7×10^{-4}	9.60	5.0×10^{-4}
1.7×10^{-3}	9.80	1.3×10^{-3}
3.6×10^{-3}	9.90	2.7×10^{-3}
1.0×10^{-2}	10.00	7.5×10^{-3}

4.4 Set-point

Note: *The set-point is not used if you connect the AIM Gauge to a Edwards AGC Controller or AGD Display.*

To adjust the voltage at which the set-point output signal goes on, turn the set-point potentiometer, which is accessible through an access hole in the end-cap of the gauge: see Figure 1. Turn the potentiometer clockwise to increase the voltage and turn it anticlockwise to decrease the voltage. Refer to Section 4.3 to determine the operating voltage which corresponds to a given pressure.

The AIM Gauge has an error monitoring facility, which ensures that the set-point output signal is off:

- When the Gauge is switched off (that is, not enabled).
- For 0.5 seconds immediately after the AIM Gauge is switched on.
- When the pressure output signal is out of range, perhaps because the gauge has failed to strike (ignite).

If required, you can adjust the potentiometer so that the set-point operating voltage is < 1.8 V (that is, turn the potentiometer fully anticlockwise). This ensures that the set-point output signal is permanently off.

If required, you can use the set-point output signal to indicate when the Gauge is operating correctly: adjust the potentiometer so that the set-point operating voltage is $\geq$ 10 V (that is, turn the potentiometer fully clockwise). If the Gauge is operating normally, the set-point output signal will then be switched on.

Note: *If you adjust the set-point operating voltage to > 9.5 V, the hysteresis voltage will be > 10 V and the set-point output signal may not switch off when the pressure rises; if so, the set-point output signal will only go off when the gauge is switched off (that is, disabled).*

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5 Maintenance

5.1 Introduction

WARNING



Do not disconnect the electronics and magnet housing from the body tube when the body tube is connected to the vacuum system. If there is a plasma discharge in the vacuum system near the body tube, the body tube can become electrically charged.

WARNING



Disconnect the cable from the AIM Gauge before you remove the AIM Gauge from the vacuum system. High voltages are generated inside the AIM Gauge.

The internal components of the AIM Gauge are shown in Figure 4. The AIM Gauge is designed so that you can easily clean these components, or use the spares listed in Section 7 to replace these components. Refer to the following sections for details of the maintenance procedures, which you should do when necessary.

5.2 Replace the body tube

Refer to Figure 4 and use the following procedures to replace the body tube:

5.2.1 Remove the AIM Gauge from the vacuum system

1. Switch off the AIM Gauge electrical supply and ensure that the vacuum system is at atmospheric pressure.
2. Disconnect the cable connector plug (Figure 1, item 5) from the AIM Gauge and remove the AIM Gauge from the vacuum system.

