

VPM-5 SmartPirani™ Vacuum Transducer

Heat-loss Pirani and diaphragm Piezo combination gauge with 1.0E-6 to 1333 mbar measuring range



Benefits & Features

- Ultra-wide measuring range of 9 decades from 1.0E-6 to 1333 mbar
- Unmatched price-performance ratio
- Gas independent measurement from 2 to 1333 mbar
- Easy configuration with USB programmer
- 0-10 VDC programmable voltage output
- Digital RS-232 or RS-485 interface
- Optional Ceramic or Parylene sensor protection for corrosive applications
- Optional solid state setpoint relay for external controlling
- Optional on-board Display
- Pin and output compatibility with other vendors' gauges

Typical applications

- Analytical Instrumentation
- Semiconductor Processing
- Vacuum Furnaces
- Thin Film Coating
- Medical Instrumentation
- Space Simulation and Flight



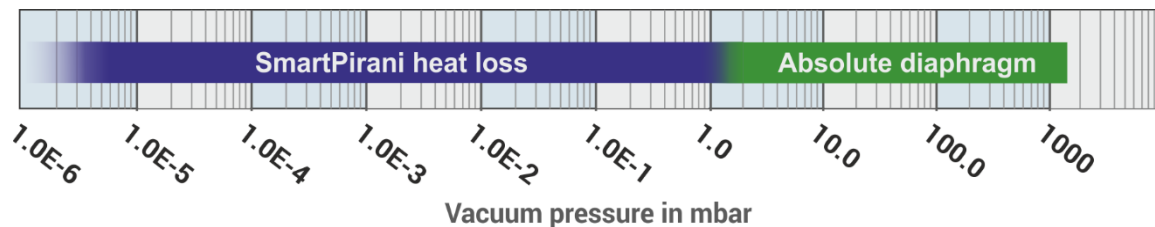
Product Datasheet



Leading Technology

The VPM-5 SmartPirani™ transducer offers best-in-class performance and has established new standards for vacuum measurement by extending the usable measuring range for thermal conductivity vacuum gauges by 1–3 decades.

The SmartPirani™ is based on cutting-edge MEMS (Microelectromechanical Systems) sensor technology, combined with a novel precision digital signal processing architecture and advanced, innovative measurement algorithms. Together with precision automated manufacturing and calibration processes, these elements provide a unique product capable of uncompromised measurement performance.



The well-known gas dependency in the rough vacuum range of thermal conductivity gauges has been eliminated by integrating a MEMS diaphragm sensor that offers precision performance comparable to more expensive capacitance manometers. Measurement is independent of gas type and concentration which enhances confidence in the measurement and ensures more accurate control of vacuum system venting processes and can prevent over-pressurization of the vacuum system.

Real-time Readout of Pressure

The integrated display provides immediate, at-a-glance visibility of real-time vacuum pressure across the full measurement range from 1×10^{-6} to 1333 mbar.

In addition to live pressure readings, the interface displays the current setpoint relay status and vacuum process temperature, enabling enhanced situational awareness and faster response during critical vacuum operations.

An intuitive menu system allows direct access to key transducer settings and calibration parameters, setpoint configuration, supporting quick configuration and efficient operation directly from the device.

The PIN code display lock prevents unauthorized personnel from changing settings.



Enabling use in Demanding Applications

For applications where the sensors may be exposed to corrosive or aggressive gases, the SmartPirani™ is available with a conformal protective coating that acts as an effective barrier.

Depending on the application, the SmartPirani™ transducer series is now available with either an optional ceramic or Parylene protective barrier to protect against corrosion or oxidation of sensor materials.

Ceramic is highly corrosion-resistant and is a well-proven material for vacuum sensor diaphragms in capacitance diaphragm gauges.

Parylene is a unique polymer with highly corrosion-resistant and hydrophobic properties. The Parylene barrier is designed for medical applications, including lyophilization and sterilization.

