

VIM-1

Spinning rotor gauge vacuum measurement
 1×10^{-6} to 10 mbar

Advantages

- Easy to use by one-button operation
- Excellent long-term stability
- Digital RS-232 or RS-485 interface
- Corrosion resistant sensor
- Bakeable all-metal sensor design
- Low-cost disposable sensor
- Passive sensor without ion- or heat source

Applications

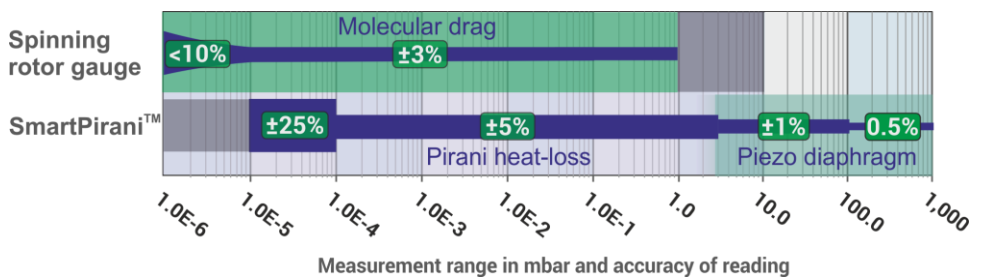
- Cryogenic vessels
- Vacuum insulation panels
- Vacuum tubing monitoring
- Window glass manufacturing
- Lyophilization
- Vacuum equipment testing



- ✓ RoHS
- ON/OFF
- 0-10 VDC
- RS-232
- RS-485

The VIM-1 instrument is based on a robust spinning rotor sensor that measures the pressure-dependent molecular drag on a magnetically levitated spinning steel ball.

Spinning rotor gauges have been used for decades as transfer standard precision instruments in metrology vacuum calibration applications. The VIM-1 takes the spinning rotor gauge technology to industrial applications, where static vacuum needs to be measured and verified. The low-cost sensor design can be integrated in customer equipment, and the instrument and measuring head can be used to operate multiple sensors.

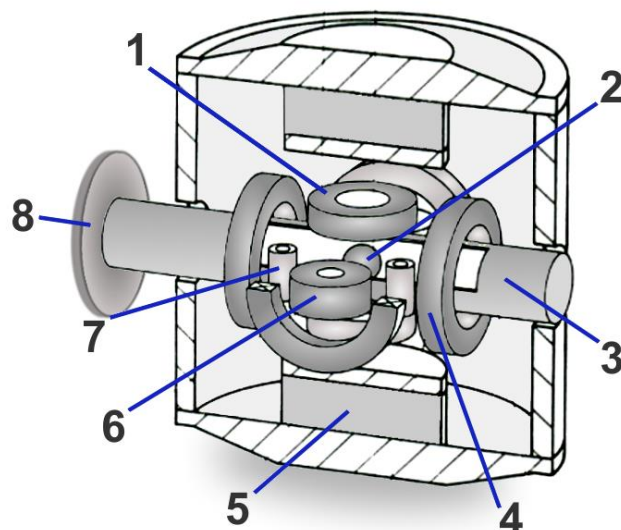


The VIM-1 is available as a stand-alone spinning rotor gauge instrument or as a full-range package combined with a VPM-5 SmartPirani™ vacuum transducer for PC interfacing via USB.

