

Vacuum - Measuring, Controlling

Vacuum Gauges

Calibration Service

VACVISION

Vacuum Controller

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Contents

Vacuum - measuring, controlling

General

Applications for Vacuum Gauges	5
Select the Combination of Sensor and Gauges which is ideal for your Application	6
Basic Terms of Vacuum Metrology	10
Connection Accessories for Small Flanges	12

Products

Mechanical Gauges (Vacuum Gauges Analog Readout)

Bourdon Vacuum Gauges.	13
Capsule Vacuum Gauges	14
Diaphragm Vacuum Gauge DIAVAC DV 1000	16

Handheld Measurement Instruments

PIEZOVAC Sensor PV 101 / THERMOVAC Sensor TM 101	18
--	----

Active Sensors / Transmitters

CERAVAC Transmitters CTR 100 N and CTR 101 N	20
THERMOVAC Transmitters TTR 91 N (S), TTR 96 N, TTR 911 N (C), TTR 916 N	24
THERMOVAC Transmitters TTR 101 N (S)	30
PENNINGVAC Transmitters PTR 90 N	34
PENNINGVAC Transmitters PTR 225 N, PTR 237 N	38
Loadlock Transmitter TTR 200 N, PTR 200 N.	42
IONIVAC Transmitter ITR 90.	46
IONIVAC Transmitter ITR 200 S	50
Spiral Tube	54

Connection Cables for Active Sensors	56
---	-----------

Operating Units for Active Sensors

DISPLAY ONE	58
DISPLAY TWO, THREE	60

Controller for Active Sensors

GRAPHIX ONE, TWO, THREE	62
-----------------------------------	----

Ultra High Vacuum Operating Units and Passive Sensors

COMBIVAC CM 51, CM 52	64
THERMOVAC Sensors TR 211, TR 211 NPT, TR 212, TR 216	68
PENNINGVAC Sensors PR 25 to PR 28	70
IONIVAC IM 540	72
IONIVAC Sensors IE 414 and IE 514	76

Additional Sensors

Linear Pressure Sensors DI/DU 200, DI/DU 201, DI/DU 2000, DI/DU 2001, DI/DU 2001 rel.	78
Older Sensors / Replacement Sensors	82

Pressure Switches and Control Instruments

Pressure Control System Move 84
Low Pressure Safety Switch PS 113 A 92
Pressure Switches PS 115 94
Switching Amplifier SV 110 96
Diaphragm Pressure Regulators MR 16 and MR 50. 98

Miscellaneous

Leybold Calibration Service 100

VACVISION

Applications. 102

Products

Vacuum Controller **VACVISION** 104
Accessories for Vacuum Controller **VACVISION**. 106

Applications for Vacuum Gauges

Gauges	Gauges												
	BOURDONVAC A	BOURDONVAC C	Capsule Vacuum Gauge	DI/VAC DV 1000	Handheld Measuring Instruments	CERNAV Transmitter CTR	Linear Pressure Sensors DI/DU	THERMOVAC Transmitter TTR	PENNINGVAC Transmitter PTR	IONIVAC Transmitter ITR	Low Pressure Switch PS 115	Pressure Switch PS 113 A	Diaphragm Pressure Regulators MR 16/50
Mechanical engineering													
Automotive industry; filling of brake and air conditioning systems					■	■	■	■					
Vacuum conveying technology	■	■	■	■		■							■
Packaging technology			■	■		■						■	
Isolation vacuum	■		■	■	■	■	■				■		
Chemical processes													
Absolute pressure measurements in gas mixtures	■	■	■	■		■	■						
Drying and degassing processes		■		■		■							■
Solvent recovery				■			■						■
Vacuum pressure control in existing central vacuum supply systems							■						■
Electrics/electronics/optics													
Evaporation and coating systems					■		■	■	■				
Monitoring and controlling of sputter systems							■	■	■				
Semiconductor technology (CVD, plasma etching etc.)					■		■			■			
Ion implantation					■		■	■					
Lamp production			■		■	■	■	■					
Analytical instruments and surface physics													
ESCA, SIMS, AES, XPS							■	■	■	■			
Electron microscopy							■	■	■	■			
Crystal growing								■	■	■			
Gas analysis systems, mass spectrometers							■	■	■	■			
Research													
Measurement of ultimate pressure in UHV systems										■			
Application in MBE systems								■	■	■			
Application in MBE systems										■			
Beam guidance systems, cyclotron								■		■			
Fusion experiments										■			
Space simulation chamber							■	■	■	■			
System control/pressure control													
Pressure checks on backing pumps and vacuum systems							■					■	
Safety circuits in vacuum systems, protection of vacuum gate valves							■		■		■	■	
Control of ionization vacuum gauges							■						
Pressure measurements on HV pump systems, e.g. diffusion, TMP, cryopump systems							■	■	■	■			
Venting systems											■	■	
Valve control, pressure dependant systems control							■	■	■	■	■	■	
Simple pressure control arrangements				■		■		■				■	■
Calibration													
Calibration of vacuum gauges and mass spectrometers				■						■			
Reference instruments for the determination of the physical properties of gases				■									
Precision measurements of low pressures also, in the presence of corrosive or reactive gases,				■									
Miscellaneous													
Vacuum annealing, melting, soldering and hardening furnaces				■			■	■	■				
Cooling and air conditioning technology				■	■	■	■						
Electron beam welding				■			■	■	■				
Metallurgy							■	■	■				

Select the Combination of Sensor and

Operating Ranges for Active Sensors

	mbar	10 ⁻¹²	10 ⁻¹¹	10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²	10 ³
Capacitance Diaphragm																	
CERAVAC-Transmitters (x = 2, 3, 4 oder 5) ¹⁾																	
CTR 100 / 100 N (1000 Torr)													0,13				1330
CTR 100 / 100 N (100 Torr)												0,013					133
CTR 100 / 100 N (10 Torr)											0,0013					13	
CTR 100 / 100 N (1 Torr)									0,00013				1,3				
CTR 100 / 100 N (0,1 Torr)								0,000013				0,13					
CTR 101 / 101 N (1000 Torr)													0,13				1330
CTR 101 / 101 N (100 Torr)												0,013					133
CTR 101 / 101 N (10 Torr)											0,0013					13	
CTR 101 / 101 N (1 Torr)									0,00013				1,3				
CTR 101 / 101 N (0,1 Torr)									0,000013				0,13				
Thermal Conductivity (according to Pirani)																	
THERMOVAC-Transmitters ¹⁾																	
TTR 101 (Pirani combined with capacitance diaphragm)									5 · 10 ⁻⁵								1500
TTR 91 / 91 N									5 · 10 ⁻⁵								1000
TTR 96 S / 96 N S									5 · 10 ⁻⁵								1000
TTR 911 / 911 N									1 · 10 ⁻⁵								1000
TTR 911 CC / 911 N C S									5 · 10 ⁻⁵								1000
TTR 916 / 916 N									5 · 10 ⁻⁵								1000
Cold Cathode Ionization (according to Penning)																	
PENNINGVAC-Transmitters																	
PTR 90 / 90 N, DN 40 CF								1 · 10 ⁻⁸									1000
PTR 90 / 90 N, DN 40 ISO-KF								1 · 10 ⁻⁸									1000
PTR 90 / 90 N, DN 25 CF								1 · 10 ⁻⁸									1000
PTR 225 / 225 N, DN 25 ISO-KF								1 · 10 ⁻⁸				0,05					
PTR 237 / 237 N, DN 40 CF								1 · 10 ⁻⁸				0,05					
Hot Cathode Ionization																	
IONIVAC-Transmitters (Bayard-Alpert combined with Pirani) ¹⁾																	
ITR 90									5 · 10 ⁻¹⁰								1000
ITR 200 with and without display									5 · 10 ⁻¹⁰								1000
Linear Pressure Sensors ¹⁾																	
DI/DU 200 and 201														0,1			200
DI/DU 2000 and 2001																	
DI/DU 2001 rel.																-1000	+1000
Handheld Measurement Instruments																	
THERMOVAC Sensors																	
TM 101															1		+1000
Loadlock Transmitters																	
TTR 200 N, DN 16 ISO-KF																	
PTR 200 N, DN 16 ISO-KF																	
																	1500
																	1500

