Datasheet

VPM-5 SmartPirani™

Pirani Vacuum Transducer

1×10^{-6} to 1333 mbar / 7.5×10^{-7} to 1000 Torr

Ultra-wide range pirani / piezo transducer

Advantages

- Ultra-wide measuring range of 9 decades
- Advanced digital signal processing provides unmatched price-performance ratio
- Easy configuration via S4-Connect™ USB programmer
- 0-10 VDC program-mable voltage output
- Digital RS-232 or RS-485 interface
- StableZero™ drift compensation
- Optional solid state setpoint relay for process control

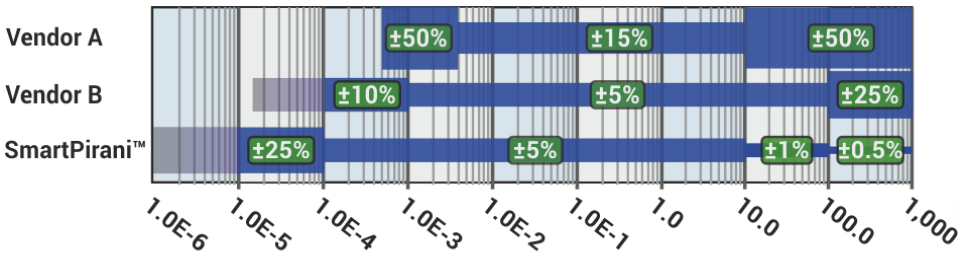
Applications

- Mass spectrometers
- Scanning electron microscopes
- Furnace heat treatment
- PVD coating of glass, optics, tools etc.
- Refrigeration service and manufacturing
- Semiconductor processing

RoHS | 0-10 VDC | ON/OFF | RS-232 | RS-485 | S4-Connect

The VPM-5 SmartPirani™ transducer offers best-in-class performance and has established new standards by extending the useable 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 only available from Sens4. Together with precision automated manufacturing and calibration processes, these elements in combination provide a unique product capable of uncompromised measurement performance.



Measurement range in mbar and accuracy of reading

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. This feature ensures more accurate control of vacuum system venting processes and can prevent over-pressurization of the vacuum system.

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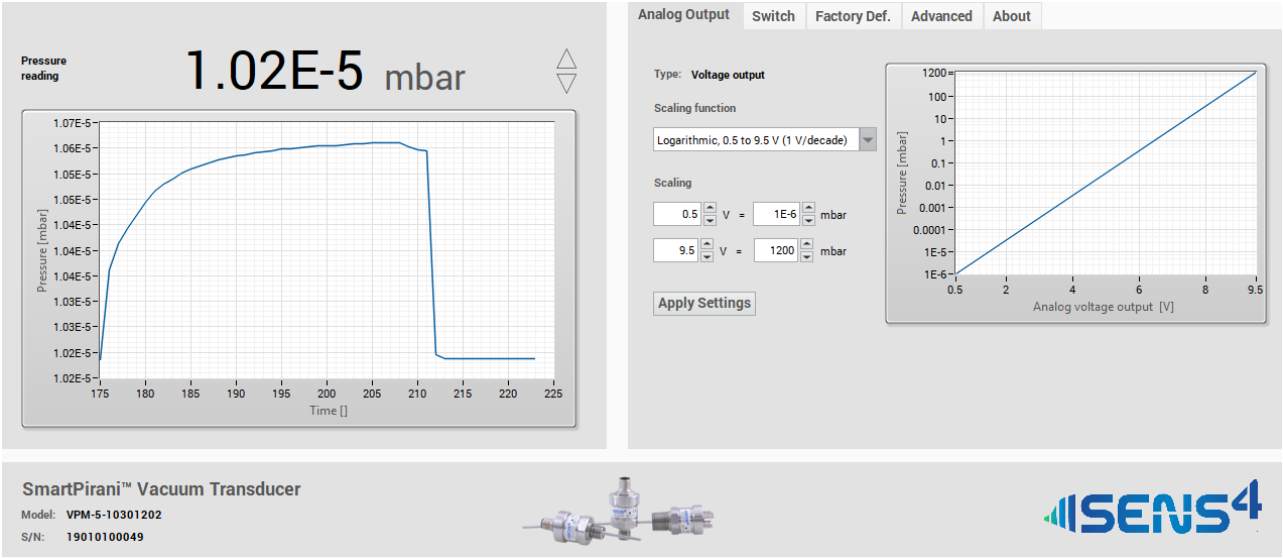
Programmable settings and parameters

Transducer settings and parameters are user-programable from a PC or smartphone with the innovative S4-Connect™ digital communication interface. Transducers with an RS-232 or RS-485 serial interface can either be configured via the serial interface or the S4-Connect™ interface. 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. The S4-Connect™ USB programmer in combination with the free, intuitive configuration software is a plug-and-play solution for transducer programming, real-time measurements and diagnostics.



