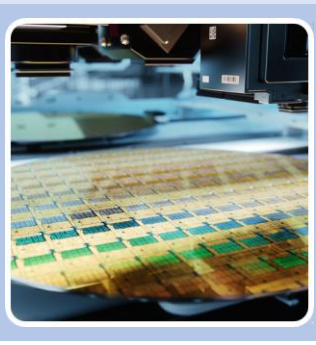
VDM-2 Ceramic Diaphragm Vacuum Transducer

Piezo sensor diaphragm gauge with 0.1 to 1333 mbar measuring range.

Benefits & features

- **Measuring range of 4 decades from 1.0E-1 to 1333 mbar**
- **Cost attractive alternative to traditional 1000 Torr full-scale CDGs**
- **Gas-independent measurement throughout the pressure range**
- **Corrosion resistant Ceramic or Parylene diaphragm**
- **0-10 VDC programmable voltage output**
- **Digital RS-232 or RS-485 interface**
- **Optional solid-state setpoint relays for external controlling**
- **Drop-in replacement with other vendors' vacuum gauges**



Typical applications

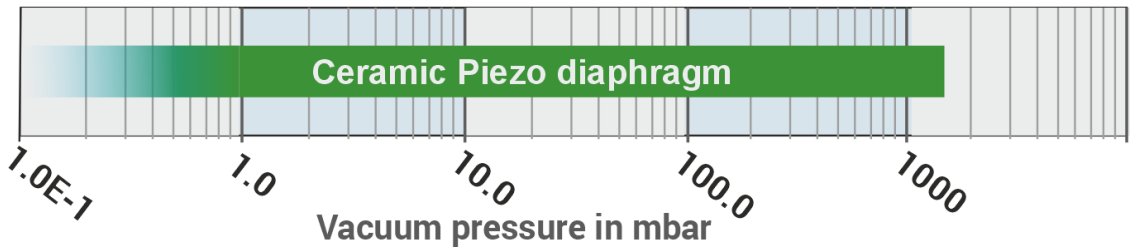
- **Semiconductor Processing**
- **PVD Coating**
- **CVD Processing**
- **Medical Device Sterilization**
- **Short Path Distillation**
- **Vacuum Furnaces**
- **Freeze drying**

Product datasheet

SENS4

Ceramic Diaphragm sensor technology

The VDM-2 Ceramic Diaphragm vacuum transducer is based on a corrosion resistant aluminum oxide diaphragm that bends as function of the applied pressure. The core pressure sensor element utilizes piezo resistive measurement. The diaphragm sensor measures the vacuum gas pressure independently of gas type or composition.



Compared to stainless steel Piezo vacuum transducers that typically use oil-filled sensor elements, the Ceramic Piezo sensor element is clean and dry, eliminating the risk of contaminating the vacuum system.

Alternative to Capacitance Diaphragm Gauges

Capacitance diaphragm gauges are used in many vacuum applications for measurement and control of advanced processes. The VDM-2 transducer is a cost-effective and compact alternative to traditional 1000 Torr/mbar full-scale Capacitance Diaphragm Gauges (CDGs).

Enabling use in harsh environments

The VDM-2 enables use in demanding vacuum applications where corrosive gases and chemical compounds may be present. The Ceramic aluminum oxide diaphragm offers excellent corrosion resistant properties against many solvents and acids.

The VDM-2 transducer is also available with an optional Parylene protective barrier to guard against corrosion or oxidation of sensor materials. Parylene, a unique polymer with highly corrosion resistant and hydrophobic properties, is specifically designed for medical applications such as lyophilization and hydroperoxide plasma sterilization of medical devices.

In vacuum systems and processes where macroscopic particulates are present, the optional protective baffle acts as an efficient barrier against deposition of contaminants on the sensor diaphragm.

The aluminum oxide sensor element is designed to be robust, capable of withstanding instant ventilation and over-pressurization up to 2 bar absolute (29 psia).