¹⁾ Different Part Numbers depend on the vacuum connection

Select the Combination of Sensor and

Operating Ranges for passive Sensors

	mbar	10 ⁻¹²	10 ⁻¹¹	10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²	10 ³
Thermal Conductivity (according to Pirani)																	
THERMOVAC Sensors ¹⁾																	
TR 211											0.0005						1000
TR 211 NPT											0.0005						1000
TR 212											0.0005						1000
TR 216											0.0005						1000
Cold Cathode Ionization (according to Penning)																	
PENNINGVAC Sensors																	
PR 25					1 x 10 ⁻⁹						0.01						
PR 26					1 x 10 ⁻⁹						0.01						
PR 27					1 x 10 ⁻⁹						0.01						
PR 28					1 x 10 ⁻⁹						0.01						
IONIVAC Sensors																	
IE 414 (Bayard-Alpert)																	0.01
IE 514 (Extractor)																	0.0001
	mbar	10 ⁻¹²	10 ⁻¹¹	10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²	10 ³

¹⁾ Differences of the sensors in the same operating range caused by the materials in contact with the medium

Gauges which is ideal for your Application

Operating Units for passive Sensors

	IONIVAC	COMBIVAC					
	IM 540	CM 51	CM 52				
Part No. EU / US	230 100	-	-				
Part No. RS 232 C	-	230 110	230 115				
Part No. Profibus	-	230 111	230 116				
		1, 2	1, 2				
		1, 2	1, 2				
		1, 2	1, 2				
		1, 2	1, 2				
		3					
		3					
		3					
		3					
	1, 2	3	3				
	1, 2	3	3				

1, 2, 3 indicate the channel to which the sensor may be connected

Basic Terms of Vacuum Metrology

Today, the total range of vacuum pressure accessible to measurement extends from atmospheric pressure (about 1000 mbar (750 Torr)) down to 10^{-12} mbar/Torr, i.e. it extends over 15 powers of ten. The instruments used for measuring the pressure within this wide range are called vacuum gauges. For physical reasons it is not possible to create a single vacuum sensor through which it might be possible to perform quantitative measurements within the entire pressure range. Therefore, a variety of different vacuum gauges are available, each with their own characteristic measurement range which commonly extends over several powers of ten. A difference is made between direct and indirect pressure measurements. In the case of direct (or absolute) pressure measurements, the readings obtained through the vacuum gauge are independent of the type of gas and the pressure which is to be measured. Common are so-called mechanical vacuum gauges where the pressure is determined directly by recording the force acting on the surface of a diaphragm. In the case of so-called indirect pressure measurements the pressure is determined as a function of a pressure dependant property of the gas (thermal conductivity, ionization probability, for example). These properties do not only depend on the pressure, but also on the molar mass of the gases. For this reason, the pressure readings obtained through vacuum gauges which rely on indirect pressure measurements, depend on the type of gas. The readings usually relate to air or nitrogen as the measurement gas. For the measurement of other vapors or gases the corresponding correction factors must be applied.

Vacuum Gauges where the Pressure Readings are Independent of the Type of Gas (Mechanical Vacuum Gauges)

BOURDON Vacuum Gauge

The inside of a tube which is bent into a circular arc (the so-called Bourdon tube) is connected to the vacuum system. Due to the effect of the external atmospheric pressure, the end of the tube bends more or less during the evacuation process. This actuates the pointer arrangement which is attached to this point. The corresponding pressure can be read off on a linear scale. With Bourdon gauges it is possible to roughly determine pressures between 10 mbar (7.5 Torr) and atmospheric pressure.

Capsule Vacuum Gauge

This vacuum gauge contains a hermetically sealed, evacuated, thinwalled diaphragm capsule which is located within the instrument. As the vacuum pressure reduces, the capsule bulges. This movement is transferred via a system of levers to a pointer and can then be read off as the pressure on a linear scale.

Diaphragm Vacuum Gauge

In the case of the diaphragm vacuum gauge which is capable of absolute pressure measurements, a sealed and evacuated vacuum chamber is separated by a diaphragm from the vacuum pressure to be measured. This serves as the reference quantity.

With increasing evacuation, the difference between the pressure which is to be measured and the pressure within the reference chamber becomes less, causing the diaphragm flex. This flexure may be transferred by mechanical means like a lever, for example, to a pointer and scale, or electrically by means of a strain gauge or a bending bar for conversion into an electrical measurement signal. The measurement range of such diaphragm vacuum gauges extends from 1 mbar (0.75 Torr) to over 2000 mbar (1500 Torr).

Capacitance Vacuum Gauge

The pressure sensitive diaphragm of these capacitive absolute pressure sensors is made of Al_2O_3 ceramics. The term "capacitive measurement" means that a plate capacitor is created by the diaphragm with a fixed electrode behind the diaphragm. When the distance between the two plates of this capacitor changes, a change in capacitance will result. This change, which is proportional to the pressure, is then converted into a corresponding electrical measurement signal. Here too, an evacuated reference chamber serves as the reference for the pressure measurements. With capacitance gauges it is possible to accurately measure pressures from 10^{-5} mbar/Torr to well above atmospheric pressure, whereby different capacitance gauges having diaphragms of different thickness (and therefore sensitivity) will have to be used.

Vacuum Gauges where the Pressure Readings depend of the Type of Gas

Thermal Conductivity Gauge (Pirani)

This measurement principle utilizes the thermal conductivity of gases for the purpose of pressure measurements in the range from 10^{-4} mbar/Torr to atmospheric pressure. Today, only the principle of the controlled Pirani gauge is used by Leybold in order to attain a quick response. The filament within the gauge head forms one arm of a Wheatstone bridge. The heating voltage which is applied to the bridge is controlled in such a way, that the filament resistance and thus the temperature of the filament remains constant regardless of the quantity of heat given off by the filament. Since the heat transfer from the filament to the gas increases with increasing pressures, the voltage across the bridge is a measure of the pressure.

Improvements with regard to temperature compensation have resulted in stable pressure readings also in the face of large temperature changes, in particular when measuring low pressures.

Cold Cathode Ionization Vacuum Gauge (Penning)

Here the pressure is measured through a gas discharge within a gauge head whereby the gas discharge is ignited by applying a high tension. The resulting ion current is output as a signal which is proportional to the prevailing pressure. The gas discharge is maintained also at low pressures with the aid of a magnet.

