Datasheet

VPM-7 SmartPirani™ ATM

Vacuum transducer for load-lock control

1×10^{-6} to 1,333 mbar / 7.5×10^{-7} to 1,000 Torr

Ultra-wide range pirani / piezo transducer with atmospheric switch function

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

Advantages

- Ultra-wide measuring range of 9 decades
- Precision atmospheric switch function
- Reliable solid-state relays for control
- Barometric pressure measurement
- 0-10 VDC program-mable voltage output
- Digital RS-232 or RS-485 interface
- StableZero™ drift compensation
- Drop-in replacement for MKS 901P
- Vacuum temperature sensor for diagnostics
- RGB LED color pressure indicator

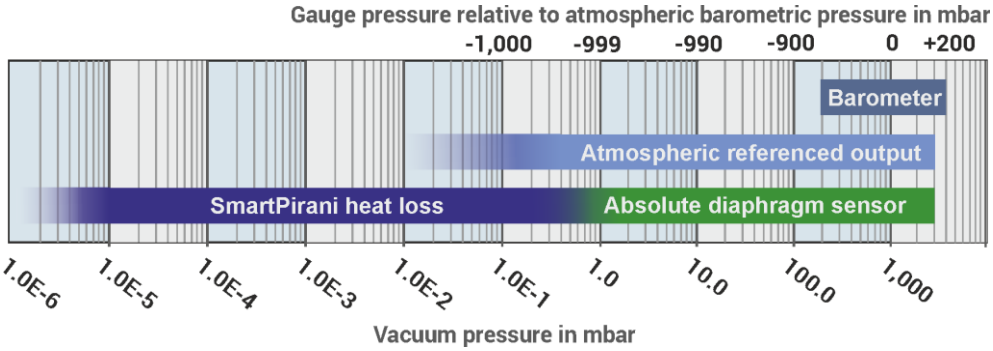
Applications

- Load-lock control
- High cycle load-locks
- Analytical instruments
- Furnace heat treatment
- PVD coating of glass, optics, tools etc.
- Refrigeration service and manufacturing
- Semiconductor processing

The VPM-7 SmartPirani™ ATM transducer is designed for semiconductor load-lock precision pressure control and other vacuum applications where accurate pressure measurement relative to atmospheric ambient pressure is important. It offers best-in-class performance with wider measurement range, higher accuracy, faster measurement cycle than legacy load-lock transducers and other load-lock sensor solutions.
It is based on a patent pending technology that has established new standards by extending the useable measuring range for thermal conductivity Pirani heat-loss vacuum gauges by 1-3 decades.

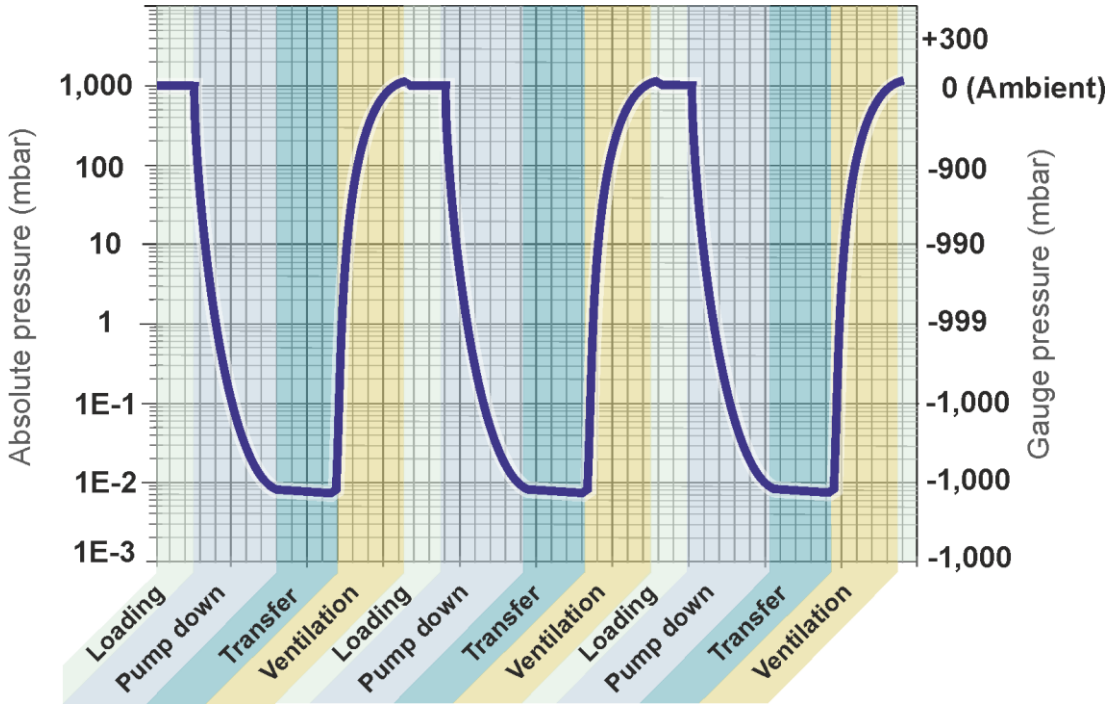
All-in-one multi-sensor transducer solution