StableZero™ drift compensation

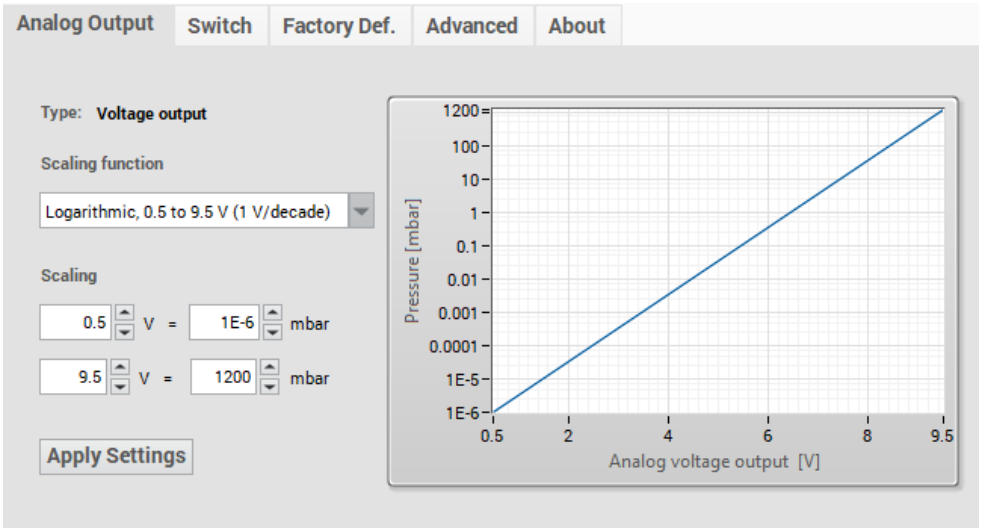
The SmartPirani™ transducer uses an innovative proprietary approach to active temperature compensation and calibration that provides an ultra-stable zero-point. The StableZero™ technology not only enables a reliable, wide dynamic range – it also eliminates the need for frequent user re-zeroing due to zero-point drift commonly known from legacy Pirani and convection gauges. The active StableZero™ temperature compensation also compensates for measurement signal errors introduced by fluctuations in the ambient temperature.

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 electro-mechanical relays, the solid-state relays offer superior reliability and faster switching time while providing arc free contacts and generating no EMI (electromagnetic interference) when switching contacts.
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.

Analog voltage output

The analog output can be user-configured via the S4-Connect™ or RS-232/RS-485 interface to any arbitrary scaling in the range 0-10 VDC. The analog output scaling feature enables amplified signal in a limited pressure range. Furthermore, a wide selection of analog output scaling options to emulate other vendors vacuum gauges and transducers is available.



Customized settings

The transducer can be delivered with a custom configuration to match specific application requirements. 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.

Applications

The SmartPirani™ is suitable for a wide range of industries and applications including fore-line measurement, mass spectrometers, scanning electron microscopes, coating processes, and gas-backfilling.

Analytical equipment

Mass spectrometers and scanning electron microscopes are types of analytical equipment that use vacuum gauges to determine 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.

Physical vapor deposition

Coating of materials by use of physical vapor deposition (PVD) processes is used in many diverse industries including solar, medical, automotive, tooling, optics and packaging. In metal deposition applications the sputtering process often results in particulate contamination of vacuum equipment. Such particulates will damage vacuum gauges, which impacts measurement performance or reduces the gauge's life-time.

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

Move to the next-generation vacuum transducers

The SmartPirani™ series products offer plug-and-play compatibility with vacuum transducers and transmitters from other vendors. The SmartPirani™ is available with pin compatibility, analog voltage pressure signal emulation and digital protocol emulation. The emulation features enable quick, seamless upgrading of traditional wire Pirani transducers, convection gauges and legacy micro-Pirani transducers and allows moving to next-generation vacuum transducers without change of cabling and system equipment software.