New concepts for the design of such sensors permit safe and reliable operation of these so-called Penning sensors in the pressure range from 10^{-2} to 1×10^{-9} mbar/Torr.

Cold Cathode Ionization Vacuum Gauge (Penning)

These sensors commonly use three electrodes. A hot cathode emits electrons which impinge on an anode. The gas, the pressure of which is to be measured, is thus ionized. The resulting positive ion current is detected through the third electrode - the so-called ion detector - and this current is used as the signal which is proportional to the pressure.

The hot cathode sensors which are mostly used today, are based on the Bayard-Alpert principle. With this electrode arrangement it is possible to make measurements in the pressure range from 10^{-10} to 10^{-2} mbar/Torr.

Other electrode arrangements permit access to a higher range of pressures from 10^{-1} mbar/Torr down to 10^{-10} mbar/Torr. For the measurement of pressures below 10^{-10} mbar/Torr so-called extractor ionization sensors after Redhead are employed. In extractor ionization gauges the created ions are focused onto a very thin and short ion detector. Due to the geometrical arrangement of this system, interfering influences such as X-ray effects and ion desorption can be almost completely eliminated. The extractor ionization gauge permits pressure measurements in the range from 10^{-4} to 10^{-12} mbar/Torr.

Selection of the right Vacuum Gauge

When selecting a suitable instrument for pressure measurements, the pressure range is not the only criteria. The operating conditions for the instrument play an important part. If, for example, there is the risk of excessive contamination, vibrations, or if air inrushes are to be expected etc., the instrument must be rugged enough. Thus for industrial applications diaphragm gauges, controlled thermal conductivity gauges as well as cold cathode ionization gauges after Penning are strongly recommended. Precision instruments are very often quite sensitive to rough operating conditions. These should therefore only be used while observing the corresponding applications information.

Connection Accessories for Small Flanges

Ordering Information

DN 10 ISO-KF

DN 16 ISO-KF

DN 25 ISO-KF

	Part No.	Part No.	Part No.
Outer centering ring with O-ring Aluminum / FPM (FKM) ((Viton))	183 53	183 53	183 54
Fine filter on centering ring with O-ring Stainless steel / FPM (FKM) ((Viton))	883 95	883 96	883 97
Baffle with centering ring (FPM) ((FKM))	-	-	230 078
Connection accessories for metal seals or bake out room up to 150 °C			
Ultra sealing ring, aluminum (Set of 3)	883 73	883 73	883 75
Outer support ring	883 74	883 74	883 76
Clamping ring	882 75	882 75	882 77

Ordering Information

DN 40 ISO-KF

DN 16 CF

DN 40 CF

	Part No.	Part No.	Part No.
Outer centering ring with O-ring Aluminum / FPM (FKM) ((Viton))	183 55	-	-
Fine filter on centering ring with O-ring Stainless steel / FPM (FKM) ((Viton))	883 98	-	-
Baffle with centering ring (FPM) ((FKM))	230 079	-	-
Connection accessories for metal seals or bake out room up to 150 °C			
Ultra sealing ring, aluminum (Set of 3)	883 77	-	-
Outer support ring	883 78	-	-
Clamping ring	882 78	-	-
Connection accessories for CF connections			
Copper seals, (set of 10 pieces)	-	839 41	839 43
Screw (set of 25 pieces)	-	839 00	839 01
Replacement sinter filter with centering ring	231 93 515	-	-

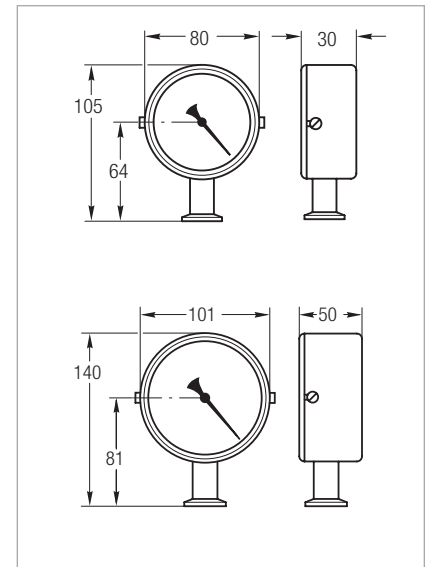
Products

Mechanical Gauges

Bourdon Vacuum Gauges



Rugged relative pressure vacuum gauges based on the Bourdon principle covering the pressure range from 1 to 1020 mbar (0.75 to 765 Torr).



Dimensional drawing for the BOURDONVAC A (top) and the BOURDONVAC C (bottom)

Advantages to the User

- Highly reliable, rugged, insensitive to vibrations
- Linear readout, independent of the type of gas
- Excellent media compatibility owing to the stainless steel movement (BOURDONVAC C)
- IP 54 protection (BOURDONVAC C)

Typical Applications

- Vacuum distillation
- Drying processes
- Vacuum conveying systems

Technical Data

BOURDONVAC A

BOURDONVAC C

Measurement range	mbar (Torr)	1 to 1020 (0.75 to 765)	1 to 1020 (0.75 to 765)
Measurement uncertainty	% FS	1	1
Class 1 (EN 837)	% FS	1	1
Overload range (abs. briefly)	bar	1.5	1.3
Storage temperature range	°C	-25 to +60	-25 to +60
Nominal temperature range	°C	+10 to +60	+10 to +100 (max.)
Flange connection	DN	16 ISO-KF	16 ISO-KF
Length of scale	mm	207	188
Diameter	mm	80	101
Overall height	mm	105	140
Weight	kg (lbs)	0.25 (0.55)	0.5 (1.10)
Leak tightness	mbar x l/s	1×10^{-8}	1×10^{-8}
Materials in contact with the medium		Nickel plated standard steel, bronze, soft solder	Stainless steel 1.4404

Ordering Information

BOURDONVAC A

BOURDONVAC C

	Part No.	Part No.
Bourdon vacuum gauge	160 40	161 20

Capsule Vacuum Gauges



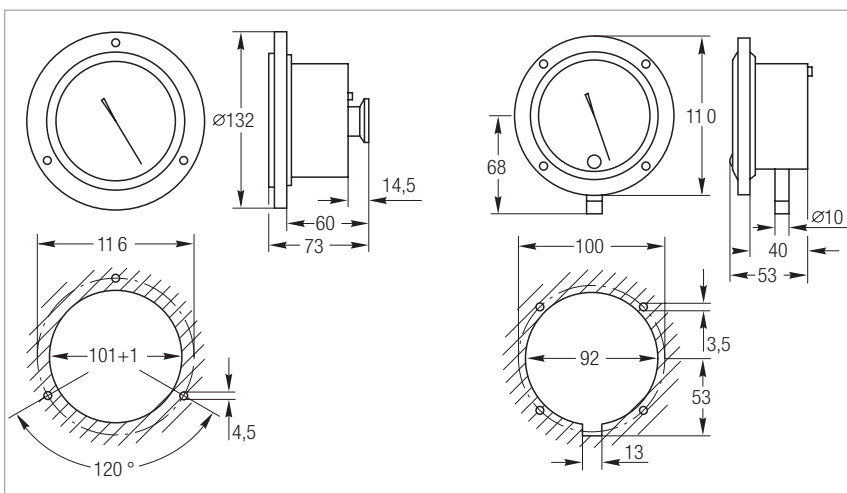
Rugged absolute pressure gauges for the pressure range from 1 to 1000 mbar (0.75 to 750 Torr).

