Instruction Manual

Digital Active Inverted Magnetron Gauge (nAIM)

Description	Item Number
nAIM RS485 NW25	D14690010
nAIM RS485 DN40 CF	D14690020
nAIM-I RS485 NW25	D14690030
nAIM RS232 NW25	D14690510
nAIM RS232 DN40 CF	D14690520
nAIM-I RS232 NW25	D14690530
nAIM-L RS485 NW25	D14691010
nAIM-L RS485 DN40 CF	D14691020
nAIM-LI RS485 NW25	D14691030
nAIM-L RS232 NW25	D14691510
nAIM-L RS232 DN40 CF	D14691520
nAIM-LI RS232 NW25	D14691530

Original Instructions

EDWARDS

Official Distributor in Australia

EZZI VISION

Vacuum and Thin Film Technology

CONTACT US
T: 1800 GO EZZI
E: sales@ezzivision.com.au
W: ezzivision.com.au

VIC: 13/62 Ramset Drive, Chirnside Park, VIC 3116, Australia
NSW: Unit 1, 80 O'Riordan St, Alexandria, NSW 2015, Australia
WA: Unit 11, 24 Baile Road, Canning Vale, WA 6155 Australia

Why Choose Ezzi Vision?

'Partner with excellence in Vacuum Technology, opt for Ezzi Vision'

Decades of Expertise: With 30+ years in the industry, Ezzi Vision is highly experienced in vacuum technology and its applications.

Quality Assurance: We ensure that every Edwards pump meets the highest standards of performance and reliability.

Innovative Solutions: Leading in technological advancements, we provide the latest Edwards pumps, known for their innovation and efficiency.

Customer-Centric: Ezzi Vision delivers personalized service and expert advice to meet your needs.

Nationwide: Ezzi Vision brings quality vacuum solutions to all of Australia.

After-Sales Support: We provide comprehensive support to maintain your equipment's longevity and efficiency.

Sustainable Practices: Our products at Ezzi Vision align with contemporary environmental standards, promoting sustainable practices in your business operations.

With Ezzi Vision propel your business forward using state-of-the-art technology and steadfast support.

Declaration of Conformity

We, Edwards,
Innovation Drive,
Burgess Hill,
West Sussex,
RH15 9TW, UK

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

Digital Active Pirani Gauge (nAPG)	D026-9X-XXX
Digital Active Inverted Magnetron Gauge (nAIM)	D146-9X-XXX
Digital Wide Range Gauge (nWRG)	D147-9X-XXX

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

EN61326-2-3: 2013	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.61010-1-12	Safety requirements for electrical equipment for measurement, Control and laboratory use – Part 1: General requirements
UL61010-1, 3rd Edition	Safety requirements for electrical equipment for measurement, Control and laboratory use – Part 1: General requirements

and fulfils all the relevant provisions of

2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2012/19/EU	Waste from 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

Mr Larry Marini – Senior Technical Manager

28.02.2017, Eastbourne

Date and Place

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

P200-10-102
Issue A

Material Declaration

In accordance with the requirements of the Chinese regulatory requirement on the Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products Order No. 32 (also known as 'China RoHS2') and SJ/T 11364 Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products:

Product		Product Label	Meaning
nAIM RS485 NW25	D14690010		*This product contains hazardous substances in at least one of the homogeneous materials used which are above the limit requirement in GB/T 26572 as detailed in the declaration table below.* *These parts can safely be used for the environmental protection use period as indicated.*
nAIM RS485 DN40 CF	D14690020		
nAIM-I RS485 NW25	D14690030		
nAIM RS232 NW25	D14690510		
nAIM RS232 DN40 CF	D14690520		
nAIM-I RS232 NW25	D14690530		
nAIM-L RS485 NW25	D14691010		
nAIM-L RS485 DN40 CF	D14691020		
nAIM-LI RS485 NW25	D14691030		
nAIM-L RS232 NW25	D14691510		
nAIM-L RS232 DN40 CF	D14691520		
nAIM-LI RS232 NW25	D14691530		

材料成分声明
Materials Content Declaration

部件名称 Part name	有害物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
印刷电路组件 (PCA) Printed Circuit Assembly (PCA)	X	O	X	O	O	O
电缆/电线/连接器 Cable/wire/connector	X	O	O	O	O	O
机械部件 Mechanical Components	X	O	O	O	O	O

O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.
X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求
X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

These products are EU RoHS complaint, the following Exemptions apply:
6(b) **Lead** as an alloying element in aluminium containing up to 0.4% by weight
6(c) Copper alloy containing up to 4% **lead** by weight
7(a) **Lead** in in high melting temperature type solder (i.e lead based alloys containing 85% by weight or more lead)
(c) I Electrical and electronic components containing **lead** in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound
7(c) II **Lead** in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher
8(b) **Cadmium** and its compounds in electrical contacts
15 **Lead** in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages
34 **Lead** in cermet-based trimmer potentiometer elements

Page left blank for D of C to be inserted

This page has been intentionally left blank.

Contents

GEC/ 2020-AVI-GCN-0011

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

Contents

Illustrations

Figure Page

Tables

Table Page

Trademark credits

Scotchbrite™ is a trademark of 3M Global Trading, Inc.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

This page has been intentionally left blank.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

1 Introduction

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Edwards Digital Active Inverted Magnetron Gauge (nAIM). The nAIM must be used as specified in this manual. Read this manual before installing and operating the nAIM.

Important safety information is highlighted as WARNING and CAUTION instructions; these instructions must be obeyed. 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.

Edwards offer European customers a recycling service.