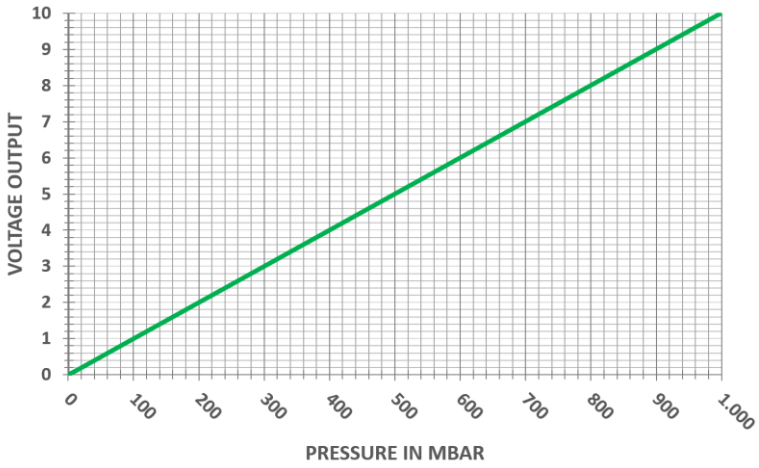
Other vendor compatibility

The drop-in replacement vacuum transducers are designed with connector pin-out compatibility, enabling seamless replacement of other vendor gauges without change of cabling.
Additionally, these transducers emulate the analog output scaling and range of equivalent products from other manufacturers.
Moreover, Sens4 transducers have the capability to emulate the digital serial communication protocol, facilitating easy installation without requiring adjustments to the communication software of the vacuum equipment. This digital protocol emulation ensures compatibility with power supply and controller display units from different vendors.

Measure and control of advanced vacuum processes

The VDM-2 transducer features multiple output options that offer more than just a pressure measurement signal.

Analog voltage output
The analog output provides a voltage signal for external pressure readout or controls.
The VDM-2 transducer is available with many different preconfigured analog output curves for seamless replacement of gauges from various vendors.
Furthermore, the output can be configured by the user for arbitrary linear scaling.



Digital interface

The RS-232 and RS-485 serial interfaces facilitate the transfer of measurement data with no signal degradation over extended cable lengths or interference from electrical noise.
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.
When the analog output is set to a reduced measuring range, such as 100 Torr full scale, the digital output independently provides full range measurements up to 1333 mbar (1000 Torr).

Reliable and robust setpoint relay control

The three independent solid-state switch relays serve to control pumps, valves, safety interlock circuits, and other equipment. Their primary control functionality includes on/off regulation, featuring a programmable setpoint and hysteresis value.

Setpoint values can be programmed independently of analog output full scale range.

Compared to electro-mechanical relays, solid-state relays provide greater reliability and faster switching times. They feature arc-free contacts and generate no electromagnetic interference (EMI) during contact switching. The VDM-2 optional relays are designed for durability and are UL listed, CSA recognized, and EN/IEC 60950-1 certified. This ensures maximum confidence when using them to monitor critical vacuum processes.

Typical applications

The VDM-2 transducer offers an excellent price/performance ratio and can be used for surveillance and measurement of fore-line vacuum pressure in many industrial and scientific applications.

Semiconductor Industry

The VDM-2 transducer can substitute unheated 1000 Torr Capacitance Diaphragm Gauges and thereby provide a cost-effective solution for measurement and control of fore-line pressure in semiconductor equipment.

The corrosive resistant ceramic sensor enables use where residuals of corrosive process gases can be present. Additionally, the baffle barrier can provide protection against macroscopic particles.

Short Path Distillation

Short Path Distillation is a vacuum assisted process where a low temperature boiling point is obtained to prevent degradation or decomposition of heat-sensitive compounds during distillation process.

The VDM-2 measuring range covers the typical process pressure during short path distillation. The optional corrosive resistant coating of either Parylene or Ceramic provides compatibility with a variety of vapors and compounds.

Short path distillation is widely used in industries such as pharmaceuticals, food, and beverage.

Hydrogen Peroxide Plasma Sterilization

Hydrogen peroxide plasma sterilization is widely used in the medical field to sterilize medical equipment and devices. The low temperature method uses vacuum pressure to form hydrogen peroxide vapor, wich in combination with gas plasma, kills microorganisms on device surfaces.

The optional conformal Parylene sensor coating offers compatibility and longevity in the harsh environment present during Hydrogen Peroxide Plasma Sterilization processes.

Technical data

Specifications	
Measuring range in mbar	0.1 to 1333 mbar (0.1 to 1000 Torr)
Measuring principle	Ceramic diaphragm piezo resistive
Accuracy 100 to 1333 mbar	0.5% of reading
Accuracy 1 to 99.9 mbar	0.05% of full scale (1333 mbar)
Hysteresis 1×10^{-1} to 10 mbar (ISO19685:2017)	1% of reading
Hysteresis 10 to 1200 mbar (ISO19685:2017)	0.1% of reading
Analog output resolution	16 bit (150 µV)
Analog output update rate	560 Hz
Response time (ISO 19685:2017)	<20 ms
Temperature compensation	+10 to +50 °C
Solid state relay set point range	1 to 1333 mbar (0.75 to 1000 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 +80 °C
Bake-out temperature (non-operating)	+80 °C
Maximum media pressure(3)	2 bar absolute (29 psia)
Burst pressure(4)	4 bar absolute (58 psia)
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, Viton®, Aluminum oxide (Al_2O_3 96%)
Vacuum exposed materials (media wetted) Parylene protected version	316 Stainless steel, Viton®, Parylene
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) Viton® is a trademark of THE CHEMOURS COMPANY FC, LLC
(3) Overpressure limit is the maximum allowed pressure without irrevocable damage to the sensor element.
(4) Burst pressure is the maximum pressure without rupture of sensor diaphragm.

