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**
- **Pin and output compatibility with other vendors' gauges**

Typical applications

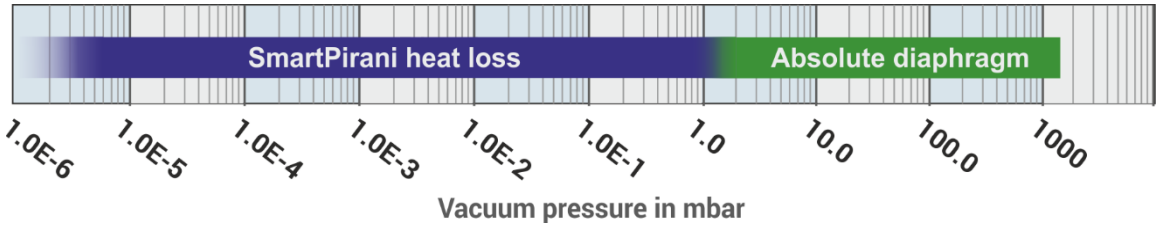
- **Analytical instrumentation**
- **Semiconductor processing**
- **Vacuum furnaces**
- **Thin film coating**
- **Medical instrumentation**
- **Space simulation and flight**

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. The 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.

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.

With the protective coating options, the new SmartPirani™ transducers are well-suited for tough vacuum environments.

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

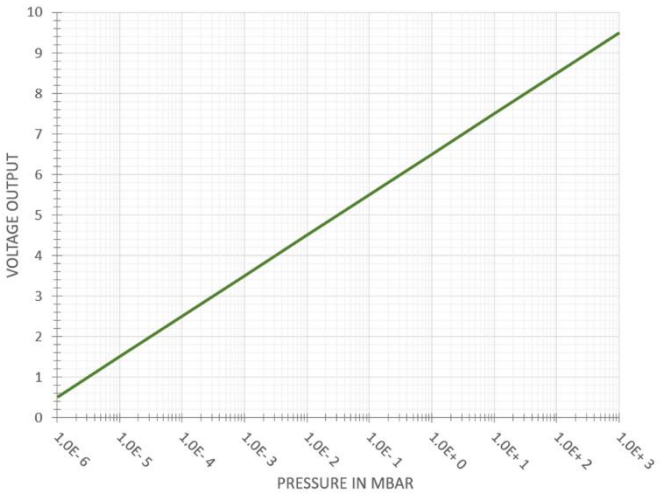
In some vacuum processes, particulates can damage vacuum gauges, and for these applications, the SmartPirani™ transducers are offered with a protective baffle that acts as a barrier against macroscopic particles.

With the protective coating options, the new SmartPirani™ transducers are well-suited for tough vacuum environments.

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_3N_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_2O_3)
Process leak tightness	$<1\cdot10^{-9}$ 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

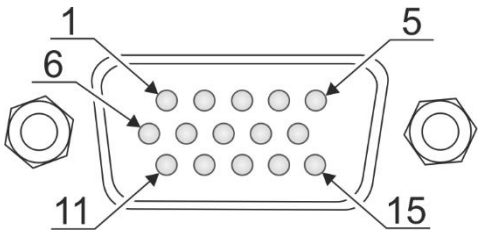
Specifications are subject to change without further notice.

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)

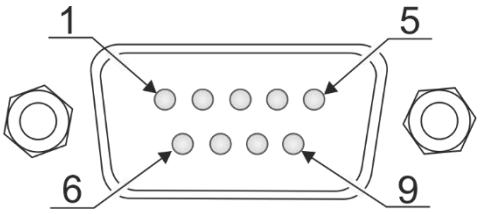
(4) Optional relay
(5) Optional secondary analog voltage output



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

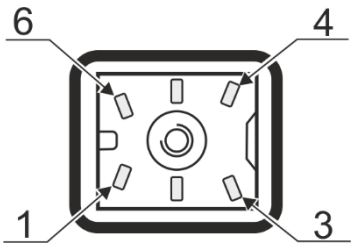
Pin	Description
1	Relay 1 NO (normally open contact) (6)
2	Relay 1 NC (normally closed contact) (6)
3	Supply voltage 12-30 VDC
4	Supply voltage – (return)
5	Analog voltage signal +
6	Relay 1 Common (6)
7	RS-232 Transmit / RS-485 (-)
8	Analog voltage signal – (return)
9	RS-232 Receive / RS-485 (+)