1.2 Description

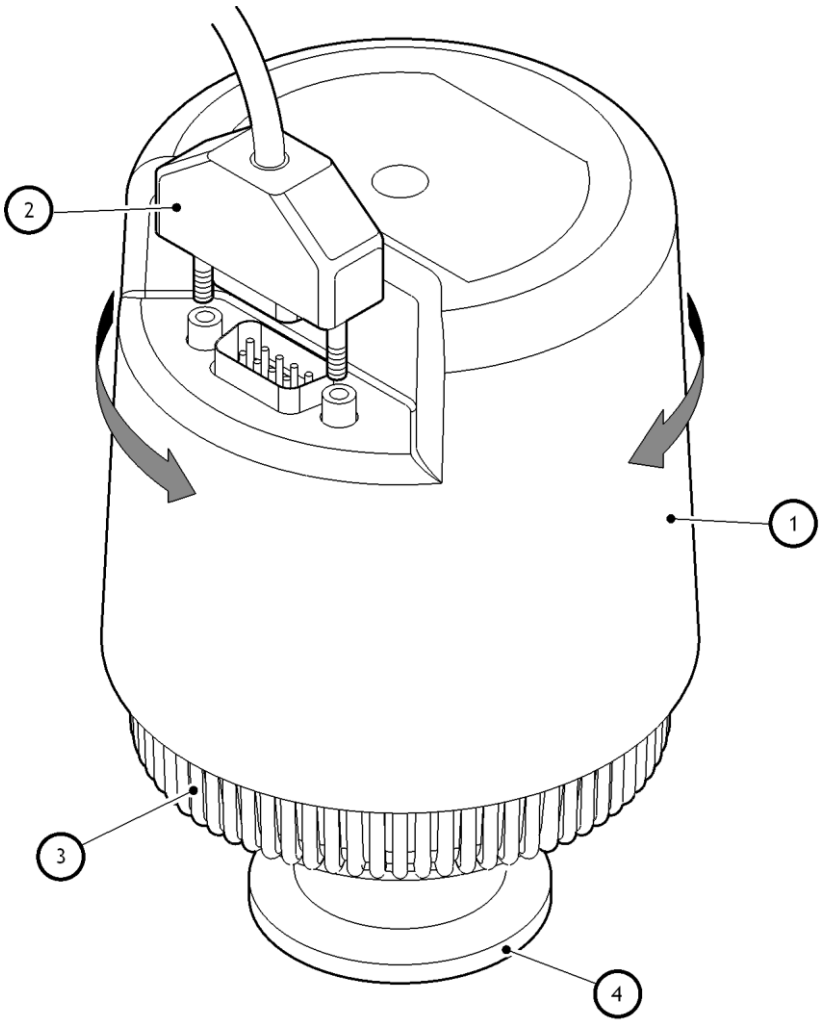
The nAIM gauge, shown in Figure 1, is an inverted magnetron gauge head and gauge controller in a single compact unit. The gauge operates as a cold cathode ionisation gauge, in which the pressure is measured indirectly as a function of the current which flows in a Townsend discharge maintained in the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

The nAIM is available in a number of variants based on Magnet, Tube, Flange and Serial communications interface. Magnets are available in Standard and Low-field which have a very low external magnetic field and are suitable for use with sensitive analytical instruments. Tubes are available in Standard and Industrial, which are suitable for harsh applications. Flanges are available in NW25 and DN40 CF.

All gauge calibration and control functions are carried out over serial communications. The serial communications interface is available in two versions: RS232 for point-to-point systems; RS485 for either point-to-point or multi-drop systems.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

Figure 1 - General view of the nAIM gauge



1. Electronics housing
2. Electrical connector
3. Magnet housing
4. Vacuum flange

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

2 Technical data

2.1 Mechanical data

Table 1 - Mechanical data

Parameter	Value
Dimensions	Refer to Figures 2 and 3
Mass	
NW25	810 g
Low Field & NW25	860 g
DN40 CF	1060 g
Low Field & DN40 CF	1110 g
Internal volume of tube	26 cm^3
Enclosure rating	IP42 (vertical, with the vacuum flange at the bottom) IP40 (all other orientations)

2.2 Performance, operating and storage conditions

Table 2 - Performance, operating and storage conditions

Parameter	Value
Measurement range	10^{-9} to 1 x 10^{-2} mbars
Accuracy	± 30 %
Maximum over pressure	10 bar absolute (9 bar gauge)
Ambient temperature	
Operating	5 to 60 °C
Storage	-30 to +70 °C
Humidity	80 % RH up to 31 °C decreasing linearly to 50 % RH at 40 °C and above
Maximum altitude	3000 m (indoor use only)
Pollution degree	2

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

2.3 Electrical data

Table 3 - Electrical data

Parameter	Value
Electrical supply voltage	
Nominal	+15 to +48 V d.c.
Minimum	+14.5 V d.c.
Maximum	+52.8 V d.c.
Max voltage ripple	1 V peak-to-peak
Max source resistance	50 Ω
Maximum power consumption	2 W
Electrical connector	9 way D-type male
Setpoint output	Open collector transistor
Rating	48 V d.c., 100 mA max
Back EMF suppression diode*	
Min. surge rating	1 A
Min. reverse voltage rating	100 V
Gauge identification resistance	
All digital gauges	10 kΩ ± 2 %

* *Required when using an external d.c. relay connected to the setpoint output.*

2.4 Serial communications

Table 4 - Serial communications

Parameter	Value
RS232 transmit	
Mark	< -8 V (I_{out} max: -8 mA)
Space	> +8 V (I_{out} max: +8 mA)
RS232 receive	
Mark	< +1 V (I_{in} max: -2 mA)
Space	> +2 V (I_{in} max: +2 mA)
Maximum input	± 12 V
RS485	
Output differential	> 1.5 V (I_{out} max: ± 25 mA)
Input differential threshold	> ± 0.2 V (I_{in} max: ± 1 mA)
Maximum input	-7 V to +12 V
Bus load	The gauge applies one unit load to the RS485 bus
Default setup	9600 baud, 8 bits, 1 stop bit, no parity
Maximum baud rate	38400 baud

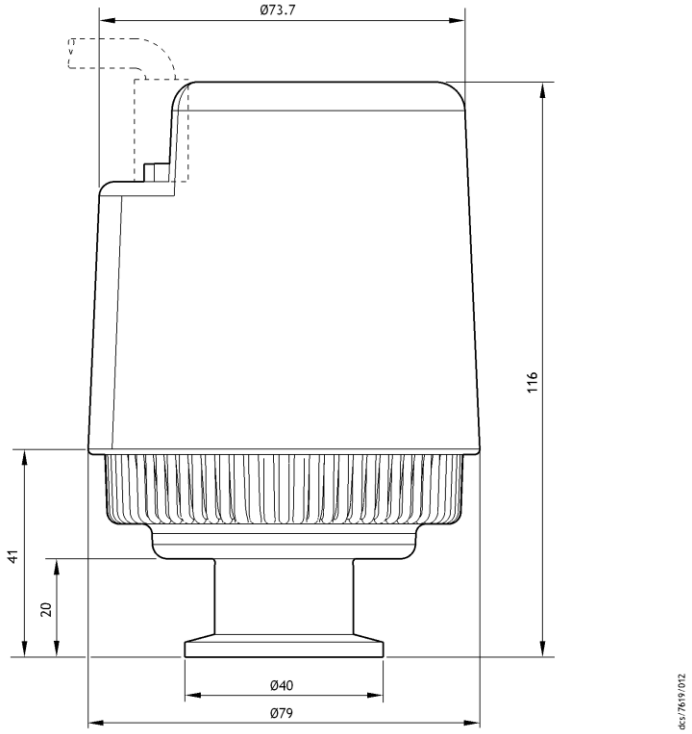
© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