The SmartPirani™ will in many applications provide both cost reduction and enhanced measurement performance when replacing legacy vacuum gauges and transducers.

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 1,333 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	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 1.4307 / AISI 304L
Vacuum exposed materials (media wetted)	304L Stainless steel, Kovar, glass, silicon, nickel, aluminum, SiO_2, Si_3N_4, gold, Viton®, low out-gassing epoxy resin, solder, RO4305
Process leak tightness	$<1\cdot10^{-9}$ mbar·l/s
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) Overpressure limits only applicable with using fittings rated to the specified

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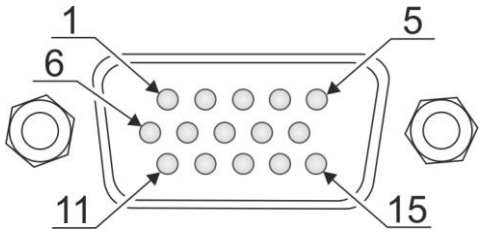
Specifications are subject to change without further notice

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) (1)
8	Relay 1 Common (1)
9	Relay 1 NC (normally closed contact) (1)
10	Relay 2 NC (normally closed contact) (1)
11	Relay 2 Common (1)
12	Relay 2 NO (normally open contact) (1)
13	Relay 3 NO (normally open contact) (1) or analog out 2
14	Relay 3 Common (1)
15	Relay 3 NO (normally open contact) (1)

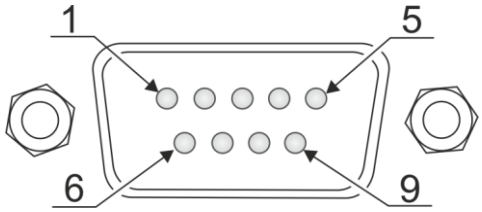
(1) Optional relay



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

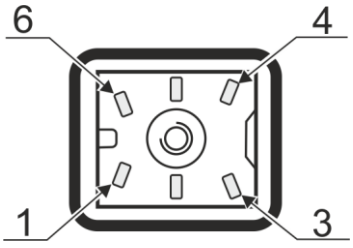
Pin	Description
1	Relay 1 NO (normally open contact)(1)
2	Relay 1 NC (normally closed contact) (1)
3	Supply voltage 12-30 VDC
4	Supply voltage – (return)
5	Analog voltage signal +
6	Relay 1 Common(1)
7	RS-232 Transmit / RS-485 (-)
8	Analog voltage signal – (return)
9	RS-232 Receive / RS-485 (+)

(1) Optional relay



6 Pin Hirschmann connector

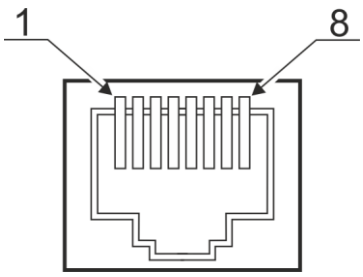
Pin	Description
1	Identification resistor (3K)
2	Analog voltage signal +
3	Analog voltage signal – (return)
4	Supply voltage 12-30 VDC
5	Supply voltage – (return)
6	Chassis



8 Pin RJ45 / 8P8C

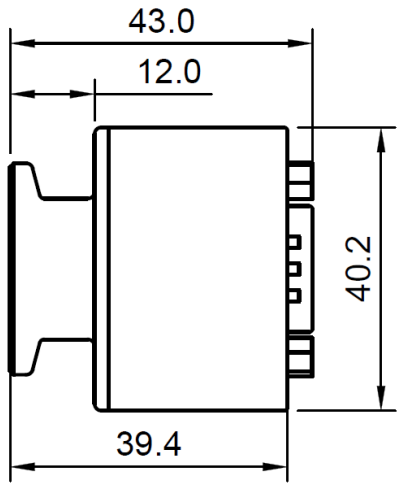
Pin	Description
1	Supply voltage 12-30 VDC
2	Supply voltage – (return)
3	Analog pressure voltage signal +
4	Identification resistor
5	Analog pressure voltage signal – (return)
6	Relay 2 NO (normally open contact)(1)
7	Relay 1 NO (normally open contact)(1)
8	Relay COMMON

(1) Optional relay



Dimensions

All dimensions in mm.