The VPM-7 is a true multi-sensor transducer with four pressure outputs combining a barometric ambient sensor, a wide-range heat-loss Pirani, an absolute diaphragm sensor and a signal relative to atmospheric pressure to optimize pressure control of a modern load-lock vacuum chamber. The diaphragm sensor reading is gas independent from 2 to 1,333 mbar absolute.



sales@sens4.com
www.sens4.com
+45 8844 7044

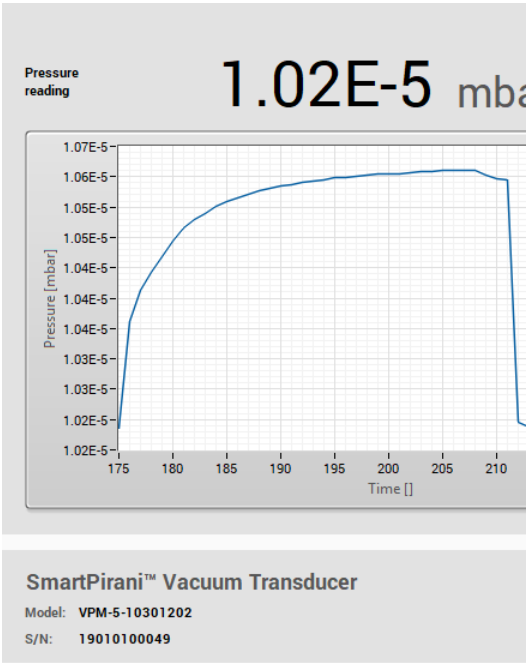
A Load-lock is a vacuum chamber used for loading devices like semiconductor wafers from the ambient air pressure to the vacuum processing chamber. The Load-lock is typically cycled between atmospheric barometric ambient pressure and an adequate vacuum pressure required to transfer the wafers to the processing vacuum chamber. Accurate control of pressure in the load-lock vacuum chamber is critically important to prevent ambient air and particulate contamination of the load-lock and wafers.



Programmable settings and parameters

The transducer settings and parameters can be user-programmed to control vacuum system and application parameters.

The digital serial 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 serial USB programmer in combination with the free, intuitive configuration software is a plug-and-play solution for transducer programming, real-time measurements and diagnostics.



Reliable and robust pressure control

For optimized Load-lock performance several pressure parameters need to be accurately and reliably controlled. The SmartPirani™ ATM transducer has three independent solid-state switch relays that can be configured to control venting, the transfer chamber gate-valve and the load-lock door.

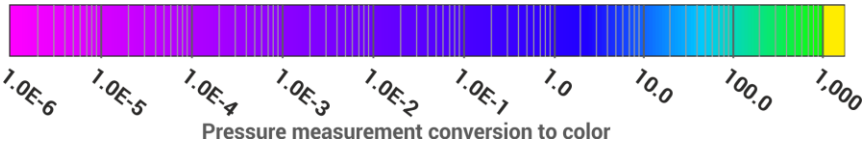
Compared to traditional electro-mechanical relays, the solid-state relays offer superior reliability and faster switching time while providing arc free contacts and generating no EMI (electromagnetic interference) when switching contacts. The SmartPirani™ ATM control relays are designed to last and are 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. An optional secondary analog output enables external monitoring of both the full-range vacuum pressure and the pressure signal relative to atmospheric pressure.

RGB LED for pressure indication

The SmartPirani™ ATM introduces a new approach for visually determining the measured pressure by a multi-color LED that smoothly changes color throughout the pressure range. This selectable visual function is a low-cost alternative to integrated displays and provides a rough indication of the measured pressure. It also provides a clear visual warning if the vacuum system is pressurized above ambient pressure.



Pressure measurement conversion to color

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™ ATM transducer is designed for pressure measurement and control in vacuum applications that requires wide range measurement from atmosphere to high vacuum in combination with accurate control of gas backfill of the vacuum system to atmospheric pressure.
The multi-sensor design eliminates the need for separate atmospheric switches to the control safe venting of the vacuum chamber to atmospheric pressure.

Analytical equipment

In analytical equipment, like mass spectrometers and scanning electron microscopes, samples are transferred from the ambient atmospheric pressure to the vacuum system chamber for analysis.
The ultra-wide range of the SmartPirani™ ATM eliminates the need for additional expensive high vacuum ionization gauges to determine safe operation of an equipment ion source.

Semiconductor load-lock

The SmartPirani™ ATM combines wide range vacuum pressure measurement and pressure measurement relative to atmospheric pressure required to operate a modern load-lock in semiconductor process equipment.