(6) Optional relay



6 Pin Hirschmann connector

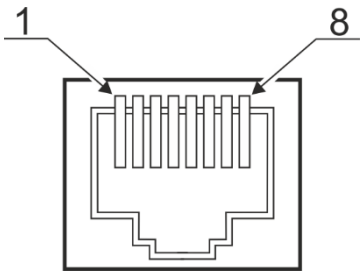
Pin	Description
1	Identification resistor (3K)
2	Analog voltage signal +
3	Analog voltage signal – (return)
4	Supply voltage 12-30 VDC
5	Supply voltage – (return)
6	Chassis



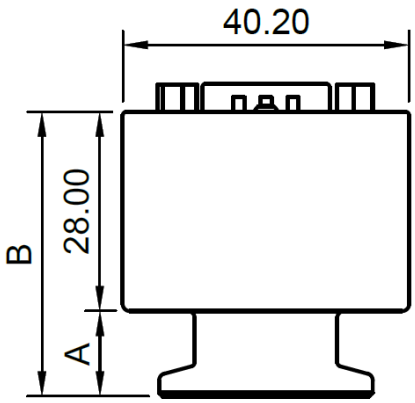
8 Pin RJ45 / 8P8C

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 flange / D-SUB Connector


DN25KF flange / D-SUB Connector


VCR4F flange / D-SUB Connector


VCR8F flange / D-SUB Connector


1/8" NPT flange / D-SUB Connector


DN16CF flange / D-SUB Connector


DN16KF Extended flange / D-SUB Connector


DN16KF flange / FCC68 Connector


DN16KF Extended flange / FCC68 Connector


VCR4F flange / FCC68 Connector


DN16KF flange / Hirschmann Connector


DN16KF flange / Hirschmann Connector

Order Guide

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

Vacuum flange / sensor protection

DN16KF	1	0
DN25KF	2	0
NPT 1/8"	3	0
VCR4 female	4	0
VCR8 female	5	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
DN16KF, Ceramic protected sensors	1	3
DN25KF, Ceramic protected sensors	2	3
NPT 1/8", Ceramic protected sensors	3	3
VCR4 female, Ceramic protected sensors	4	3
VCR8 female, Ceramic protected sensors	5	3
DN16CF rotateble, Ceramic	6	3
DN16KF Extended, Ceramic	8	3
DN16KF with light baffle, Ceramic	1	4
DN16KF with heavy duty baffle, Ceramic	1	5
DN25KF with light baffle, Ceramic	2	4
DN25KF with heavy duty baffle, Ceramic	2	5
DN16KF, Parylene protected sensors	1	6
DN25KF, Parylene protected sensors	2	6
NPT 1/8", Parylene protected sensors	3	6
VCR4 female, Parylene protected sensors	4	6
VCR8 female, Parylene protected sensors	5	6
DN16CF rotateble Parylene protected sensors	6	6
DN16KF Extended, Parylene protected sensors	8	6
DN16KF with light baffle, Parylene	1	7
DN16KF with heavy duty baffle, Parylene	1	8
DN25KF with light baffle, Parylene	2	7
DN25KF with heavy duty baffle, Parylene	2	8

Digital interface

RS-232 / S4-Connect™ (9 and 15 pin D-sub)	1
RS-485 / S4-Connect™ (9 and 15 pin D-sub)	2
S4-Connect™ (RJ45/FCC68 and Hirschmann)	3

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

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
B	8 pin RJ45 / FCC68, ID Res 85K

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)

Unit

1	torr
2	mbar
3	Pascal

Online Order & RFQ

Our popular VPM-5 configurations are readily available in our online store for quick and hassle-free ordering.

Visit our online product configurator for request for quote for the comprehensive VPM-5 product offering.

➢ Go to VPM-5 Product Page

Accessories

RS232 / RS485 to USB converter 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)

Customer Service contact

Email: sales@sens4.com

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**

Connect on social media

VPM-5 Datasheet – REV1.2 Novermber 2024

Contact

Sens4 A/S
Nordre Strandvej 119G
3150 Hellebaek
Denmark

Phone: +45 88447044
Email: info@sens4.com