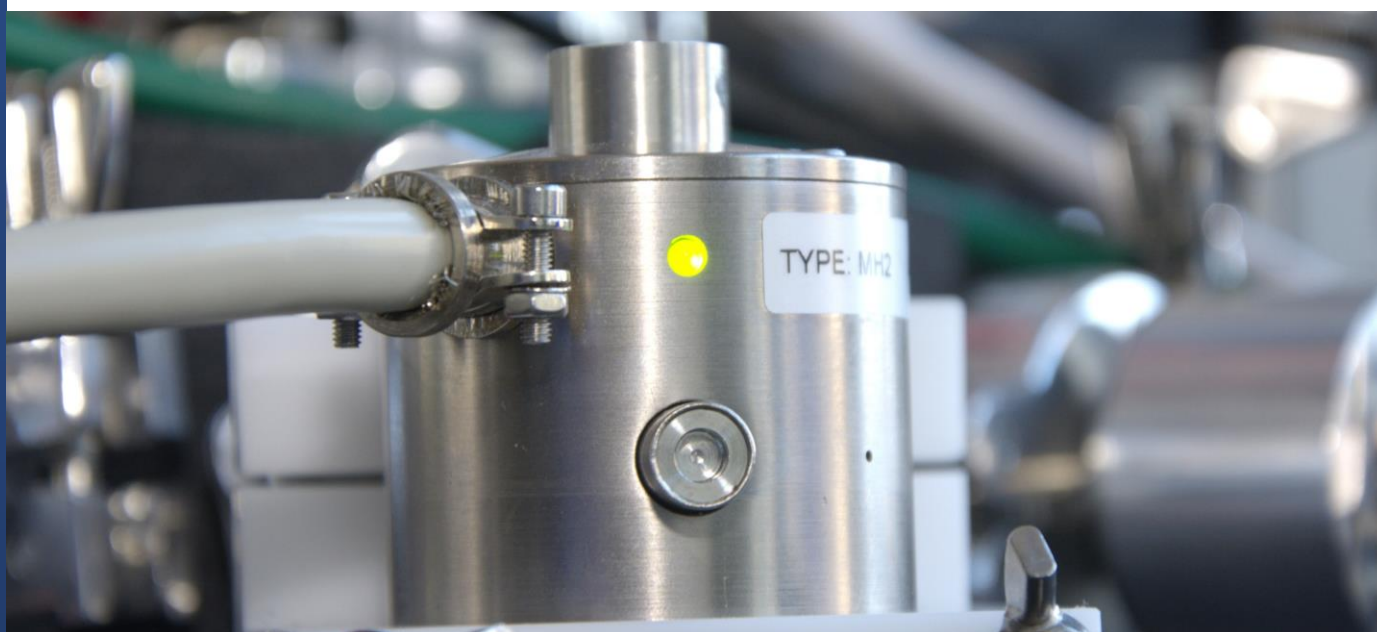
Spinning rotor gauge technology

The spinning rotor gauge sensor device consists of a steel ball inside a tube. The sensing head includes the surrounding electronics and coils to drive and measure the steel ball rotation.

1. Sensing ball levitation coil
2. Sensing ball element
3. Sensor tube
4. Rotation driving coil
5. Permanent magnet
6. Measurement coil
7. Damping coil
8. Vacuum flange



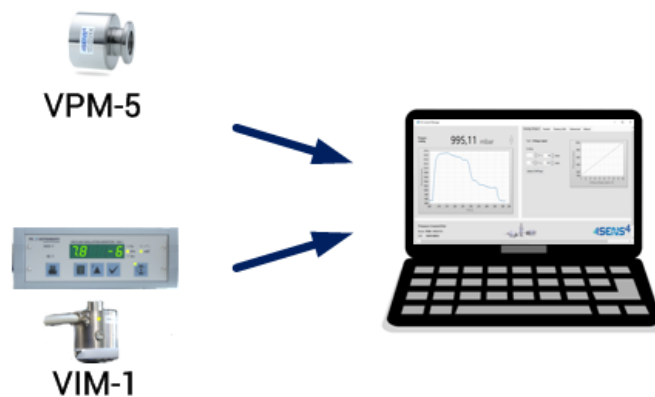
During the measurement loop the magnetic driving coil accelerates the steel ball to 660 rps (rotations per second) after which the driving coil is de-energized. The measurement coil then measures the rotations of the ball during the deceleration time period. The deceleration rate of the ball is a function of the pressure-dependent molecular drag. The spinning rotor gauge measurement cycle and display update rate can be set to 3, 5, 10 or 20 seconds.