2.5 Materials exposed to vacuum

Table 5 - Materials exposed to vacuum

Parameter	Value
Tube assembly	Stainless steel Glass Fluoroelastomer

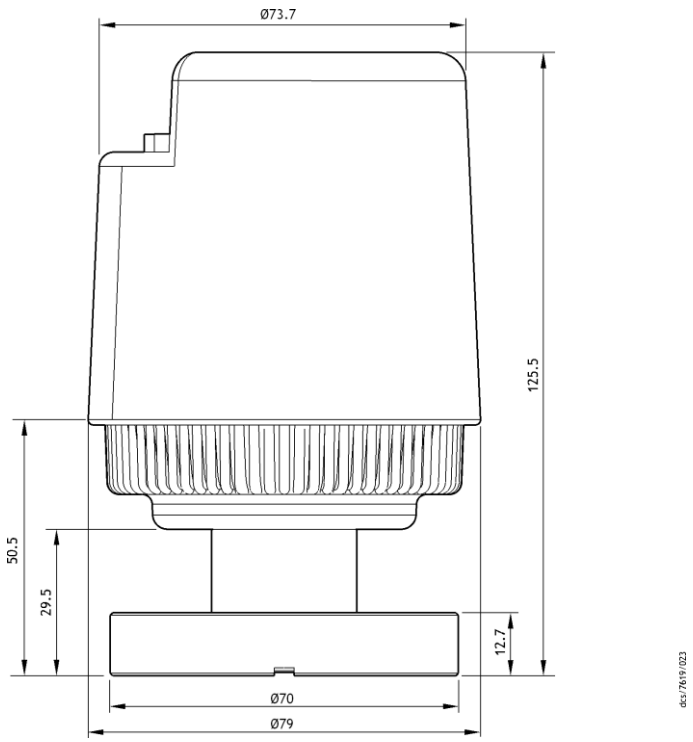
Figure 2 - Dimensions (mm) of the nAIM gauge (NW25)



© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

Technical data

Figure 3 - Dimensions (mm) of the nAIM gauge (DN40 CF)



© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

3 Installation

3.1 Unpack and inspect

WARNING

The nAIM gauge incorporates magnets. Keep away from heart pacemakers, computers, credit cards and any other magnetically sensitive devices.

WARNING

Magnetic Field may interfere with pacemakers. Maintain a distance of minimum 10 cm between the magnet and the heart pacemaker. You can also use anti-magnetic shield to prevent the influence of strong magnetic field.

Remove all packing materials and protective covers and check the nAIM.

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

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

3.2 Fit the nAIM gauge to the vacuum system

CAUTION

Where protection against fluid ingress is required, ensure that the gauge is installed vertically, with the vacuum flange at the bottom. For all other mounting orientations the gauge has no protection against fluid ingress and should be installed where fluids cannot enter the gauge.

The nAIM gauge can be mounted in any orientation. To avoid the buildup of debris or condensable material in the body tube of the nAIM gauge (which will probably cause pressure measurement errors), Edwards recommend installing the nAIM gauge vertically, as shown in Figures 2 and 3.

Use an O-ring / centring ring or Co-seal and clamp to connect the NW25 flange of the nAIM gauge to a similar flange on the vacuum system.

Use a copper gasket and screws to connect the DN40 CF flange of the nAIM gauge to a similar flange on the vacuum system.

If required, turn the end-cap (relative to the magnet housing) so that the electrical connection socket is in a convenient position on the system; refer to Figure 1 and hold the magnet housing and turn the end-cap until the electrical connection socket is in the required position.

In accordance with good practice, it is recommended that your vacuum system has a secure Earth (ground) connection, and that the tube of the nAIM gauge is electrically connected to the vacuum system.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

3.3 Electrical connections

WARNING

Ensure that the gauge is installed in accordance with all national and local safety regulations. Ensure that all wiring is safely secured to eliminate trip hazards.

WARNING

If the nAIM gauge malfunctions, the pressure measurement may be incorrect. If such a failure could cause injury to people or damage equipment, install a suitable control system to indicate the failure and, if necessary, to close down the process system.

3.3.1 Connect to customer supply and control equipment

A schematic diagram of the recommended electrical connections to the nAIM gauge is shown in Figure 5.

The pins on the nAIM gauge electrical connection socket are used as shown in Figure 4 and Table 6. The specification of the electrical supply, d.c. relay and back EMF suppression diode are given in Section 2.

Figure 4 - D-type 9-way male connector

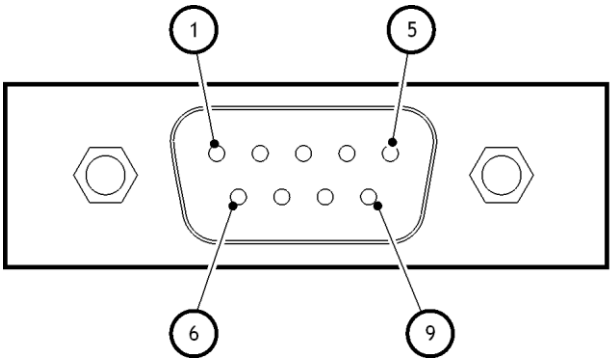


Table 6 - Pin identification

Pin number	Connection
1	Supply positive
2	Supply common
3	Not connected
4	ID resistor
5	RS485 / RS232 Common
6	Setpoint output
7	Not connected
8	RS485 Negative / RS232 Transmit
9	RS485 Positive / RS232 Receive

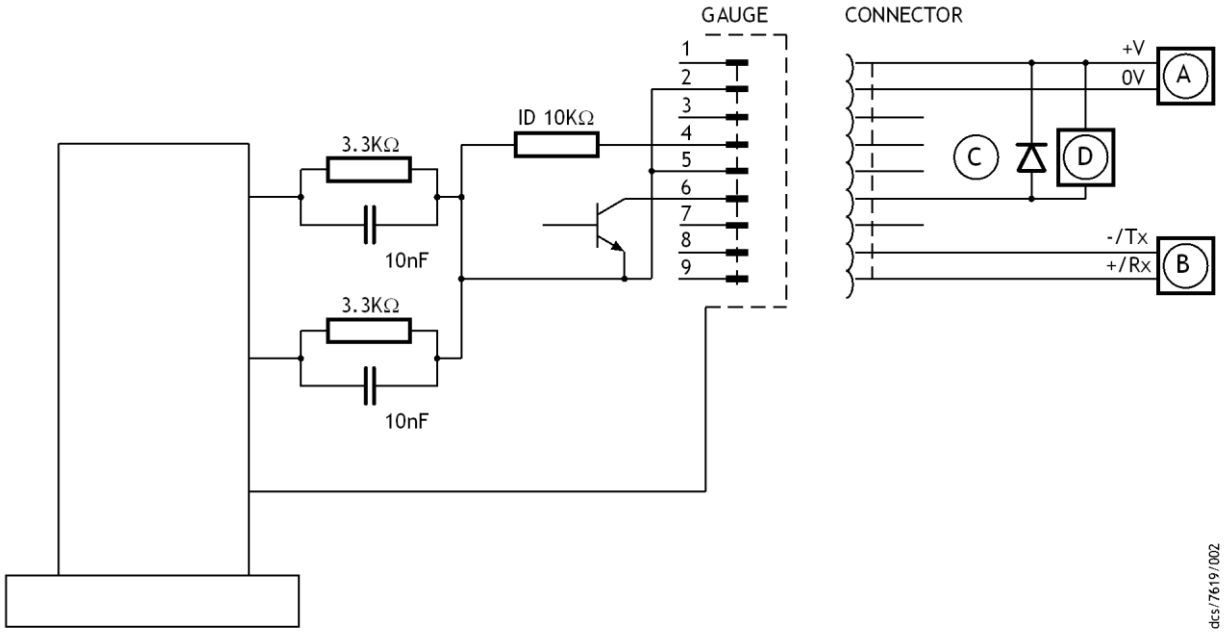
Connections to pins 4 and 6 are optional.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