Advantages to the User

- Rugged and insensitive to vibrations
- Models available for two measurement ranges (1 to 100 mbar (0.75 to 75 Torr) and 1 to 1000 mbar (0.75 to 750 Torr))
- Readout independent of the type of gas and changes in atmospheric pressure
- Linear pressure readout
- Installation direct via the connection flange or panel mounting
- Model with integrated isolation valve for use on packaging machines (Part No. 160 68)

Typical Applications

- Measurement of absolute pressures (for inert gases only)
- Vacuum conveying systems
- Operation monitoring
- Packaging



Dimensional drawings for the capsule vacuum gauges
Part Nos. 160 63/64 (left) and Part No. 160 68 (right)

Technical Data

Capsule Vacuum Gauge

Measurement range	mbar (Torr)	1 to 100 (0.75 to 75)	1 to 100 (0.75 to 75)	1 to 1000 (0.75 to 750)
Measurement uncertainty	% FS	1.0	2.5	1.6
Overload range (abs. briefly)	bar	1.5	1.5	1.5
Storage temperature range	°C	-25 to +60	-25 to +60	-25 to +60
Nominal temperature range	°C	+10 to +50	+10 to +50	+10 to +50
Length of scale	mm	205	180	205
Dead volume, approx.	cm ³	235	167	235
Diameter	mm	132	110	132
Weight	kg (lbs)	0.7 (1.54)	0.6 (1.32)	0.7 (1.54)
Vacuum connection	DN	16 ISO-KF	10 mm dia. hose nozzle with integrated isolation valve	16 ISO-KF
Max. inclination when installed		45°	45°	45°
Materials in contact with the medium		Brass Standard steel nickel plated Glass NBR Aluminum Copper beryllium Soft and hard solder Resin	Brass Standard steel nickel plated Glass NBR Aluminum Copper beryllium Soft and hard solder Resin	Brass Standard steel nickel plated Glass NBR Aluminum Copper beryllium Soft and hard solder Resin

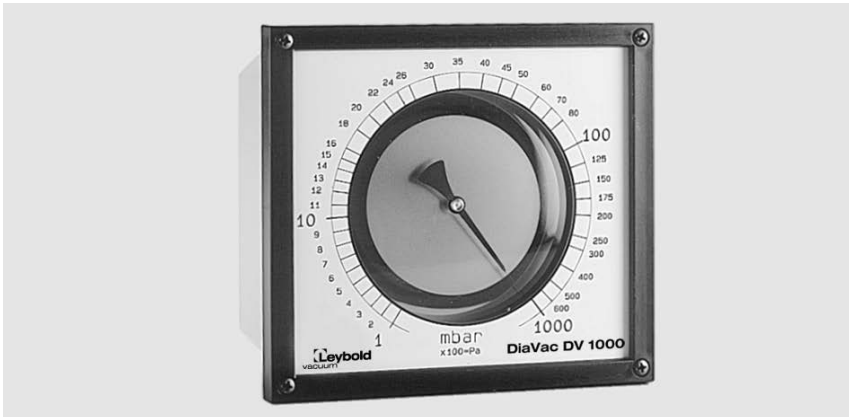
Measuring,
controlling

Ordering Information

Capsule Vacuum Gauge

	Part No.	Part No.	Part No.
Capsule vacuum gauge	160 63	160 68	160 64

Diaphragm Vacuum Gauge DIAVAC DV 1000



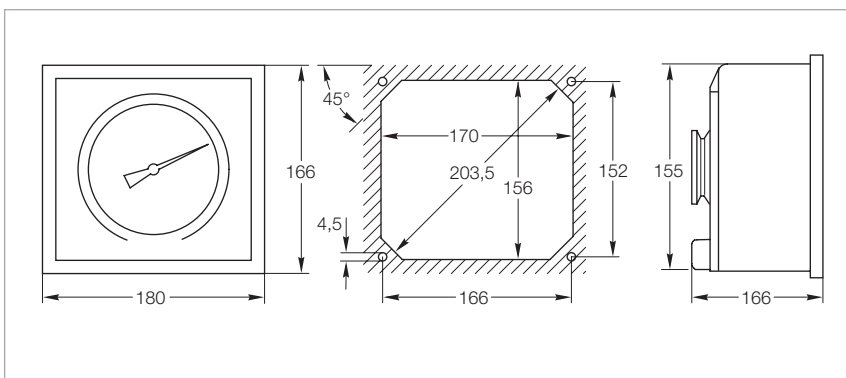
Rugged mechanical diaphragm vacuum gauge of high accuracy for the rough vacuum range from 1 to 1000 mbar (1 to 750 Torr).

Advantages to the User

- Wide measurement range from 1 to 1000 mbar (1 to 750 Torr) with high resolution in the range from 1 to 100 mbar (1 to 75 Torr)
- The scale of each gauge is individually calibrated
- Absolute pressure gauge
- Readout independent of the type of gas and changes in atmospheric pressure
- Stainless steel diaphragm for excellent compatibility with most media
- Laser welding technology for high precision diaphragm mount
- Rugged table-top housing, can be freely mounted above the flange connection; also for panel mounting
- Measurement chamber can be easily cleaned owing to the detachable measurement flange

Typical Applications

- Chemical processes
- Vacuum distillation
- Absolute pressure measurements for gas mixtures
- For use in explosion hazard rated areas
- Drying processes
- Lamp manufacture



Dimensional drawing and panel cut-out for the DIAVAC DV 1000

Technical Data

DIAVAC DV 1000

Measurement range	mbar (Torr)	1 to 1000 (1 to 750)
Measurement uncertainty		
1 - 10 mbar (1.0 - 7.5 Torr)		±1 mbar (Torr)
10 - 1000 mbar (7.5 - 750 Torr)		± 10% of meas. value
Storage temperature range	°C	-10 to +60
Nominal temperature range	°C	0 to +60
Permissible overload (abs.)	bar	3
Length of scale	mm	270
Dead volume	cm ³	130
Vacuum connection	DN	40 ISO-KF
Dimension (W x H x D)	mm	180 x 166 x 100
Weight	kg (lbs)	2.7 (5.95)
Materials in contact with the medium		Stainless steel 1.4301, 1.4310 (diaphragm), FPM (FKM)

Ordering Information

DIAVAC DV 1000

	Part No.
DIAVAC DV 1000	
mbar readout	160 67 ¹⁾
Torr readout	896 06 ¹⁾
DAkS calibration	157 12
Replacement sinter filter with centering ring, DN 40 ISO-KF	231 93 515
Replacement housing, complete	240 000

¹⁾ Complete with centering ring and sintered filter

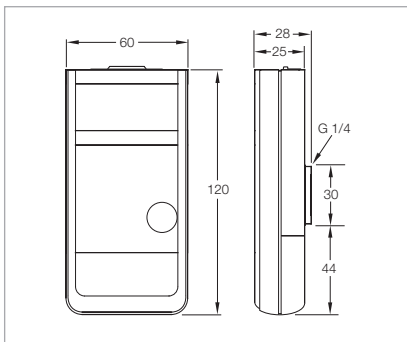
Handheld Measuring Instruments

Digital PIEZOVAC Sensor PV 101

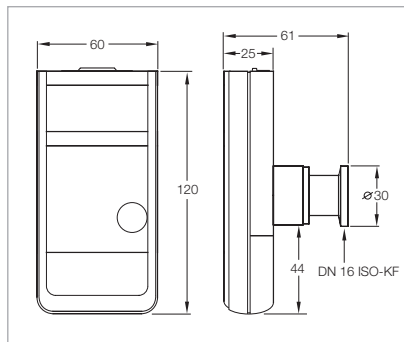
Digital THERMOVAC Sensor TM 101



PIEZOVAC Sensor PV 101 (left) and THERMOVAC Sensor TM 101 (right)