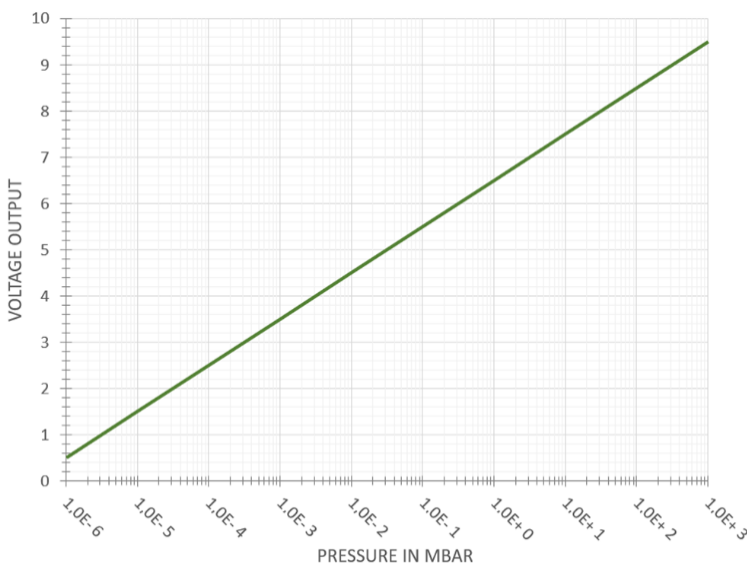
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Measure and Control Advanced Vacuum Processes

The VPM-5 SmartPirani™ is engineered for best-in-class measurement and control of vacuum gas pressure. Several output options are providing more than just a pressure measurement signal.

Analog voltage output



The analog output voltage provides a signal for external readout or controls. The VPM-5 offers as standard a voltage output signal of 1VDC/decade mbar, Torr, or Pascal.

Furthermore, it can also be user-configured or ordered preconfigured with a large selection of other analog output options that enables drop-in replacement of gauges from other vendors.

Digital Interface

The RS-232 and RS-485 serial interfaces can be used to transfer pressure and temperature measurement data to external equipment. The digital interface enables diagnostics, predictive maintenance, service, calibration, setpoint configuration, analog output scaling, and acquisition of real-time vacuum pressure measurements for on-screen visualization.

Reliable and Robust Setpoint Relay Control

The three independent solid-state switch relays can be used for external control of pumps, valves, safety interlock circuits, and other external equipment. The basic control uses on/off regulation with a programmable setpoint and hysteresis value. Each solid-state relay offers both normally closed and normally open contacts.

Compared to electromechanical relays, the solid-state relays provide superior reliability and faster switching times, with arc-free contacts and no EMI (electromagnetic interference) when switching. The SmartPirani™ relays are designed to last and are UL listed, CSA recognized, and EN/IEC 60950-1 certified for maximum confidence when used to control critical vacuum processes and high-cycle applications.

Temperature Measurement

The VPM-5 SmartPirani™ is designed for measuring pressure but also offers a vacuum-side temperature measurement signal that can be used for vacuum process surveillance and diagnostics. The temperature measurement can be accessed through the digital interface.

Customized Settings

The VPM-5 transducer can be delivered with a custom configuration to meet specific application requirements, ready to work for a specific equipment installation out of the box. Examples of pre-configured options include measurement range, vacuum pressure unit, setpoint configuration, and output signal scaling. Customized products will be assigned a unique part number for easy and simple future reordering.

Other Vendor Compatibility

The VPM-5 SmartPirani™ transducer is available with pin compatibility, analog voltage pressure signal emulation, and digital protocol emulation for vacuum transducers and transmitters from other vendors.

The emulation features for other vendors enable quick, seamless upgrading of traditional wired Pirani transducers, convection gauges, and legacy micro-Pirani transducers, allowing a move to next-generation vacuum transducers without changing cabling or system equipment software.

In many applications, the VPM-5 SmartPirani™ will provide both cost reductions and enhanced measurement performance when replacing legacy vacuum gauges and transducers.

The other vendor emulation also provides compatibility with controller and display units from other vendors.

Connect digital through supply voltage line

Traditionally, other vendors' transducers equipped with FCC68/RJ45/8P8C and Hirschmann connectors do not offer digital communication. The novel S4-Connect interface enables access to the digital core of the VPM-5 transducer through digital communication over the power supply line.

The S4-Connect USB communicator enables easy configuration of transducer settings, diagnostics, and calibration adjustments.