The value of the ID resistor is determined by measuring the resistance between pins 4 and 5. All serial gauges are identified by a 10 kΩ resistor as full gauge identification is carried out over serial communications.

The setpoint output on pin 6 is an active low open-collector transistor suitable for driving a d.c. relay or control logic. If connecting a relay a suppression diode must be used, to protect the gauge from transient voltages generated when the relay is switched off, as shown in Figure 5.

Figure 5 - Recommended electrical connections



A. Electrical supply
B. RS485 / RS232 serial communication
C. Back EMF suppression diode (optional)
D. d.c. relay (optional)

3.3.2 Connecting the serial interface

The nAIM gauge has one of two serial communications protocols built in, RS232 or RS485. Either interface can be used for point-to-point communication with a single gauge from the digital gauge range. The RS485 interface can be used for multi-drop communication with multiple gauges from the digital gauge range.

3.3.2.1 Connecting RS232

The RS232 interface uses two lines for data transfers and an additional line as a signal common. Hardware handshaking is not implemented. The connector pin out is not compatible with standard computer serial leads and these must not be used.

It is recommended that shielded cable be used for the interface to reduce interference problems and the length of the RS232 link should be less than 10 metres. For longer links, either install line drivers or use RS485.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

3.3.2.2 Connecting RS485

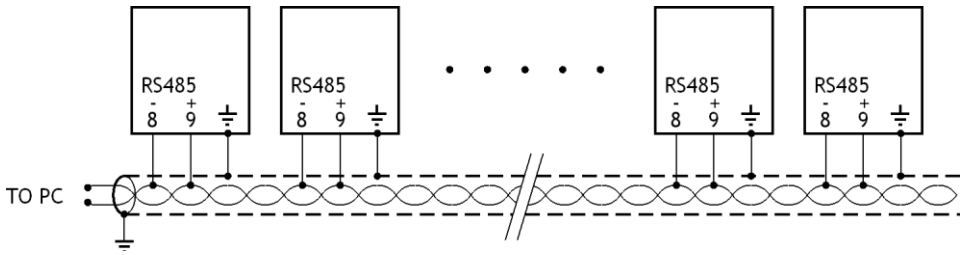
The RS485 interface uses two lines for differential data transfers. Multiple gauges from the digital gauge range, and other RS485 compatible Edwards products, can be connected to the same serial bus (refer to Figure 6).

CAUTION

All of the ground connections are tied together. If differences exist in the local ground voltage, damage could occur. If the gauges being connected are liable to experience different ground potentials, a suitable RS485 isolator should be connected between them.

It is recommended that shielded twisted pair cable be used for the interface to reduce interference problems and the length of the RS485 link should be less than 1000 metres. Long links may require the addition of 120 Ω terminating resistors at each end of the link to improve communications reliability.

Figure 6 - RS485 and ground connections between multiple gauges



© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4 Operation

4.1 Safety

WARNING

Do not use the nAIM gauge to measure the pressure of explosive or flammable gases or mixtures.

WARNING

Never operate the nAIM 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 4 kV) are generated inside the body tube of the nAIM gauge; these could cause injury to people or could be a source of ignition.

WARNING

Do not disconnect the nAIM gauge 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

When measuring the pressure of gases of high molecular weight, the pressure indicated can be below the true pressure. Ensure that the nAIM gauge is not over-pressurised when using heavy gases.

WARNING

Use the gauge only for its intended purpose as described in this instruction manual.

WARNING

The nAIM gauge incorporates magnets. Keep away from heart pacemakers, computers, credit cards and any other magnetically sensitive devices.

Note: *The nAIM gauge has a magnet that may affect devices that are sensitive to high magnetic fields. The effect is reduced on the Low Field version.*

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.2 Serial communications

The nAIM gauge is a digital gauge. All gauge controls and pressure measurements are carried out over serial communications.

The communications to the gauge operate on a master / slave principle. The gauge is the slave and will only transmit a message in response to one sent to it. The master, a PC for example, must always start the conversation.

A conversation consists of a message to the gauge and its response back. Having sent a message to the gauge, wait for the reply before continuing.

There are two basic types of message sent to the gauge:

- Command sending information to the gauge (!)
- Query requesting information from the gauge (?).

All messages end with a carriage return.

Refer to the digital gauge range Serial communications manual (D026-91-880) for full details of the serial command protocol and message format.

Refer to Section 8 for a quick reference guide to serial commands supported by this gauge.

4.2.1 Set baud rate - !C780

The gauge baud rate can be set to 9600, 19200 or 38400. The command reply is returned at the current baud rate before the gauge baud rate setting is updated.

The default gauge set up is 9600 baud.

This command can be locked to prevent accidental adjustment.

4.2.2 Multi-drop mode

Multi-drop mode is only supported by RS485 gauges and is enabled when a node address is assigned to a gauge. In multi-drop mode, commands and queries are only responded to when prefixed by a multi-drop header with a valid destination address. Replies are returned to the source address. Node addresses "00" and "99" have special meaning and should be used as described below:

Wildcard "99" addressed messages should only be used with a single gauge in multi-drop mode where its node address is unknown. Use with multiple gauges will result in comms collisions and no valid reply will be received.

Broadcast "00" addressed messages can be used with multiple gauges in multi-drop mode where all gauges require the same command to be performed - e.g. Baud rate setting. No reply will be sent and no alternate message confirmation will be provided.

Refer to the digital gauge range Serial communications manual (D026-91-880) for full details of the serial command protocol and message format. This includes further information on multi-drop mode and gauge responses.

4.2.2.1 Set node address - !750

The gauge node can be set to a value between 00 and 98. It can be read back with the read node address query. Assigning a node address of 00 disables multi-drop mode, and assigning a node address between 01 and 98 enables multi-drop mode. The command reply is returned from the current node address before the gauge node address setting is updated.

The default gauge set up is node address 00 - multi-drop disabled.