Dimensional drawings PIEZOVAC PV 101 (mm)



Dimensional drawings THERMOVAC TM 101 (mm)

The **PIEZOVAC PV 101** has been specially developed for food sector deployments. The device can be operated directly under vacuum conditions. Thanks to its detachable flange connection the size of the sensor was significantly reduced. In the medium vacuum range pressures of up to 0.1 mbar will be traced and read out. The exclusive use of its piezo sensor significantly increases the battery's service life so that the device is continuously ready for operation.

The **THERMOVAC TM 101** is the essential device for on-site service calls. Thanks to the easy use and integrated measurement data memory, pressures can be directly measured at different locations for monitoring the application. Owing to the advanced measuring range of the high-precision Pirani sensor, pressures of up to 5×10^{-4} mbar can be displayed.

Advantages to the User

- Direct display of measuring values; other monitoring devices are not necessary
- Developed for deployments in demanding environments
- Versatile deployment due to mains-independent power supply
- High-precision measurements of all common gas types
- Export and analysis of stored measurement values via USB interface
- Online analysis of measurement values via USB interface

The digital compact PIEZOVAC PV 101 and THERMOVAC TM 101 combine high-quality sensor technology with modern processor technology in a handy design.

Owing to their battery mode, the devices can be attached and operated at any pressure measuring point, and directly display or store up to 2,000 values for later evaluations and visualizations. All data values stored can be exported and displayed on a computer via USB link and by means of the optional VacuGraph software. The software is especially useful for setting up the devices or calculating rises in pressure for detecting rough leaks.

A carrying case providing space for all required accessories and for storing and transport protection is enclosed with the device and the software.

Typical Applications

- Versatile deployment with vacuum pump and vacuum plant servicing
- Comparative measurements of fixed pressure gauges
- Direct measuring inside vacuum vessels or vacuum packs
- Measuring of rough leaks after maintenance services

Technical Data

PIEZOVAC Sensor

PV 101

THERMOVAC Sensor

TM 101

Measurement principle		Piezo-resistiv	Piezo-resistive (gas type independent) and thermal conductance Pirani
Indicated units of measurement		mbar, Torr, hPa	mbar, Torr, microns, Pa
Measurement range	mbar (Torr)	1200 bis 0,1 (900 to 0,075)	1200 bis $5 \cdot 10^{-4}$ (900 to 3.75×10^{-4})
Maximum overload	bar abs.	2	2
Maximum overload			
1200 - 10 mbar (900 to 75 Torr)	%	$\pm 0,3$ of full-scale	$\pm 0,3$ of full-scale
$10 - 2 \times 10^{-3}$ mbar (7.5 to 1.5×10^{-3} Torr)	approx. %	-	10 of measured value
$< 2 \times 10^{-3}$ mbar ($< 1.5 \times 10^{-3}$ Torr)	approx. %	-	< factor2
Gas type correction factor		Ar, CO ₂ , He, CO, H ₂ , N ₂ , Kr	Ar, CO ₂ , He, CO, H ₂ , N ₂ , Kr
Materials in contact with the vacuum		Stainless steel 1.4305, Viton®, silicon gel	Stainless steel, gold, tungsten, nickel, glass, Viton
Measurement cycle	s	0.1	1.0
Data storing rate	s	0.1 to 6000	1 to 6000
Operating temperature			
Sensor	°C	+5 to +50	+5 to +50
Battery	°C	-20 to +45	-20 to +45
Storage temperature			
Sensor	°C	-20 to +60	-20 to +60
Battery	°C	+10 to +25	+10 to +25
Supply voltage		Rechargeable 9 V battery (recommendation: type Panasonic 6LR61PM, 9 V / 500 mAh) or 12 - 15 V DC external adaptor (miniature jack, + terminal at the tip)	Rechargeable 9 V battery (recommendation: type Panasonic 6LR61PM, 9 V / 500 mAh) or 12 - 15 V DC external adaptor (miniature jack, + terminal at the tip)
Power consumption			
< 200 mbar (< 150 Torr)	mW	2	60
> 200 mbar (> 150 Torr)	mW	2	2
Operating duration			
6LR61 alkaline (vacuum operation)	h	< 2500	up to 75
Display		LCD 12 mm	LCD 12 mm
Connection (stainless steel)		G 1/4 internal thread (DN 16 ISO-KF with adaptor)	DN 16 ISO-KF
PC interface		Mini USB-B connector	Mini USB-B connector
Data type		ASCII-Text	ASCII-Text
Dimensions	mm	60 x 120 x 28	60 x 120 x 61
Protection class	IP	40	40
Weight (including battery)	kg (lbs)	0.2 (0.44)	0.23 (0.51)

Ordering Information

PIEZOVAC Sensor

PV 101

THERMOVAC Sensor

TM 101

	Part No.	Part No.
Sensor Including AIMn battery, 9 V block 6LR 61	230 080 V01	230 081 V01
Accessory kit for VacuGraph Windows software including USB interface cable (2 m) protection case with foam insert and 15 V wall power supply for 100 - 260 V, 50/60 Hz mains and AIMn battery, 9 V block 6LR 61	230 082 V01	230 082 V01

Active Sensors

CERAVAC Transmitters CTR 100 N and CTR 101 N



CERAVAC Transmitter CTR 100 N (links) und CERAVAC Transmitter CTR 101 N (rechts)

The CERAVAC transmitters with an advanced all-welded INCONEL® and stainless steel sensor and microprocessor-based electronics offer excellent accuracy and reproducibility. The CTR 100 N and CTR 101 N allow gas type independent pressure measurements and are able to tolerate bursts of pressure without suffering physical damage or calibration shifts. The robust sensor is suited for the most corrosive processes as the sensor is highly resistant to corrosion from common process chemicals. The sensor of the CTR 101 N is internally heated and regulated to 45 °C to offer full-scale pressure ranges from 1000 to 0.1 Torr.