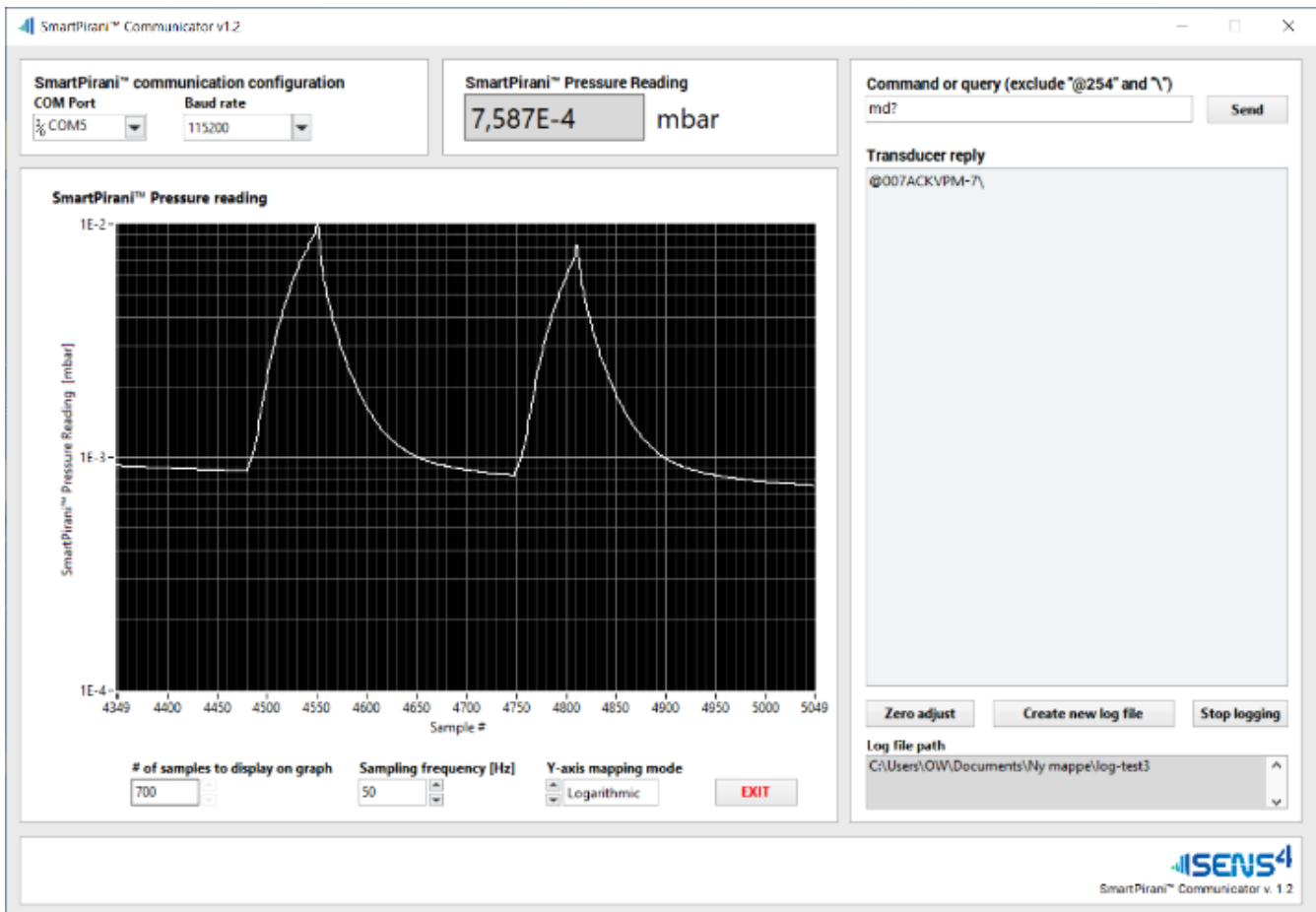


Datalogging and Analyzing

The SmartPirani™ Communicator user software is a freeware package for Windows that offers real-time onscreen measurements and a comprehensive data-logger tool for logging measurement data to a file for storage, data analysis, or presentation.

The SmartPirani™ Communicator is freeware software compatible with the SmartPirani™ transducer series with RS-232 and RS-485 digital interfaces.

The SmartPirani™ transducer, in combination with the power supply and USB converter, is a cost-effective data-logger package for characterizing vacuum system performance and rate-of-rise leak detection.



Typical Applications

The SmartPirani™ is designed for reliable measurement and control of advanced vacuum processes and is suitable for a wide range of applications in both industry and science. A wide selection of VPM-5 configurations is available to meet the different requirements of various applications.

Analytical Instrumentation

Mass spectrometers and scanning electron microscopes are types of analytical equipment that use vacuum gauges to determine the safe operation of an ion source. In certain applications, the ultra-wide range of the SmartPirani™ eliminates the need for additional, expensive high-vacuum ionization gauges.



Semiconductor Industry

Traditionally, convection-type wire Pirani vacuum gauges have been used in the semiconductor industry because of their resistance to corrosive gases. The new protective ceramic or Parylene sensor surface option expands the applicable applications for the MEMS Pirani-based vacuum transducers and is now a real performance upgrade alternative to legacy convection vacuum gauges.

Physical Vapor Deposition

Coating materials using physical vapor deposition (PVD) processes are common in many diverse industries, including solar, medical, automotive, tooling, optics, and packaging.