This command can be locked to prevent accidental adjustment.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.2.2.2 Read node address - ?750

The read gauge node address query returns the gauge multi-drop node address. This query can be used with the multi-drop wildcard "99" node address prefix, on a point-to-point serial connection, when the actual gauge node address setting is unknown.

4.2.2.3 Auto-enumerate - !C781

The gauge node can be automatically set to a value between 01 and 98. This command disables all comms replies and uses the gauge setpoint output as a message receipt flag. The gauge comms replies can be re-enabled when the validity of the assigned node address is confirmed.

Refer to the digital gauge range Serial communications manual (D026-91-880) for full details of the auto enumeration process.

This command can be locked to prevent accidental adjustment.

4.3 Gauge identification

All serial gauges are identified by a single value of ID resistor and this is 10 kΩ. All further gauge identification is carried out over serial communications.

4.3.1 Read wildcard identification - ?S0

The read wildcard identification query is consistent across all Edwards products that support serial communications and returns the hardware version, software version and user programmable gauge name.

4.3.2 Read gauge identification - ?S751

The read gauge identification query returns the hardware version, software version and user programmable gauge name.

4.3.3 Set gauge name - !S751

The gauge name can be set to a value between 0000 and 9999. It is read back as part of the gauge identification query.

This command can be locked to prevent accidental adjustment.

4.3.4 Read gauge serial number - ?S790

The read gauge serial number query returns the gauge serial number.

4.4 Pressure measurement

4.4.1 Read gauge pressure - ?V752

The read gauge pressure query returns the measured pressure in the selected gas type and pressure units and the gauge status. Refer to Section 4.10 for details of the gauge status bits.

The default gauge set-up is Nitrogen / Air and Pascal.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.4.2 Acknowledge gauge errors - !S752

Gauge errors are acknowledged and are cleared by sending the Acknowledge gauge errors command to the gauge. Gauge errors that are still active cannot be cleared and will remain active until the cause of the error state is removed. Digital gauge errors are returned in the gauge status and can be read when the gauge pressure is queried. Refer to Section 4.10 for details of the gauge status bits.

4.4.3 Set gauge strike control - !C752

CAUTION

Do not operate the nAIM gauge for long periods when the system pressure is above 1 x 10^{-2} mbar as the anode pin can be damaged and the nAIM gauge can be severely contaminated.

It is recommended that the gauge is only enabled when the system pressure is lower than 1 x 10^{-2} mbar and the gauge is disabled when the system pressure is 1 x 10^{-2} mbar or higher.

Gauge striking can be enabled and disabled. The status of the gauge during striking is displayed in the gauge status and can be read when the gauge pressure is queried.

4.4.4 Set Pressure units - !S755

Gauge pressure units can be set to mbar, Pascal or Torr. The selected gauge pressure units are returned in the gauge status that is displayed when the gauge pressure is read.

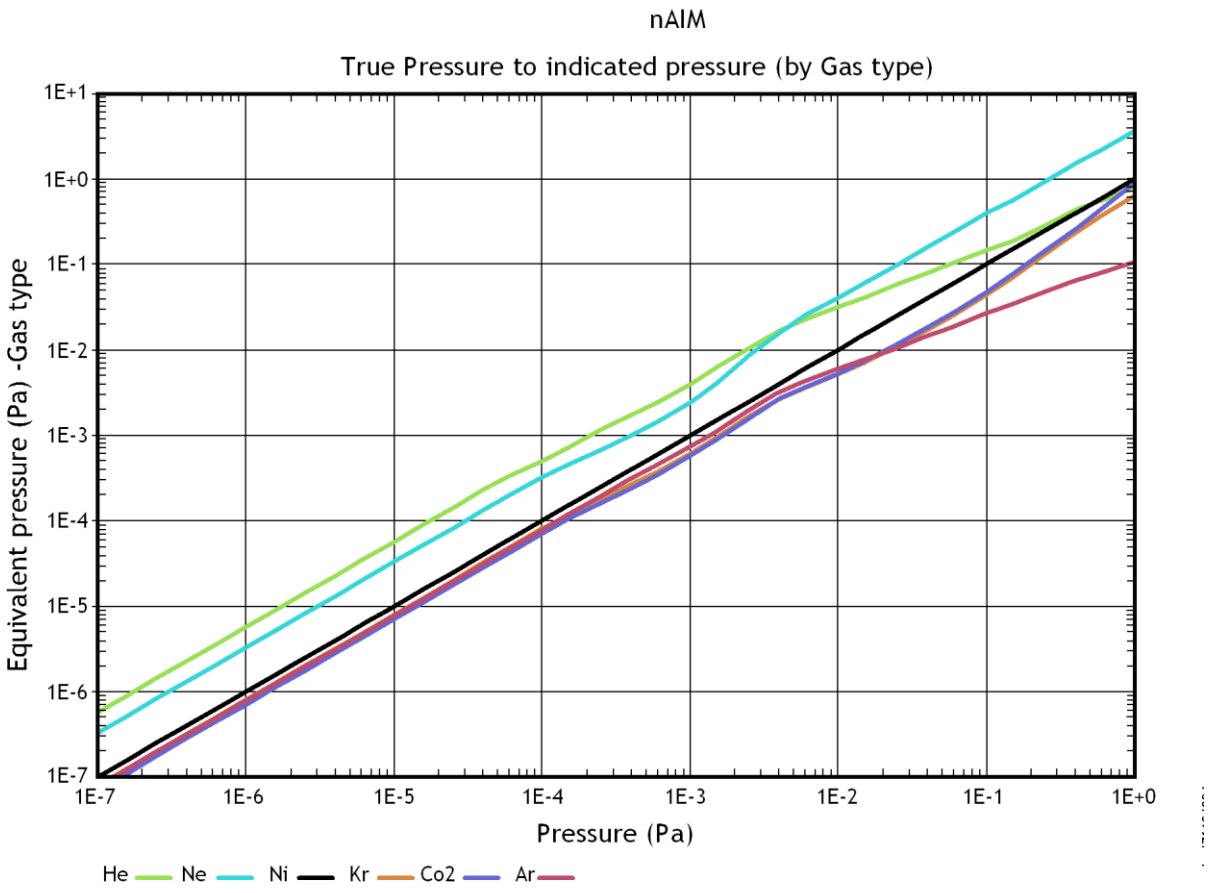
This command can be locked to prevent accidental adjustment.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.5 Gas dependency

The nAIM gauge is calibrated for use in Nitrogen, and will read correctly with dry air, oxygen and carbon monoxide. For any other gas type an internal conversion is applied in order to indicate the correct pressure reading. Figure 7 shows the equivalent pressure readings for six common gases: Nitrogen, Argon, Helium, Carbon Dioxide, Neon and Krypton. The gas conversion is carried out by the gauge at the time of measurement and the pressure reading is returned in the selected gas type.