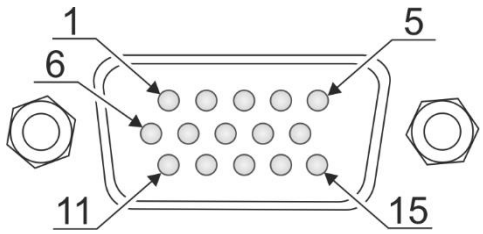
Specifications are subject to change without further notice.

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)

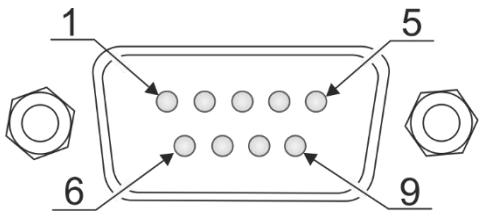
(1) Optional relay
(2) Optional secondary analog voltage output



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

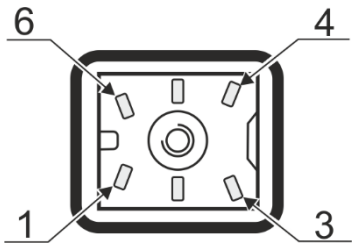
Pin	Description
1	Relay 1 NO (normally open contact) (6)
2	Relay 1 NC (normally closed contact) (6)
3	Supply voltage 12-30 VDC
4	Supply voltage – (return)
5	Analog voltage signal +
6	Relay 1 Common (6)
7	RS-232 Transmit / RS-485 (-)
8	Analog voltage signal – (return)
9	RS-232 Receive / RS-485 (+)

(3) Optional relay



6 Pin Hirschmann connector

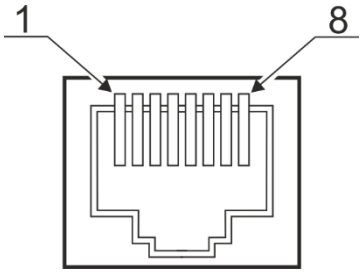
Pin	Description
1	Identification resistor (13K9)
2	Analog voltage signal +
3	Analog voltage signal – (return)
4	Supply voltage 12-30 VDC
5	Supply voltage – (return)
6	Chassis



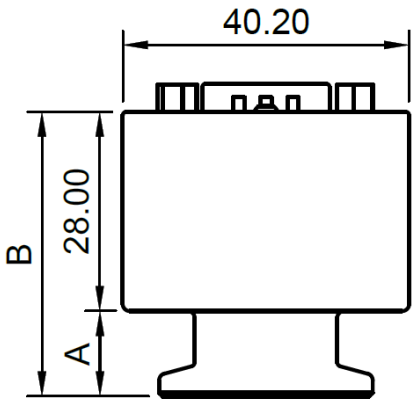
8 Pin RJ45 / 8P8C

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)

(4) 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

VDM-2-	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
DN16CF rotatable	6	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, 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 rotatable Parylene protected sensors	6	6
DN16KF Extended, Parylene protected sensors	8	6
DN16KF with light baffle, Parylene	1	7
DN25KF with light baffle, Parylene	2	7

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 (Sens4 VPM-5,7,15,17..)	0	1
1.0-9 VDC 1 VDC/Dec (MKS 901P/925/910)	0	2
0-10 VDC 100 Torr linear Capacitance manometer	1	3
0-10 VDC 1000 Torr linear (MKS 902B)	1	4
0-10 VDC 500 Torr FS linear	3	7
0-10 VDC 200 Torr FS linear	3	8
1-9.8 VDC (Pfeiffer APR 250, 260... 1000 mbar)	3	9
1-9.8 VDC (Pfeiffer APR 250, 260... 2000 mbar)	4	0
0-5V VDC 1000 Torr FS linear (MKS 902B)	4	2
0-5V VDC 10 Torr FS linear	4	3
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	5	9
0-10VDC 1000 mbar Capacitance manometer	6	0
0-10VDC 1100 mbar Capacitance manometer	6	1

Unit

1	torr
2	mbar
3	Pascal

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)