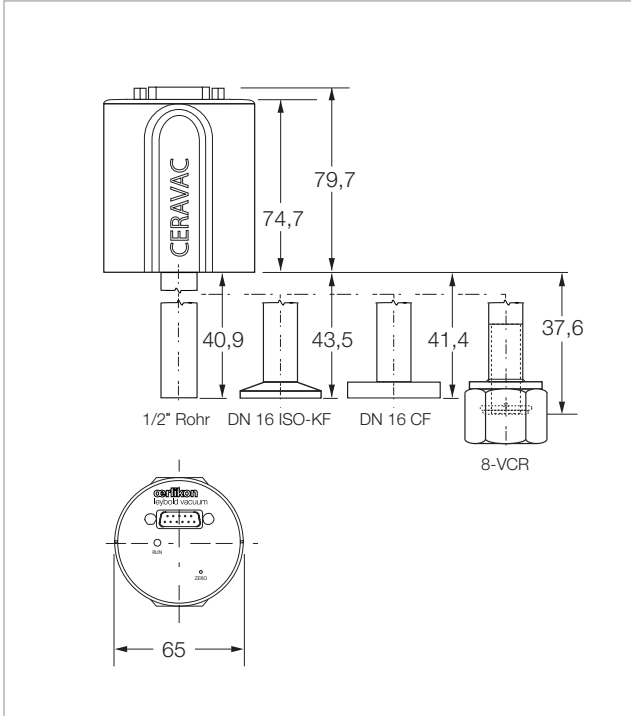
Advantages to the User

- Excellent accuracy and long-term stability
- Very good temperature compensation regardless of ambient conditions
- Highly resistant against corrosion and aggressive gases
- Fast and accurate response to pressure changes
- Improved reliability by high overpressure rating
- Serial Interface (RS 232 protocol)
- Zero adjust push button
- Optional heated (45 °C) version offers 2x better accuracy

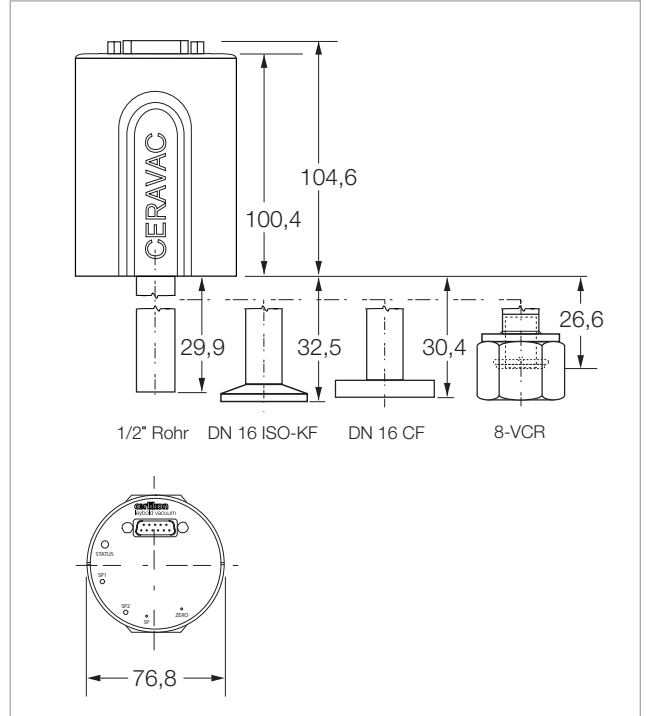
Typical Applications

- General vacuum measurement and control with very low measurement uncertainty
- Fore and medium vacuum pressure measurement
- Research & Development
- System process control
- Chemical and Semiconductor processes
- LED and solar cell manufacturing
- Physical Vapor Deposition (PVD)
- Reference sensor for calibration systems

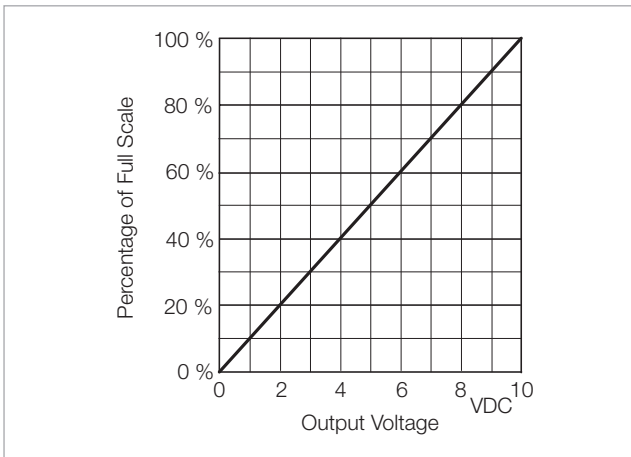
INCONEL® is a registered trademark of Inco Alloys International, Inc.



Dimensional drawing for the CERAVAC Transmitter CTR 100 N



Dimensional drawing for the CERAVAC Transmitter CTR 101 N



Characteristic of the CERAVAC Transmitter CTR 100 N and CTR 101 N

Technical Data

CERAVAC Transmitter

CTR 100 N (Temperature Compensated)

CTR 101 N (45 °C heated)

Full scale (FS) / Measurement range		0.1 Torr / 1×10^{-5} - 0.1 Torr 1 Torr / 1×10^{-4} - 1 Torr 10 Torr / 1×10^{-3} - 10 Torr 20 Torr / 2×10^{-3} - 20 Torr 100 Torr / 0.01 - 100 Torr 1000 Torr / 0.1 - 1000 Torr	0.1 Torr / 1×10^{-5} - 0.1 Torr 1 Torr / 1×10^{-4} - 1 Torr 10 Torr / 1×10^{-3} - 10 Torr – 100 Torr / 0.01 - 100 Torr 1000 Torr / 0.1 - 1000 Torr
Measurement uncertainty		0.2% ± temperature effect 0.5% ± temperature effect (0.1 Torr)	0.12% ± temperature effect 0.15% ± temperature effect (0.1 Torr)
Sensor Measurement principle		INCONEL® membrane Capacitance diaphragm gauge	INCONEL® membrane Capacitance diaphragm gauge
Supply voltage	V DC	+14 to +30	+14 to +30
Power consumption	W	≤ 1	≤ 11 (at operating temperature ≤ 8)
Electrical connection		D-Sub 15 PIN	D-Sub 15 PIN
Analog output Measurement range	V	0 - 10	0 - 10
Interface		RS 232	RS 232
Setpoints		0	2
Status indicators		LED	LED
Max. cable length	m	30	30
Max. overrange pressure	bar (hPa)	3.1 (3100)	3.1 (3100)
Operating temperature range	°C (°F)	+15 to +50	+15 to +40
Storage temperature range	°C (°F)	-20 to +80	-20 to +80
Max. bakeout temperature	°C (°F)	Not bakeable	Not bakeable
Max. rel. humidity	% n.c.	25 to 95	25 to 95
Installation orientation		Any	Any
Wetted part material		INCONEL®, Stainless steel 316	INCONEL®, Stainless steel 316
Dead volume, approx.	cm ³	6.29	6.29
Weight	g (lbs)	513 (0.11)	669 (0.15)
Protection class	IP	40	40
CE certification		EMC Directive 2014/30/EEC	EMC Directive 2014/30/EEC
Controller type		GRAPHIX ONE / TWO / THREE	GRAPHIX ONE / TWO / THREE
Temperature effects Zero of FS	% / °C	0.005 (1000/100/20/10 Torr) 0.015 (1 Torr) 0.02 (0.1 Torr)	0.0025 (1000/100/10/1 Torr) 0.005 (0.1 Torr)
Span of reading	% / °C	0.01 (1000/100/20/10/1 Torr) 0.03 (0.1 Torr)	0.01 (1000/100/10/1 Torr) 0.03 (0.1 Torr)
Response time (10% to 90% FS)	ms	40 / 80 (1 Torr) / 120 (0.1 Torr)	40 / 80 (1 Torr) / 120 (0.1 Torr)