Figure 7 - Equivalent pressure readings for six common gases



4.5.1 Set gas type - !S756

Gauge gas type can be set to Nitrogen, Argon, Helium, Carbon Dioxide, Neon or Krypton. The selected gauge gas type is returned in the gauge status and can be read when the gauge pressure is queried.

This command can be locked to prevent accidental adjustment.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.6 Setpoint

The setpoint output is an open collector transistor that is activated based on the gauge pressure reading. The setpoint thresholds are set and read in the gauge gas type and pressure units. When the gauge gas type or pressure units are changed, the setpoint thresholds are automatically updated.

The setpoint output is turned OFF (open) when the gauge pressure reading is above the high threshold and turned ON (closed) when below the low threshold. The high and low thresholds allow for programmable hysteresis. No additional hysteresis is added by the gauge.

If the low threshold is set higher than the high threshold, then the high threshold is updated at the same time to the same value. Equally, if the high threshold is set lower than the low threshold, then the low threshold is updated at the same time to the same value.

When both thresholds are set below the operating range of the gauge, then setpoint operation will be disabled.

The gauge setpoint output state is also returned in the gauge status and can be read when the gauge pressure is queried.

4.6.1 Set setpoint thresholds - !S754

The gauge setpoint thresholds can be set to pressure values between 1×10^{-10} and 9.9×10^{-6} and these will be in the gauge gas type and pressure units. If the gas type or pressure units are changed, then the setpoint thresholds will be automatically updated for the new settings. The gauge setpoint thresholds can be read back with the read gauge setpoint threshold query.

This command can be locked to prevent accidental adjustment.

4.6.2 Read setpoint thresholds - ?S754

The read gauge setpoint threshold query returns the setpoint threshold pressure in the gauge gas type and pressure units.

4.7 Gauge parameter control

4.7.1 Set gauge command lock - !S753

Gauge commands can be locked to prevent accidental adjustment by sending the command lock command to the gauge. When the gauge command lock is set, changes to gauge parameters are prohibited and attempts to adjust them will return a gauge state error.

4.7.2 Return to default settings - !S757

The gauge pressure units, gas type and setpoint thresholds can be reset to gauge defaults by sending the return to defaults command to the gauge.

This command can be locked to prevent accidental adjustment.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.8 Gauge run parameters

A number of counters are provided to monitor the run hours of the gauge, the operational hours of the magnetron element and the pressure exposure of the magnetron element. This information can be used to aid in determining the best service interval for the gauge tube based upon the specific process environment.

The gauge run hours counter is the time that the gauge has been operating.

The magnetron run hours counter is the time that the magnetron has been operating.

The magnetron exposure counter is the cumulative gauge pressure over the time that the magnetron has been operating.

A threshold value for the magnetron exposure can be set to trigger a status flag that indicates that a tube service is advised. This threshold is defaulted to OFF and can be set by the user to an appropriate value based upon the user's specific process, setup and experience. Refer to Section 4.10 for details of the gauge status bits.

The value of the magnetron exposure counter is dependent on the gas type selected. For consistent results the gas type setting should not be changed.

4.8.1 Read internal temperature - ?V759

The read internal temperature query returns the internal temperature of the gauge processor in degrees Celsius.

4.8.2 Read run hours - ?V769

The read run hours query returns the number of hours the gauge has been operating, the number of hours the magnetron has been operating, and the cumulative magnetron pressure exposure in pressure hours.

4.8.3 Reset run hours - !C769

The gauge run hours counters can be reset to zero by sending the reset run hours command to the gauge.

This command can be locked to prevent accidental adjustment.

4.8.4 Set magnetron exposure threshold - !S769

The magnetron exposure threshold can be set to an exposure value between 1×10^{-7} and 5×10^{5} and this will be in the gauge pressure unit hours. A value of 0.0E±00 will disable the magnetron exposure status flag. If the gauge pressure units are changed, the magnetron exposure threshold will be automatically updated for the new setting. The magnetron exposure threshold can be read back with the read magnetron exposure threshold query.

This command can be locked to prevent accidental adjustment.

4.8.5 Read magnetron exposure threshold - ?S769

The magnetron exposure threshold query returns the magnetron exposure threshold value in the gauge pressure unit hours. A value of 0.0E±00 indicates that the magnetron exposure status flag is disabled.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.9 Response error codes

The error codes (Table 7) returned in the case of command or query failure are consistent across all Edwards products that support serial communications.

Table 7 - Error codes

Error code	Meaning
0	Acknowledge - no error
1	Invalid command for object ID
2	Invalid query / command
3	Missing parameter
4	Parameter out of range
5	Invalid command in current state
6	Data checksum error
7	EEPROM read or write error
8	Operation timeout
9	Invalid config ID

Refer to the digital gauge range Serial communications manual (D026-91-880) for full details of the serial command protocol and message format. This includes further information on command error codes.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

4.10 Gauge status bits

The gauge status is returned with every pressure reading as 16 bits of ASCII encoded HEX:

"F"				"F"				"F"				"F"			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Table 8 - Gauge status bits

BIT	Status flag	Meaning
0	Gauge Err	Gauge specific error active*
1	Mag ON	Gauge Magnetron strike On or Off
2	SPOP ON	Setpoint On or Off
3	Gauge LK	Gauge parameters Locked
4	Pressure units	Gauge pressure units: 1=mbar, 2=Pa (Default), 3=Torr
5		
6	FlashEE Err	All stored parameters and calibrations defaulted
7	Calibrating	Calibration in progress - pressure reading invalid
8	Mag Str	Magnetron striking
9	Mag Str Fail	Magnetron striking failure (Not Struck)
10	-	Not applicable to this gauge
11	-	Not applicable to this gauge
12	Gas type	Gauge Gas type: 0=N_2 (default), 1=Ar, 2=He, 3=CO_2, 4=H, 5=Ne, 6=Kr
13		
14		
15	Mag Exposure	Magnetron exposure threshold exceeded†

* *Gauge specific errors are bits 6 to 11 inclusive*

† *Gauge status flag with user settable magnetron exposure threshold*

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

This page has been intentionally left blank.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

5 Maintenance

The internal components of the nAIM gauge are shown in Figure 9. The nAIM gauge is designed so that the components can be replaced using the spares listed in Section 7.3. Refer to the following sections for details of maintenance procedures that should be performed when necessary.

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 pins of the anode assembly can become electrically charged.

WARNING

Disconnect the cable from the nAIM gauge before removing the nAIM gauge from the vacuum system. High voltages are generated inside the nAIM gauge.