Connection

1	9 Pin D-sub male
2	15 pin HD D-sub male
3	15 pin HD D-Sub male / dual analog out
7	8 pin RJ45 / FCC68, ID Res 27K
8	8 pin RJ45 / FCC68, ID Res 36K
D	6 pin Hirschmann, ID res 13K9

Accessories

RS-232 / RS-485 to USB converter 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)

TVC-3 TrueVac™ Controller

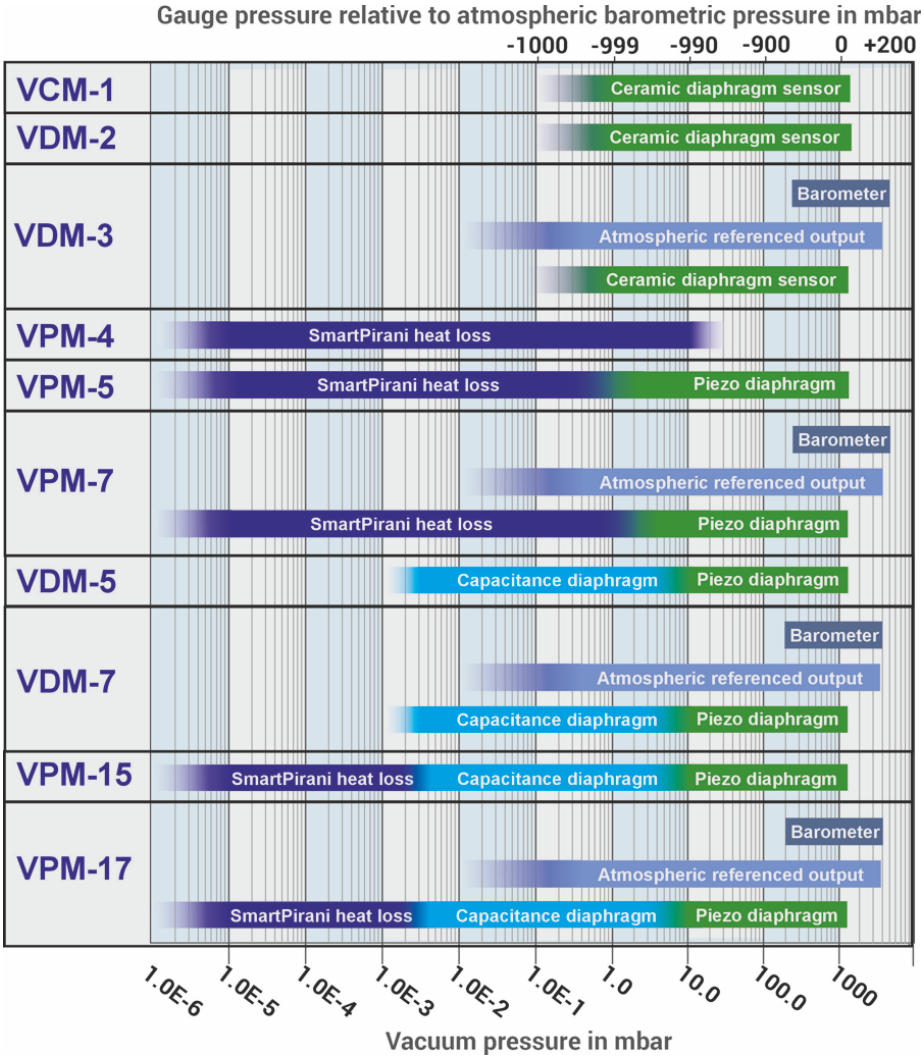
Part number	Description
TVC-3-3102	TVC-3 TrueVac Controller, 3ch, 90-230VAC
CBL-TVC3-9DS-03	Cable TVC-1 to 9 pin D-sub, 3 meter
CBL-TVC3-15HDS-03	Cable TVC-1 to 15 HD pin D-sub, 3 meter
CBL-TVC3-RJ45-03	Cable TVC-1 to RJ45, 3 meter

TVC-1 TrueVac™ Handheld Display

Part number	Description
TVC-1-01	TrueVac display unit
CBL-TVC1-9DS-02	Cable TVC-1 to 9 pin D-sub, 2 meter
CBL-TVC1-9DS-03	Cable TVC-1 to 9 pin D-sub, 3 meter
CBL-TVC1-15HDS-02	Cable TVC-1 to 15 HD pin D-sub, 2 meter
CBL-TVC1-15HDS-03	Cable TVC-1 to 15 HD pin D-sub, 3 meter
CBL-TVC1-RJ45-02	Cable TVC-1 to RJ45, 2 meter
CBL-TVC1-RJ45-03	Cable TVC-1 to RJ45, 3 meter

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.



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. It's our mission 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

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