Order guide

VPM-5-	1	0	1	0	1	2	3	2

Vacuum flange		
DN16KF	1	0
DN25KF	2	0
NPT 1/8"	3	0
VCR4	4	0
DN16KF Extended	8	0
DN16KF with light baffle	1	1
DN16KF with heavy duty baffle	1	2
DN25KF with light baffle	2	1
DN25KF with heavy duty baffle	2	2

Connection	
1	9 Pin D-sub male
2	15 pin HD D-sub male
3	15 pin HD D-Sub male / dual analog out
4	6 pin Hirschmann, ID res 3K
5	6 pin Hirschmann, ID res 5.1K
6	6 pin Hirschmann, ID res 9.1K/11.1K
7	8 pin RJ45 / FCC68, ID Res 27K
8	8 pin RJ45 / FCC68, ID Res 36K
9	8 pin RJ45 / FCC68, ID Res 43K
A	8 pin RJ45 / FCC68, ID Res 71K5

Digital interface	
RS-232 / S4-Connect™	1
RS-485 / S4-Connect ™	2
S4-Connect™	3

Setpoints	
0	None
1	1x Solid-State Relay (Only 9 pin D-sub)
2	2x Solid State Relays (Only RJ45/FCC68)
3	3x Solid State Relays (Only 15 pin HD D-sub)

Analog Output		
0.5 - 9.5 (1 V/dec)	0	1
1.0-9 VDC 1 VDC/Dec (MKS 901P/925/910)	0	2
0.375 to 5.659 VDC (MKS GP275)	0	3
0.5V DC (MKS 523)	0	4
1.9-10 VDC (Inficon PSG55x, Leybold TTR91)	0	5
1.5-8.5 VDC (Pfeiffer TPR260/27x/28x)	0	6
1.9-9.1VDC (Edwards APG100XLC)	0	7
1.9-9.1VDC (Edwards APG100XM)	0	8
2-10VDC (Edwards APG-L)	0	9
0-10 VDC 0.1Torr FS Capacitance manometer	1	0
0-10 VDC 1 Torr FS Capacitance manometer	1	1
0-10 VDC 10 Torr FS Capacitance manometer	1	2
0-10 VDC 100 Torr Capacitance manometer	1	3
0-10 VDC 1000 Torr Capacitance manometer	1	4
2.0-8.6 VDC (MPG400/Pfeiffer PKR251, PKR261)	1	5
0.61-10.2 VDC (Leybold TTR101N)	3	5
1.8-8.6 VDC (Pfeiffer PKR251)	3	6
0-10VDC 0.1 mbar FS Capacitance manometer	5	0
0-10VDC 1 mbar FS Capacitance manometer	5	1
0-10VDC 2 mbar FS Capacitance manometer	5	2
0-10VDC 5 mbar FS Capacitance manometer	5	3
0-10VDC 10 mbar FS Capacitance manometer	5	4
0-10VDC 20 mbar FS Capacitance manometer	5	5
0-10VDC 50 mbar FS Capacitance manometer	5	6
0-10VDC 100 mbar FS Capacitance manometer	5	7
0-10VDC 200 mbar FS Capacitance manometer	5	8
0-10VDC 500 mbar FS Capacitance manometer	6	9
0-10VDC 1100 mbar Capacitance manometer	6	0
0-10VDC 1000 mbar Capacitance manometer	6	1

Unit	
1	torr
2	mbar
3	Pascal

Accessories

Part number	Description
CAL-VPM5-DAKKS	Accredited calibration certificate from DAkkS lab.

S4-Connect™ USB programmer

Part number	Description
PRG-S4-RJ45-01	S4-Connect programmer USB, 8p FCC68/RJ45
PRG-S4-HM-01	S4-Connect programmer USB, 6p Hirschmann

RS232 / RS485 with wall plug power supply

USB-to-Serial converter for VPM-5 SmartPirani transducers with wall plug power supply.

Part number	Description
PRG-WPRS2-15DS-01	RS-232 to USB, 15 pin HD D-sub, Power supply (90-230VAC)
PRG-WPRS4-15DS-01	RS-485 to USB, 15 pin HD D-sub, Power supply (90-230VAC)
PRG-WPRS2-9DS-01	RS-232 to USB, 9 pin D-sub, Power supply (90-230VAC)
PRG-WPRS4-9DS-01	RS-485 communicator USB, 9 pin D-sub, Power supply (90-230VAC)

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™

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