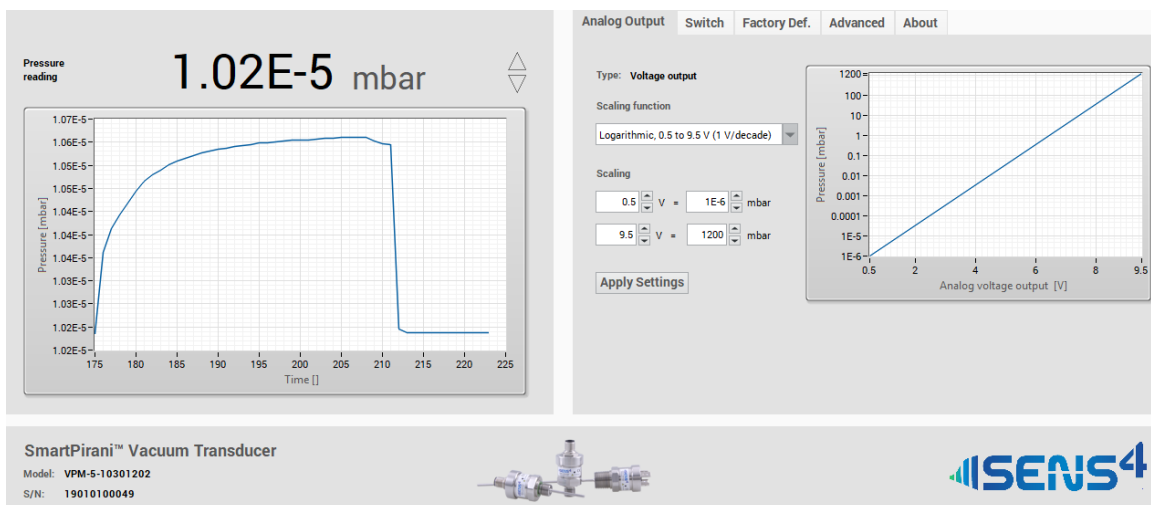
Full-range system

The VIM-1 full-range system comes with a VPM-5 SmartPirani™ transducer that adds the following features:

- Full-range measurements from 1×10^{-6} mbar to atmospheric pressure.
- Much faster response.
- Safe operation of the VIM-1, making sure that it is only operated at supported pressures.



Both the VIM-1 and the VPM-5 are controlled and monitored in parallel by a single, easy-to-use application which displays the measurements from both instruments simultaneously.



Applications

The low-cost, all-metal VIM-1 sensor element can be integrated in customer vacuum systems and requires no electrical feedthrough. It is hermetically sealed and can be exposed to both high bake-out temperatures and corrosive gasses. The sensor element is passive and does not generate any ions or thermal emission like traditional wire Pirani or hot/cold cathode gauges.

Cryogenic and liquid gas vessels

In many industries, cryogenic liquids such as liquid oxygen, nitrogen and argon are stored and transported in specially designed cryogenic tanks. A cryogenic tank is insulated with a double-wall vacuum cavity where it is critically important to maintain an adequate vacuum level of typically $<1 \times 10^{-2}$ mbar.

Integrating a sensor head in a cryogenic tank enables verification of the insulation without breaking the vacuum.

Vacuum insulation panel (VIP)

Vacuum cavities are used as insulation in a wide range of applications. Quality check of vacuum pressure inside vacuum insulation panels requires in-situ measurements using embedded sensors. The VIM-1 sensor ball element can be integrated in insulation vacuum panels for verification – ensuring adequate vacuum pressure levels and insulation properties.

Another vacuum insulation application where continuous verification of the vacuum level can be beneficial is vacuum insulated glass (VIG).

Rate-of-rise outgassing testing

In the spinning rotor gauge sensor, the only material exposed to the vacuum gas media is stainless steel and its passive sensor design makes it ideal for outgassing and leak testing by use of the rate-of-rise principle.

VIM-1 Spinning rotor gauge technical data

Spinning rotor gauge specifications

Measuring range in mbar	1×10^{-6} to 10 mbar (7.5×10^{-7} to 7.5 Torr)
Measuring principle 1×10^{-6} to 10 mbar	Molecular drag from rotating steel ball
Accuracy 1×10^{-6} to 9.99×10^{-5} mbar	10 % of reading ⁽¹⁾
Accuracy 1×10^{-5} to 1 mbar	3% of reading ⁽¹⁾
Measurement update rate (user-selectable)	3, 5, 10 and 20 seconds
Measurement readout	6 digits LED
Interfaces	USB 2.0, RS-485, RS-232 printer port
Relays	2 SPDT, 48 VDC, 0.5A
Data logging storage	1,023 values

Environment conditions (controller)

Operating ambient temperature	+10 to +40 °C
Protection rating, EN 60529/A2:2013	IP40
Humidity, IEC 68-2-38	98%, non-condensing

Power supply

Supply voltage	100 – 242 VAC, 50-60 Hz
Power consumption	<50 W

Environment conditions (sensor)

Operating temperature range	+10 to +40 °C
Bakeout temperature	<450 °C (<842 °F)
Mounting position	Horizontal

Sensor materials

Enclosure	SS 1.4404 / AISI 316L
Vacuum exposed materials (media wetted)	SS 1.4404 / AISI 316L
Protection rating, EN 60529/A2:2013	IP68
Process leak tightness	$<1 \cdot 10^{-9}$ mbar·l/s

(1) Accuracy specifications are for measurement with nitrogen gas after zero adjustment.