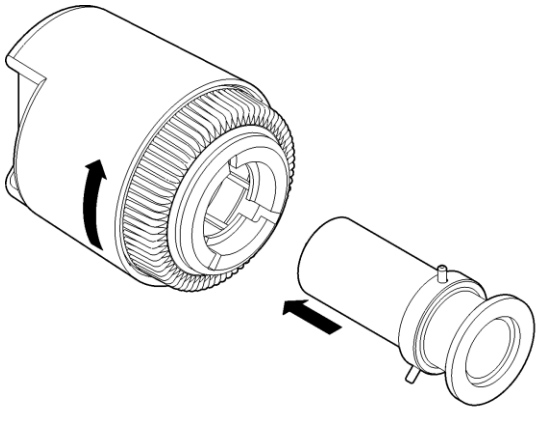
The internal components of the nAIM gauge are shown in Figure 9. The nAIM gauge is designed so that the components can be cleaned or replaced using the spares listed in Section 7.3. Refer to the following sections for details of maintenance procedures that should be performed when necessary.

5.2 Replace the body tube

Refer to Figure 8 and follow this procedure to replace the gauge body tube.

1. Unplug the electrical cable, vent the vacuum system to atmospheric pressure and remove the gauge from the vacuum system.
2. Hold the magnet housing and turn the body tube anticlockwise (when viewed from the vacuum flange) to unlock the bayonet fitting. Remove the body tube from the magnet housing.
3. Fit the replacement tube assembly into the magnet housing and turn the body tube clockwise (when viewed from the vacuum flange) to lock the bayonet fitting.
4. Refit the gauge to the vacuum system as described in Section 3.2 and reconnect the electrical cable.

Figure 8 - Refitting the body tube assembly



© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

5.3 Replace the electrode assembly

Refer to Figure 9 and the following procedure.

1. Remove the nAIM gauge from the vacuum system and the body tube assembly from the nAIM gauge as described in Section 5.2.
2. Fit the flat spanner supplied in the electrode assembly kit (refer to Section 7.3) to the two lugs in the end of the collar (2), then turn the collar (2) anticlockwise to unscrew the collar (2) from the body tube (5) and remove the anode assembly (3) and the O-ring (4).
3. 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).
4. Fit the new cathode plate (6) and cathode tube (7) into the body tube (5) and secure with the circlip (8).
5. Fit the new O-ring (4) and anode assembly (3) into the body tube (5); ensure that the orientation of the anode assembly (3) is correct. Refit the collar (2) to the body tube (5). Locate the flat spanner on the two lugs on the collar (2) and turn the collar (2) clockwise until it is fully secured in the body tube (5).
6. Refit the body tube (5) to the magnet housing, as described in Section 5.2 and nAIM gauge to the vacuum system as described in Section 3.2.

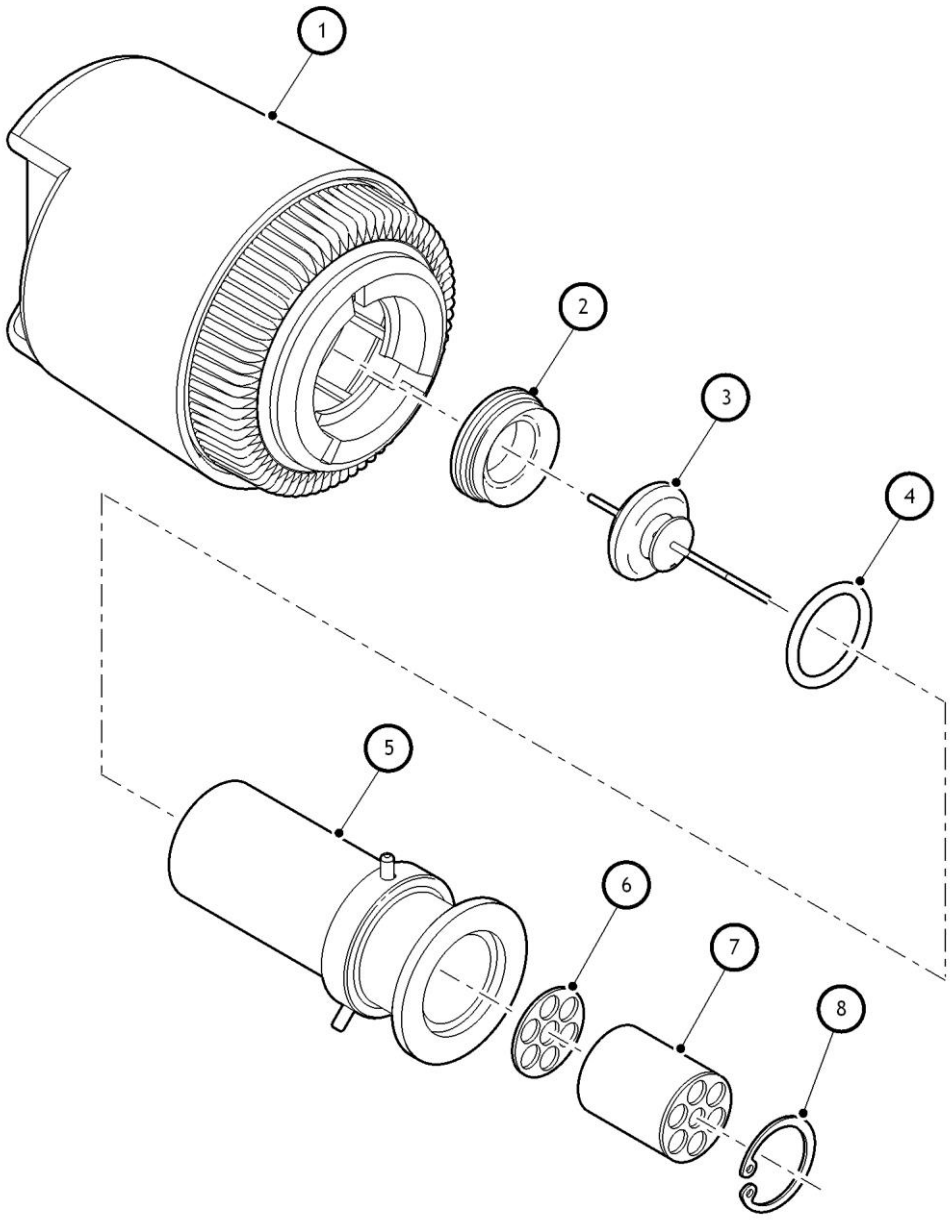
5.4 Clean the internal components

Refer to Figure 9 in the following procedure.