5.2.2 Fit the new body tube

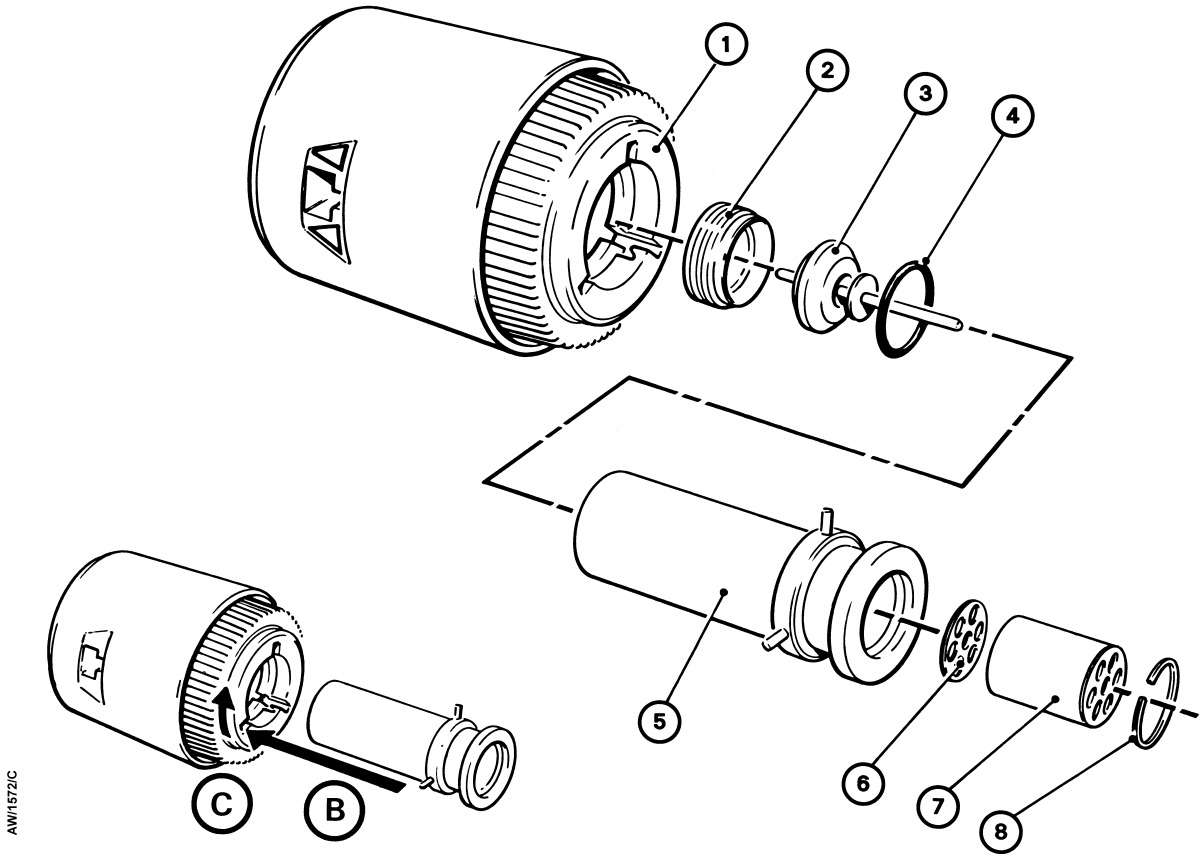
1. Hold the magnet housing (1) and turn the body tube (5) anticlockwise (when viewed from the vacuum flange) to unlock the bayonet fitting. Remove the body tube from the magnet housing.
2. Slide the new body tube into the magnet housing (1) (as shown by arrow B).
3. Hold the magnet housing (1) and turn the body tube (5) clockwise (when viewed from the vacuum flange) to lock the bayonet fitting (as shown by arrow C).

5.2.3 Refit the AIM Gauge to the vacuum system

Refit the AIM Gauge to the vacuum system as described in Section 3.2 and refit the cable connector plug to the socket on the AIM Gauge (Figure 1, item 6).

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Figure 4 - Exploded view of the AIM Gauge



1. Magnet housing
2. Collar
3. Anode assembly
4. ‘O’ ring
5. Body tube
6. Cathode plate
7. Cathode tube
8. Circlip

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5.3 Replace the electrode assembly

Refer to Figure 4 in the following procedure.

1. Remove the AIM Gauge from the vacuum system as described in Section 5.2.1.
2. Remove the body tube from the AIM Gauge as described in Step 1 of Section 5.2.2.
3. Fit the flat spanner supplied in the electrode assembly kit (refer to Section 7) to the two lugs in the end of the collar (2), then turn the collar anticlockwise to unscrew the collar from the body tube (5) and remove the anode assembly (3) and the 'O' ring (4).
4. Use circlip pliers to remove the circlip (8) from the vacuum flange end of the body tube (5), then remove the cathode tube (7) and the cathode plate (6).
5. Fit the new cathode plate (6) and cathode tube (7) into the body tube and secure with the circlip (8).
6. Fit the new 'O' ring (4) and anode assembly (3) into the body tube (5); ensure that the orientation of the anode assembly is correct.
7. Refit the collar (2) to the body tube. Locate the flat spanner on the two lugs on the collar and turn the collar clockwise until it is fully secured in the body tube.
8. Refit the body tube (5) to the magnet housing (1) as described in Steps 2 and 3 of Section 5.2.2. Refit the AIM Gauge to the vacuum system as described in Section 5.2.3.