Move to the next-generation transducer for load-lock control

The SmartPirani™ ATM transducer offers plug-and-play compatibility with vacuum transducers and transmitters from other vendors.
The SmartPirani™ ATM transducer is available with pin compatibility, analog voltage pressure signal emulation and digital protocol emulation. The emulation features make quick, seamless retrofitting and upgrading of traditional wire Pirani transducers, convection gauges and legacy MEMS micro-Pirani transducers possible and allows moving to next-generation vacuum transducers without change of cabling and system equipment software.
The SmartPirani™ ATM transducer will in many applications provide both cost reduction and enhanced measurement performance when replacing legacy vacuum gauges and load-lock transducers.

Technical data

Specifications	
Measuring range	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 9.99 mbar	5% of reading
Accuracy 10.0 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%
Barometric measurement range	300 to1200 mbar
Barometric accuracy	+/- 0.5 mbar
Atmospheric referenced pressure output range	-1,333 to + 1,333 mbar
Vacuum temperature sensor range	-20 to + 85°C
Vacuum temperature sensor accuracy	+/- 1.5 °C
Transducer temperature sensor range	-20 to + 85°C
Transducer temperature sensor accuracy	+/- 1.5 °C
Analog output resolution	16 bit (150 µV)
Analog output update rate	124 Hz
Response time	<20 ms
Temperature compensation	+10 to +50 °C
Solid state relay set point range (absolute)	5×10^{-6} to 1,333 mbar (3.75×10^{-6} to 1000 Torr)
Solid state relay set point range (atm. relative)	-1,100 to + 500 mbar (-770 to +375 Torr)
Solid state relay contact rating	50 V, 100 mA_{rms} / mA_{DC}
Solid state relay contact endurance	Unlimited (no mechanical wear)
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	350 mW (max)
Reverse polarity protection	Yes
Overvoltage protection	Yes
Internal fuse	100 mA (thermal recoverable)

Specifications are subject to change without further notice

Technical data

Materials	
Enclosure	SS 1.4307 / AISI 304L / Aluminum 6061
Vacuum Process flange (media wetted)	SS 1.4307 / AISI 304L
Vacuum exposed materials (media wetted)	304 Stainless steel, Kovar, glass, silicon, nickel, aluminum, SiO_2, Si_3N_4, gold, Viton®, low out-gassing epoxy resin, solder, RO4305
Process leak tightness (ISO 27895:2009)	$<1 \cdot 10^{-9}$ mbar·l/s
Approvals	
CE	EMC directive 2014/30/EU
RoHS compliance	Directive EU 2015/863

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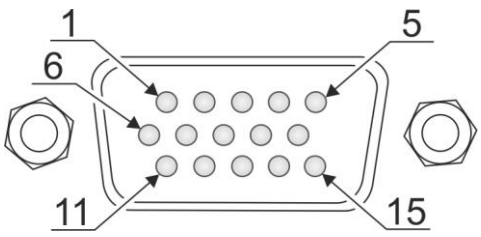
Connector Pin outs

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

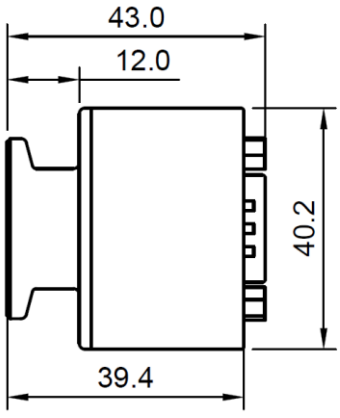
Pin	Description
1	RS-232 Transmit / RS-485 (-)
2	RS-232 Receive / RS-485 (+)
3	Supply voltage 12-30 VDC
4	Supply voltage – (return)
5	Analog voltage signal +
6	Analog voltage signal – (return)
7	Relay 1 NO (normally open contact) (1)
8	Relay 1 Common (1)
9	Relay 1 NC (normally closed contact) (1)
10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

(1) Optional relay



Dimensions (DN16KF flange)

All dimensions in mm.



Order guide

VPM-7-	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

Connection

2	15 pin HD D-sub male
3	15 pin HD D-Sub male / dual analog out

Setpoints

0	None
1	1x Solid State Relay
2	2x Solid State Relays
3	3x Solid State Relays

Digital interface

RS232 / S4-Connect™	1
RS485 / S4-Connect ™	2

Unit

1	torr
2	mbar
3	Pascal

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
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

Other analog outputs are availeble on request

Accessories

Programming device	
S4-Connect™ programmer USB, 15 pin D-sub connector	PRG-S4-15DS-01
S4-Connect™ programmer USB, 15 pin D-sub connector	PRG-S4-15DS-01
RS-232 USB programmer, 1.5 m cable	PRG-RS232-DS15 RS-232
RS-485 USB programmer, 1.5 m cable	PRG-RS485-DS15 RS-485
Calibration certificate	
Accredited calibration certificate from DAkkS lab.	CAL-VPM7-DAKSS

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™

Sens4 A/S | Ndr. Strandvej 119G | 3150 Hellebaek | Denmark

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sales@sens4.com www.sens4.com +45 8844 7044