1. Remove the internal components from the magnet housing as described in 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) and body tube (5) and anode assembly (3) in a suitable degreasing agent (using an ultrasonic tank if available). Thoroughly soak them in a suitable laboratory detergent. Rinse in clean water to remove the detergent and then in methanol to remove all of the water, then thoroughly dry the components.
5. Refit the components in the electronics and magnet housing as described in Section 5.3.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

Figure 9 - Exploded view of the body tube assembly



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

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

5.5 Fault finding

Table 9 - Fault finding

Symptom	Possible cause	Remedy
No Reply to communications	Incorrect electrical supply voltage or supply polarity reversed.	Check electrical supply and connections.
	Incorrect communications interface or serial comms connections reversed.	Check communications interface and connections.
	Incorrect baud rate selected.	Check all supported baud rates.
	Incorrect multi-drop address selected.	Check gauge node address setting by using the wildcard node address on a point-to-point communications connection.
	Communications collisions due to multiple gauges connected on a point-to-point system, or duplicate node address on a multi-drop system.	Check each gauge node address setting by using the wildcard node address on a point-to-point communications connection.
	Replies disabled during auto-enumeration.	Ensure replies enabled.
Pressure reading incorrect	Vacuum leak.	Leak check vacuum system.
	Incorrect pressure units selected.	Check pressure units setting.
	Incorrect gas type selected.	Check gas type setting.
	Tube contaminated.	Clean the tube or replace the tube.
Gauge indicates strike failure	Vacuum below operating range of the gauge.	Command strike within operating range of the gauge.
	Tube contaminated.	Clean the tube or replace the tube.
Gauge indicates FlashEE error	Gauge parameters and factory calibration have been defaulted.	Contact your supplier.

5.6 Calibration service

A calibration service is available for all Edwards gauges. Calibration is by comparison with reference gauges, traceable to National Standards. Contact Edwards for details.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

6 Storage and disposal

6.1 Storage

Return the nAIM gauge to its protective packaging and store the nAIM gauge in clean dry conditions until required for use. Do not exceed the storage temperature conditions specified in Section 2.2.

When required for use, prepare and install the nAIM gauge as described in Section 3.

6.2 Disposal

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

Alternatively, it may be possible to recycle the nAIM gauge and / or cables: contact Edwards or supplier for advice (also see below).

The nAIM gauge and associated cables are within the scope of the European Directive on Waste Electrical and Electronic Equipment, 2002/96/EC. Edwards offers 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 nAIM gauge and / or cables for recycling.

Particular care must be taken if the nAIM gauge has been contaminated with dangerous process substances, or if the nAIM gauge has been overheated or has been in a fire. Fluoroelastomers are used in the nAIM gauge; these are safe in normal use, but can decompose into dangerous breakdown products if heated to 260 °C and above.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

This page has been intentionally left blank.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

7 Service and spares

7.1 Introduction

Edwards products and spares are available from Edwards companies in Belgium, Brazil, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, 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.

When maintaining this product, Edwards recommends using only Edwards maintenance and service kits.

Order spare parts from the nearest Edwards company or distributor. When ordering, please state for each part required:

- Model and Item Number of the equipment
- Serial number
- Item Number and description of the part.

7.2 Service

Edwards products are supported by a world-wide network of Edwards Service Centres. Each Service Centre offers a wide range of options including: equipment decontamination; service exchange; repair; rebuild and testing to factory specifications. Equipment which has been serviced, repaired or built is returned with a full warranty.

Local Service Centres can also provide Edwards engineers to support on-site maintenance, service or repair of equipment.

For more information about service options, contact the nearest Service Centre or other Edwards company.

7.2.1 Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must send us a completed Declaration of Contamination of Vacuum Equipment and Components – Form HS2. The HS2 form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

We provide instructions for completing the form in the Declaration of Contamination of Vacuum equipment and Components – Procedure HS1.

Download the latest documents from www.edwardsvacuum.com/HSForms/, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

7.3 Spares

Table 10 - Spares

Spares	Item number
Electronics and magnet housing	
nAIM RS232	D14690800
nAIM RS485	D14690801
nAIM-L RS232	D14691800
nAIM-L RS485	D14691801
Replacement tube	
nAIM NW25	D14545801
nAIM DN40 CF	D14661805
nAIM-I NW25	D14671801
Electrode assembly kit*	
nAIM NW25	D14545802
nAIM DN40 CF	D14661806
nAIM-I NW25	D146711802

* *The electrode assembly kit contains one each of the following components: cathode plate, cathode tube, anode assembly, O-ring, plastic Pirani housing, circlip, gasket and 4 screws and washers.*

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

8 Serial command quick reference guide

Table 11 - Serial command quick reference guide

ID	Object	Operations & config ID	Parameter	Notes	Lockable
0	Wild card gauge type	?S0		Read gauge identity: Hardware version; Software version; Name	
750	Node address (RS485 build only)	!S750	nn	Set Node Address: 00 = Multi-drop disabled (default) 01-98 = Multi-drop enabled	▯
		?S750		Read Node Address	
751	Gauge type	!S751	nnnn	Set gauge name: 0000 to 9999	▯
		?S751		Read gauge identity: Hardware version; Software version; Name	
752	Gauge controls	!C752	n	Set gauge strike control: 0 = Off 1 = On	
		!S752	n	Acknowledge gauge errors: 1 = Acknowledge	
		?V752		Read gauge pressure: pressure; status bits	
753	Gauge command lock	!S753	n	Set gauge command lock: 0 = editable 1 = locked	
754	Setpoint	!S754 0;	n.nE±nn	Set high setpoint threshold: 1.0e-10 to 9.9e+06 must be >= Low threshold	▯
		?S754 0		Read high setpoint threshold	
		!S754 1;	n.nE±nn	Set low setpoint threshold: 1.0e-10 to 9.9e+06 must be <= High threshold	▯
		?S754 1		Read low setpoint threshold	
755	Pressure units	!S755	n	Set pressure units: 1 = mbar 2 = Pascal (default) 3 = Torr	▯
756	Gas types	!S756	n	Set gas type: 0 = Nitrogen / Air (Default) 1 = Argon 2 = Helium 3 = Carbon Dioxide 4 = Neon 5 = Krypton	▯
757	Return to defaults	!S757	n	Reset all user settings to default: 1 = reset setpoints, gas type and pressure units	▯
759	Internal temperature	?V759		Read internal temperature	

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

Table 11 - Serial command quick reference guide (continued)

ID	Object	Operations & config ID	Parameter	Notes	Lockable
769	Run hours	!C769	nnnn	Clear all Run hours counters 1234 = password protection	▯
		?V769		Read gauge run hours: Run hours; Magnetron hours; Magnetron exposure	
		!S769	n.nE±nn	Set exposure threshold 0.0E±00 Pa / Hrs (default = OFF)	▯
		?S769		Read exposure threshold	
780	Baud rate	!C780	n	Set baud rate: 4 = 9600 (default) 2 = 19200 1 = 38400	▯
781	Auto-enumerate (RS485 build only)	!C781	n	Auto-enumerate node address: 0 = Off - replies enabled 1 = On - replies disabled 2 = Auto - replies disabled and node address randomised	▯
790	Serial number	?S790		Read gauge serial number	

© Edwards Limited 2020. All rights reserved.
Edwards and the Edwards logo are trademarks of Edwards Limited.

This page has been intentionally left blank.

This page has been intentionally left blank.

edwardsvacuum.com