ph instruments
srg technology

VIM-2®

First stationary and mobile Spinning Rotor Gauge with Li Ion Technology

Key Advantages

- True stationary and mobile Spinning Rotor Gauge

  (>2 h battery life time)
- 10 mbar to 5 x 10^{-7} mbar measuring range
- Safe, all metal, ambient temperature
- Cost-effective two-part design
- Plug and measure, incl. App & Bluetooth (optional)
- Internal and external data logger
- High intrinsic accuracy and neglectable drift over time

Applications:

- All thermal vacuum insulation applications
- All conductive vacuum insulation applications
- Documentation, QC, R&D, Preventive Maintenance
- Trouble shooting and safety check without opening the vacuum chamber

USB TYPE C **RS 485** Bluetooth® **24 VDC**

Introduction

The VIM-2 is a stationary (grid operation) and mobile, battery-operated, highly accurate and long-term stable vacuum pressure gauge based on Spinning Rotor Gauge (SRG) technology.

Spinning Rotor Gauges are characterized, among other things, by the option to separate the sensor and measuring head / electronics and thus enable checking static vacuums in a very cost-effective manner. Due to its simplicity, the all-metal sensor can be permanently welded to the vacuum system and delivers reliable measured values even after years of use. Only the ball in the tube, and no electronic components, remain on the chamber to be measured. The system is uniquely resistant to mechanical stress and non-chlorinated corrosive media. Any interaction with the vacuum chamber takes place via electromagnetic forces that lift and accelerate the ball and measure its braking behavior. Corresponding mechanical protection that needs to be attached from the outside is included.

Advantages – Portability, accuracy and long-term stability

Spinning Rotor Gauges were previously considered to be complex to operate and were therefore almost exclusively used in calibration laboratories. A main application was, for example, the calibration of high vacuum measuring devices, ionization gauges.

The VIM-2, as a grid and battery-operated device, is user-friendly, works largely independently and can be run remotely (App via Bluetooth (optional)). It is for instance particularly suitable for measurements on cryogenic, vacuum-insulated liquid gas tanks. It´s a safe option as it does not require any electrical feedthroughs, making it an all-metal sensor that is extremely robust and resistant to aging. Compared e.g. to the Pirani-based measuring method, the measuring range is extended by approx. 3 decades into the high vacuum region, and thus provides greater and far more valuable information. It is a direct, mathematical / physical method, that only uses the effect of decelerating a rotating ball as it collides with the gas molecules as a measure of pressure.

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Most other methods use ionization by means of hot filaments or high voltage to indirectly measure the pressure, they are mechanically less stable and sensitive to contamination, even impact the vacuum pressure measurement themselves (by degassing/ionization and sputtering). Heat transfer methods (Pirani) have a limited measurement range below 10^{-3} mbar (w/o zeroing, which is often impossible). In general, all other UHV measurement methods have electrical feedthroughs and fragile electronic components in the vacuum part.

SRGs on the other hand have a unique high level of accuracy, long-term stability, no feedthroughs, measure with a simple sphere at ambient temperature, in a simple tube, all interaction with the vacuum is through electromagnetic forces.

The power supply-independent VIM-2 gives total mobility for large and remote measurement locations, it runs for hours before recharge.

Despite of SRGs of the past, a reliable measurement is provided due to the strong magnetic fields and high rotation frequency of the sensor. VIM-2 generates a magnetic field that is twice as strong (90 mT) as previously available SRGs. The standard rotation frequency of the sphere at 615 Hz provides a much more stable suspension in the magnetic field. Both effects result in an improved tolerance to imperfect alignment of the sensor tube on e.g. the cryo vacuum tank and more reliably capturing the sensor ball.

The measuring heads are not sensor-specific and therefore interchangeable with one another, and previously installed sensors, so each head can measure a large number of sensors without a significant loss of accuracy.