The SmartPirani™ is available with a user-cleanable integrated particulate baffle system specially designed for PVD applications. This baffle system is designed to block particulates while ensuring sufficiently high vacuum gas conductance and preventing clogging. The innovative baffle feature can increase the time between service intervals and enhance equipment uptime. Furthermore, in certain PVD applications, the extended range of the SmartPirani™ eliminates the need for cold cathode vacuum gauges for base pressure verification.



Technical Data

Specifications	
Measuring range in mbar	1×10 ⁻⁶ to 1333 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 1333 mbar	MEMS piezo resistive diaphragm
Accuracy 1×10 ⁻⁵ to 9.99×10 ⁻⁵	25% of reading
Accuracy 1×10 ⁻⁴ to 7.99 mbar	5% of reading
Accuracy 8.00 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 1333 mbar	0.5% reading
Hysteresis 1×10 ⁻³ to 10 mbar (ISO19685:2017)	1%
Hysteresis 10 to 1333 mbar (ISO19685:2017)	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 1333 mbar (3.75×10 ⁻⁶ to 1000 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 ⁽³⁾	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 recoverable)

Materials	
Enclosure	SS 1.4307 / AISI 304L / Aluminum 6061
Vacuum Process flange (media wetted)	SS 1.4401 / AISI 316
Vacuum exposed materials (media wetted) Standard version	316 Stainless steel, Kovar, glass, silicon, nickel, aluminum, SiO ₂ , Si ₃ N ₄ , gold, Viton®, low out-gassing epoxy resin, solder, RO4305
Vacuum exposed materials (media wetted) Parylene protected version	316 Stainless steel, Viton®, Parylene
Vacuum exposed materials (media wetted) Ceramic protected version	316 Stainless steel, Viton®, Aluminum oxide ceramic (Al ₂ O ₃)
Process leak tightness	<1·10 ⁻⁹ mbar·l/s

Reliability	
MTBF (Mean Time Between Failure)	13.092.170 hours
Failure rate FIT (Failure In Time, where time=10E+9 hours)	76,38

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

- (1) Accuracy specifications are typical values at stable temperature after zero adjustment.
- (2) Viton® is a trademark of THE CHEMOURS COMPANY FC, LLC
- (3) Overpressure limits only applicable with using fittings rated to the specified

Specifications are subject to change without further notice.

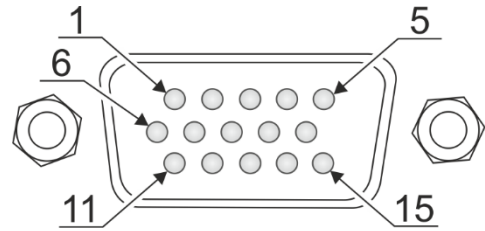
Connector Pin outs

15 Pin HD D-sub RS-232 / RS-485

Pin	Description
1	RS-232 Transmit / RS-485 (-)
2	RS-232 Receive / RS-485 (+)
3	Supply voltage 12-30 VDC
4	Supply voltage - (return)
5	Analog voltage signal +
6	Analog voltage signal - (return)
7	Relay 1 NO (normally open contact) ⁽⁴⁾
8	Relay 1 Common ⁽¹⁾
9	Relay 1 NC (normally closed contact) ⁽⁴⁾
10	Relay 2 NC (normally closed contact) ⁽⁴⁾
11	Relay 2 Common ⁽¹⁾
12	Relay 2 NO (normally open contact) ⁽⁴⁾
13	Relay 3 NO (normally open contact) ⁽⁴⁾ or analog out 2 ⁽⁵⁾
14	Relay 3 Common ⁽¹⁾
15	Relay 3 NO (normally open contact) ⁽⁴⁾

⁽⁴⁾ Optional relay

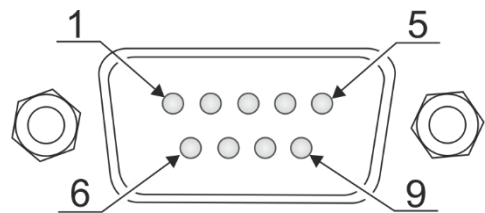
⁽⁵⁾ Optional secondary analog voltage output