Specifications are subject to change without further notice

VPM-5 SmartPirani™ transducer technical data

Specifications

Measuring range in mbar	1×10 ⁻⁶ to 1,333 mbar (7.5×10 ⁻⁷ to 1000 Torr)
Measuring principle 1×10 ⁻⁶ to 1.5 mbar	MEMS Pirani thermal conductivity
Measuring principle 1.5 to 2 mbar	Blended MEMS Pirani / piezo reading
Measuring principle 2 to 1,333 mbar	MEMS piezo resistive diaphragm
Accuracy 1×10 ⁻⁵ to 9.99×10 ⁻⁵ mbar	25% of reading
Accuracy 1×10 ⁻⁴ to 1.99 mbar	5% of reading
Accuracy 2.00 to 99.9 mbar	1% of reading
Accuracy 100 to 800 mbar	0.5% of reading
Accuracy 800 to 1099 mbar	0.25% of reading
Accuracy 1100 to 1200 mbar	0.5% reading
Hysteresis 1×10 ⁻³ to 10 mbar(ISO 19685:2017)	1%
Hysteresis 10 to 1200 mbar (ISO 19685:2017)	0.1%
Analog output resolution	16 bit (150 µV)
Analog output update rate	124 Hz
Response time (ISO 19685:2017)	<20 ms
Temperature compensation	+10 to +50 °C
Solid state relay set point range	5×10 ⁻⁶ to 1,333 mbar (3.75×10 ⁻⁶ to 1,000 Torr)
Solid state relay contact rating	50 V, 100 mA _{rms} / mA _{DC}
Solid state relay approvals	UL Recognized: File E76270 CSA Certified: Certificate 1175739 EN/IEC 60950-1 Certified

Environment conditions

Operating ambient temperature	-20 to +50 °C
Media temperature	-20 to +50 °C
Storage ambient temperature	-40 to +120 °C
Bake-out temperature (non-operating)	+120 °C
Maximum media pressure	10 bar absolute
Mounting position	Arbitrary
Protection rating, EN 60529/A2:2013	IP40
Humidity, IEC 68-2-38	98%, non-condensing

Power supply

Supply voltage	12-30 VDC
Power consumption	240 mW (max)
Reverse polarity protection	Yes
Overvoltage protection	Yes
Internal fuse	100 mA (thermal and recoverable)

Materials

Enclosure	SS 1.4307 / AISI 304L / Aluminum 6061
Vacuum Process flange (media wetted)	SS 1.4307 / AISI 304L
Vacuum exposed materials (media wetted)	304L Stainless steel, Kovar, glass, silicon, nickel, aluminum, SiO ₂ , Si ₃ N ₄ , gold, Viton®, low out-gassing epoxy resin, solder, RO4305
Process leak tightness	<1·10 ⁻⁹ mbar·l/s

Approvals

CE	EMC directive 2014/30/EU
RoHS compliance	Directive EU 2015/863

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Order guide

Description	Part number
VIM-1 System with DN25KF Spinning rotor gauge head	VIM-1-BSC-1
VIM-1 Full-range System with DN25KF Spinning rotor gauge head and VPM-5 SmartPirani™ transducer DN16KF, USB cables	VIM-1-CMB-1
Spinning rotor gauge head with 3 m cable	SRGH-3M
Sensor tube with ball, DN25KF	SRGS-KF25
Calibration certificate	
DAkKS calibration of VIM-1 system 1×10^{-6} to 1 mbar	CAL-VIM1-DAKKS

About

Sens4 develops, manufactures, markets and distributes vacuum, pressure and temperature measuring equipment for industrial applications worldwide. Our products are designed, engineered and manufactured in Denmark to the highest quality standards. Our mission is to continuously endeavor to provide customer centric state of the art measurement solutions.

Our passion | Your value™