Ordering Information

CERAVAC Transmitter

CTR 100 N

CTR 101 N

	Part No.	Part No.
DN 16 ISO-KF		
1000 Torr	230300V02	230320V02
100 Torr	230301V02	230321V02
20 Torr	230340V02	-
10 Torr	230302V02	230322V02
1 Torr	230303V02	230323V02
0.1 Torr	230304V02	230324V02
DN 16 CF-R		
1000 Torr	230305V02	230325V02
100 Torr	230306V02	230326V02
10 Torr	230307V02	230327V02
1 Torr	230308V02	230328V02
0.1 Torr	230309V02	230329V02
Cajon 8-VCR		
1000 Torr	230310V02	230330V02
100 Torr	230311V02	230331V02
10 Torr	230312V02	230332V02
1 Torr	230313V02	230333V02
0.1 Torr	230314V02	230334V02
1/2" Tube		
1000 Torr	230315V02	230335V02
100 Torr	230316V02	230336V02
10 Torr	230317V02	230337V02
1 Torr	230318V02	230338V02
0.1 Torr	230319V02	230339V02
Calibration	See Section "Miscellaneous", paragraph "Leybold calibration service"	See Section "Miscellaneous", paragraph "Leybold calibration service"
Operating Units		
GRAPHIX ONE	230680V01	230680V01
GRAPHIX TWO	230681V01	230681V01
GRAPHIX THREE	230682V01	230682V01
Connection cable, Sub-D 15-way female to Sub-D 15-way male, shielded		
5 m	Type C 124 55	Type C 124 55
10 m	230 022	230 022
15 m	124 56	124 56
20 m	124 57	124 57
30 m	124 58	124 58

Measuring,
controlling

THERMOVAC-Transmitter

TTR 91 N (S) / TTR 96 N / TTR 911 N (C) / TTR 916 N



THERMOVAC Transmitter TTR N analog (eft); digital RS232 (middle), with Display (right)

The THERMOVAC Transmitters are active sensors using the unique MEMS-Pirani technology (Micro-Electro-Mechanical-Systems). They offer analog voltage output and the S-versions offer set point relays for improved process control. For chemical and aggressive applications, the C-versions are equipped with a Parylene HT®-coated sensor. The THERMOVAC series is also equipped with a LED-ring (360°) showing the status of the sensor.

The TTR 911 N and 916 N have a touch display and/or digital interfaces available.

Advantages to the User

- Very robust MEMS-Pirani solid state sensor resilient to vibration and shock venting
- Extended measuring range up to 5×10^{-5} mbar and significantly higher accuracy compared to conventional sensors
- Reduced response times because of significantly improved signal processing
- High accuracy
- Individually temperature compensated to ensure stable measurements
- High reproducibility
- Measurement signal insensitive to mounting position
- Robust stainless steel housing
- Available with display for pressure units, set point parameters and operation status
- Available with up to three set point relays for improved process control
- Optional Computer interfaces: EtherCAT and RS 232
- Long tube version for reaching higher chamber bakeout temperatures
- LED ring to indicate status of the sensor

Typical Applications

The THERMOVAC Transmitters offer a high degree of versatility. They are suited for applications in the medium and rough vacuum range.

Typical applications are:

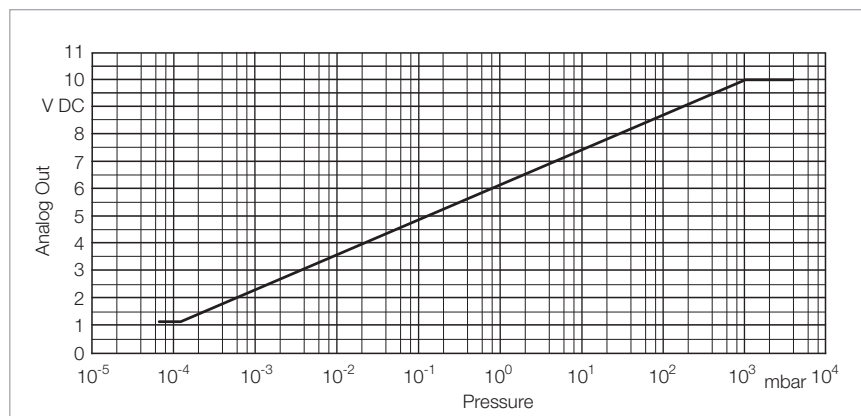
- Analytical instrumentation
- Research and development
- Vacuum Drying
- Controlling of ionization gauges
- Activation of UHV gauges
- System process control
- Process industry
- Coated versions for improved chemical resistance
- General foreline vacuum measurement

Sensor

The THERMOVAC transmitters' measurement principle is based on thermal conductivity. The transmitters are equipped with a MEMS-Pirani sensing cell that consists of a silicon chip with a heated resistive element.

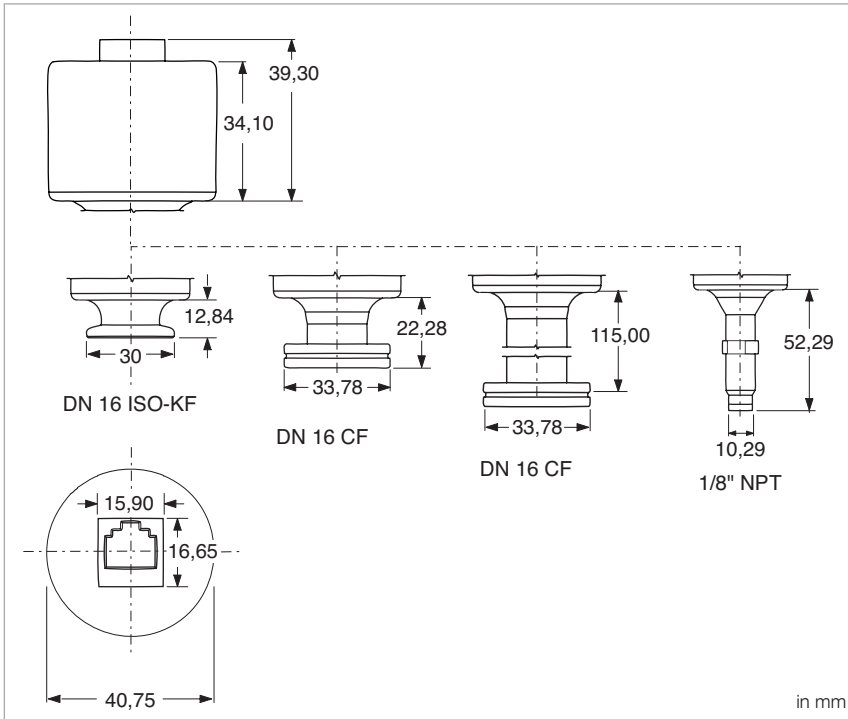
The THERMOVAC transmitters with the coated MEMS-Pirani are well suited for harsh processes and therefore more robust than the uncoated versions. Built-in relays allow switching functions to be performed directly by the transmitter, without the need of a programmable control.

An integration of the transmitters in programmable control systems is facilitated by the linear characteristic, which can be defined by entering a simple equation into a PLC or computer.