9 Pin D-sub RS-232 / RS-485

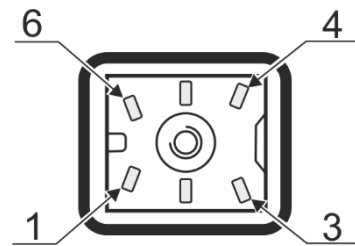
Pin	Description
1	Relay 1 NO (normally open contact) ⁽⁶⁾
2	Relay 1 NC (normally closed contact) ⁽⁶⁾
3	Supply voltage 12-30 VDC
4	Supply voltage - (return)
5	Analog voltage signal +
6	Relay 1 Common ⁽⁶⁾
7	RS-232 Transmit / RS-485 (-)
8	Analog voltage signal - (return)
9	RS-232 Receive / RS-485 (+)

⁽⁶⁾ Optional relay



6 Pin Hirschmann connector

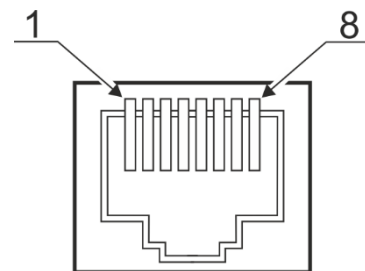
Pin	Description
1	Identification resistor (3K)
2	Analog voltage signal +
3	Analog voltage signal - (return)
4	Supply voltage 12-30 VDC
5	Supply voltage - (return)
6	Chassis



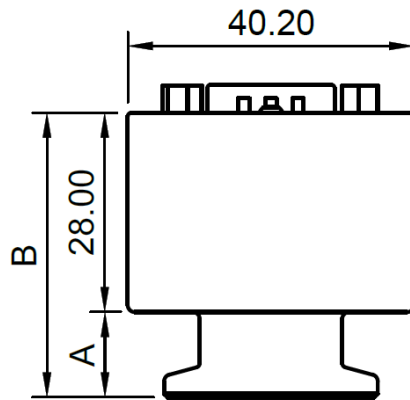
8 Pin RJ45 / 8P8C

Pin	Description
1	Supply voltage 12-30 VDC
2	Supply voltage - (return)
3	Analog pressure voltage signal +
4	Identification resistor
5	Analog pressure voltage signal - (return)
6	Relay 2 NO (normally open contact) ⁽⁷⁾
7	Relay 1 NO (normally open contact) ⁽⁷⁾
8	Relay COMMON ⁽⁷⁾

⁽⁷⁾ Optional relay



Dimensions



Flange type	A [mm]	B [mm]	A [inch.]	B [inch.]
DN16KF (P/N: VPM-5-1...)	12.00	40.00	0.47	1.57
DN25KF (P/N: VPM-5-2...)	12.00	40.00	0.47	1.57
VCR4 ¹ (P/N: VPM-5-4...)	33.70	61.70	1.32	2.43
VCR8 ¹ (P/N: VPM-5-5...)	29.43	57.43	1.15	2.26
1/8" NPT (P/N: VPM-5-3...)	37.00	65.00	1.45	2.56
DN16CF (P/N: VPM-5-6...)	21.83	49.83	0.86	1.96
DN16KF Ext. (P/N: VPM-5-8...)	29.00	57.00	1.14	1.57



Other Vacuum Measurement Products

The Sens4 vacuum transducer product range offers the market's most advanced multi-sensor transducers for use in a wide selection of industrial and scientific vacuum applications.



TrueVac™ Controller

The TrueVAC™ Vacuum Controller is an advanced, versatile instrument designed for precise monitoring and control of vacuum systems across a wide range of industrial and scientific applications. With its high-resolution digital display and intuitive interface, TrueVAC offers real-time vacuum measurement and control, allowing users to efficiently manage processes and maintain optimal conditions.

VPM-15 TriCAP™ Transducer

The VPM-15 TriCAP™ transducer is pin and output compatible with the VPM-5. The VPM-15 has an additional CDG (Capacitance Diaphragm Gauge) sensor to provide the gas independent measuring from 5.0E-3 to 1333 mbar that can be an advantage in applications where gas composition or type can change.

For demanding applications, the VPM-15 TriCAP™ is available with corrosion resistant ceramic or Parylene coated sensors.



VPM-7 for Load-lock Control

The VPM-7 SmartPirani™ ATM is designed for load-lock pressure control and enable accurate control of vacuum system venting. It provides flexible interface and several control options including high-resolution analog output with emulation curves for other vendors vacuum gauges, 3 independent solid-state relays and digital RS-232 or RS-485 interface.

About

Sens4 is a Danish technology company that develops, manufactures, markets, and distributes vacuum, pressure, and temperature measuring equipment for industrial and scientific applications worldwide. Our mission is to provide compelling product solutions that fit our customers' needs and enable them to efficiently measure and control advanced processes around the world.

Learn more about Sens4 on: sens4.com

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