5.4 Replace the electronics and magnet housing

The magnet housing and end-cap contain the AIM Gauge control electronics. Replace the complete unit as described below.

1. Remove the AIM Gauge from the vacuum system as described in Section 5.2.1.
2. Remove the body tube from the AIM Gauge as described in Step 1 of Section 5.2.2.
3. Dispose of the old magnet housing and end-cap (refer to Section 6).
4. Fit the body tube to the new magnet housing and end-cap as described in Steps 2 and 3 of Section 5.2.2. Refit the AIM Gauge to the vacuum system as described in Section 5.2.3.

5.5 Clean the internal components

Refer to Figure 4 in the following procedure.

1. Remove the internal components from the magnet housing as described in Steps 1 to 4 of Section 5.3.
2. The anode assembly (3) has a bracket mounted close to the disk on the anode. Use a strip of fine emery paper to clean the gap between the disk and the bracket.
3. Use a fine screwdriver or feeler gauge and ensure that the gap is a minimum of 0.25 mm.
4. Degrease the cathode plate (6), cathode tube (7), body tube (5) and anode assembly (3) in a suitable degreasing agent.
5. Thoroughly soak the components in a suitable laboratory detergent.
6. Rinse the components in clean water to remove the detergent.
7. Rinse the components in methanol to remove all of the water, then thoroughly dry the components.
8. Refit the components in the magnet housing as described in Steps 5 to 8 of Section 5.3.

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5.6 Fault finding

If the AIM Gauge does not operate correctly, ensure that the electrical connections are correct (refer to Section 3) and ensure that your electrical supply is suitable for the AIM Gauge (refer to Section 2).

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6 Storage and disposal

6.1 Storage

Return the AIM Gauge to its protective packaging and store the AIM Gauge in clean dry conditions until required for use. Do not exceed the storage temperature conditions specified in Section 2.

When required for use, prepare and install the AIM Gauge as described in Section 3.

6.2 Disposal

Dispose of the Product and any components safely in accordance with all local and national safety and environmental requirements.

Alternatively, you may be able to recycle the Product and/or cables: contact Edwards or your supplier for advice (also see below).

The Product and associated cables and ion gauges are within the scope of the European Directive on Waste Electrical and Electronic Equipment. Edwards offer European customers a recycling service for the Product/cables/associated gauge heads at the end of the product's life. Contact Edwards for advice on how to return the Product/cables/ion gauges for recycling.

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7 Spares and accessories

7.1 Introduction

Edwards products, spares and accessories are available from Edwards companies in Belgium, Brazil, Canada, France, Germany, Hong Kong, Italy, Japan, Korea, Switzerland, United Kingdom, U.S.A, and a world wide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive Edwards training courses.

Order spare parts and accessories from your nearest Edwards company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of part

7.2 Spares

Spare	Item Number
Electronics and magnet housing	
AIM-S-NW25	D146-41-800
AIM-SL-NW25	D146-44-800
AIM-X-NW25	D146-42-800
AIM-XL-NW25	D146-45-800
Body tube	D145-45-801
Electrode assembly kit *	D145-45-802

* *The electrode assembly kit contains one each of the following components: cathode plate, cathode tube, circlip, 'O' ring, anode assembly, collar, flat spanner.*

7.3 Accessories

The cables suitable for use with the AIM Gauge are as follows. These cables are supplied with 8-way male electrical connectors on both ends.

Cable length		Item Number
0.5 m	18 inches	D400-01-005
1 m	3 feet	D400-01-010
3 m	10 feet	D400-01-030
5 m	15 feet	D400-01-050
10 m	30 feet	D400-01-100
15 m	50 feet	D400-01-150
25 m	80 feet	D400-01-250
50 m	150 feet	D400-01-500
100 m	325 feet	D400-01-999
Surge Suppressor		D400-06-000

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