Measurement principle

The Spinning Rotor Gauge is based on the effect that gas molecules slow down a moving body as they are adsorbed on its surface and then re-emitted. The statistically distributed molecules striking from all directions are accelerated accordingly and brake the body (momentum transfer, area-related particle flux density).

In the low pressure regime (< 1 x 10^{-7} mbar) the desorption of the accelerated gas molecules does not contribute to the rotation frequency. At pressures above 1 x 10^{-4} mbar and mean free paths in the cm range, the gas viscosity is automatically compensated by means of an integrated temperature measurement.

In the case of the SRG, a simple precision ball is used as the sensor and the deceleration is determined by inductive measurement in the sensor head. Factors such as the molecular mass and temperature changes are only included in the measurement in an easily determinable root ratio.

Additionally, within small limits, variable factors determine the braking of the rotating ball:

1. The “residual drag” results from the material properties of the ball. It is particularly relevant for < 10^{-5} mbar and can be roughly pre-determined and stored as required.
2. The "molecular drag" is the actual deceleration by the surrounding medium and proportional to the pressure. The molecular drag contains the calibration factor, which deviates from a ideally smooth sphere (factor 1) by max. ± 6 % without any calibration, ± 1% can be achieved.

It should be noted that even without setting the calibration factor or the zero point, and even after years, the system still has a unique intrinsic accuracy in high vacuum, which cannot be achieved by any other vacuum measurement method and is more than sufficient for many applications.

Measurement range

Due to their principle, Spinning Rotor Gauges can be used in pressure ranges from atmosphere to UHV. Due to geometric and electromechanical conditions, however, they are optimized for the pressure range, in which they achieve uniquely high levels of accuracy and long-term stability:

1% accuracy of the measured value between 0.1 and 1 x 10^{-6} mbar can be achieved if needed, <1% drift per year is typically. The measuring range in general is 10 mbar to 5 x 10^{-7} mbar.

Technical Data

Measurement Principle	Spinning Rotor Gauge
Measurement Range	7 Torr to 4 x 10^{-7} Torr / 10 mbar to 5 x 10^{-7} mbar
Achievable accuracy	7 Torr to 0.07 Torr / 10 mbar to 0.1 mbar ca. 10 % of reading 0.07 to 7 x 10^{-7} Torr / 0.1 to 1 x 10^{-6} mbar 1 % of reading
Measurement time	3, 5, 10, 20, 30 s
Long term stability	< 1 % drift each year
Wetted materials	1.4404, 1.4034
Alignment	Horizontal
Analog interfaces	USB Type C, Bluetooth (optional), High Density 15-polig
Digital interfaces	USB, Bluetooth (optional), RS 232 (service), RS 485
Internal data logger	1023 values
Remote control / GUI	Win7/10
Operating Temperature	Electronics 10 °C to 40 °C (50 F to 104 F) Measurement head 10 °C to 50 °C (50 F to 122 F) Sensor tube bakeable until 150 °C (302F) elastomer sealed 450 °C (842F) metal sealed
Power requirements	18 to 28 VDC
Analog output	0 bis 10 VDC configurable
Flange Type	KF 25, CF40, 8 VCR, welding socket
Weight	Device 1650 g (58 oz), power adapter 510 g (18 oz), head 750 g (26.5 oz)
Dimensions	L x B x H = 325 x 275 x 100 mm (13 x 11 x 4 in.)
Power supply	Grid or battery operation
Power consumption	Maximum 1.5 A at 24 VDC, typically < 1 A
Run time in battery mode	> 2 h
Battery charging time	In 4.5 h to more than 95% of current capacity

About us

ph-instruments develops, manufactures and sells vacuum measurement systems with unique technologies for demanding tasks in industry, research and science. Our guideline is to provide our customers with cost-effective and application-related solutions. Our specialists each have more than 20 years of experience in measuring and regulating pressures in the vacuum sector. The products are developed and produced in Germany and Austria and meet the highest quality standards for measuring accuracy, sustainability and reliability. Innovative technologies help to increase energy efficiency and thus protect the environment from unnecessary CO2 emissions.