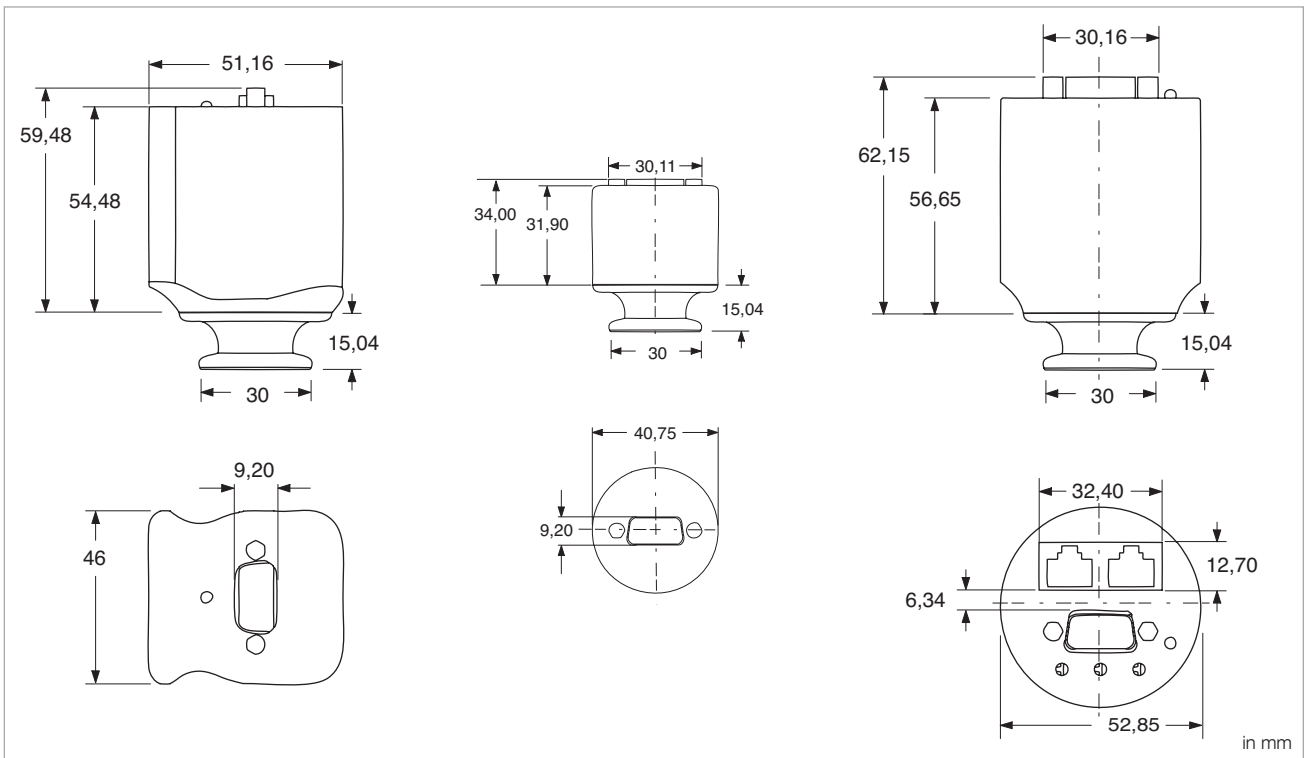


Characteristic of the THERMOVAC Transmitters TTR 91 N (S) / TTR 96 N and TTR 911 N (C) / TTR 916 N

Parylene HT® is a registered trademark of Speciality Coating Systems Inc.



Dimensional drawings for the THERMOVAC Transmitters TTR 91 N (S) / TTR 96 N (Middle left - DN 16 CF standard version, middle right backable with elongated flange)



Dimensional drawings for the THERMOVAC Transmitters TTR 911 N (C) / TTR 916 N
left: with display, middle: with RS 232, right: with EtherCAT

Technical Data

THERMOVAC Transmitter TTR 91 N TTR 91 N S TTR 96 N S

Measurement range	mbar (Torr)	5.0 x 10 ⁻⁵ to Atmosphere (3.75 x 10 ⁻⁵ to Atmosphere)		
Measurement uncertainty of reading (typical) ¹⁾	mbar	5 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to atm ±25 %		
Repeatability of reading (typical) ¹⁾	mbar	1 x 10 ⁻³ to 100 ±2 %		
Sensor		MEMS-Pirani	MEMS-Pirani	Coated MEMS-Pirani
Measurement principle		Thermal conductivity according to Pirani		
Supply voltage	V DC	9 - 30		
Power consumption	W	< 1.2		
Electrical connection		FCC 68, RJ45 (analog) / Sub-D 15 PIN (digital)		
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 1.1 to 10		
Resolution	bit	16		
Impedance	Ω	100		
Update rate	Hz	16		
Interfaces		FCC 68, RJ45 (analog) / RS232, EtherCat, Profibus (digital)		
Set point				
Range	mbar (Torr)		2.7 x 10 ⁻⁴ to 1000 (2.0 x 10 ⁻⁴ to 750)	
Relay		0	2	2
Relay contact rating		1 A @ 30 V AC/ DC, resistive load		
Relay contact resistance, max.	mΩ	100		
Relay contact endurance, min.		100 000		
1.0 A@ 30 V DC load		2 000 000		
0.2 A@ 30 V DC load				
Status indicators		LED-ring (360°)		
Max. cable length	m	100		
Overpressure limit (abs.)	bar	6 (10 bar for inert gases)		
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)		
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)		
Max. bakeout temperature	°C (°F)	85 (185), non-operating [bakeable version up to 250 (482)]		
Max. rel. humidity	% n.c.	≤ 95		
Installation orientation		Any		
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®		304 stainless steel, Viton®, Parylene-HT®
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.80		
Weight (DN 16 ISO-KF)	g	170		
Protection class	IP	40		
CE certification		EMC Directive 2014/30/EEC		
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE		

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 ° C

Ordering Information

THERMOVAC Transmitter TTR 91 N (S) / TTR 96 N

	Part No.
Without switching threshold	
TTR 91 N, DN 16 ISO-KF	230035V02
TTR 91 N, 1/8" NPT	230038V02
TTR 91 N, DN 16 CF	230036V02
TTR 91 N, DN 16 CF, Flange extended bakeable up to 250°C (482°F)	230037V02
With switching threshold	
TTR 91 N, DN 16 ISO-KF, 2SP	230040V02
TTR 91 N, 1/8" NPT, 2SP	230043V02
TTR 96 N C, DN 16 ISO-KF, 2SP, Parylene coated	230045V02
TTR 96 NC, DN 16 CF, 2SP, Flange extended bakeable up to 250°C (482°F), Parylene coated	230047V02
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Operating Units	
DISPLAY ONE	230 001
DISPLAY TWO	230 024
DISPLAY THREE	230 025
GRAPHIX ONE	230680V01
GRAPHIX TWO	230681V01
GRAPHIX THREE	230682V01
Connection cable, FCC 68 on both ends ¹⁾	Type A
5 m	124 26
10 m	230 012
15 m	12427
20 m	12428
30 m	12429
50 m	12431
75 m	12432
100 m	12433
Optional accessories	
Spiral tube DN 16 ISO-KF	230082
Connection cable, RS 232 ¹⁾	Type G
5 m	230550V01
10 m	230551V01
15 m	230552V01
20 m	230553V01

¹⁾ See chapter «Connection cables for Active Sensors»

Technical Data

THERMOVAC Transmitter TTR 911 N (C/S) / TTR 916 N

Measurement range	mbar (Torr)	5.0 x 10 ⁻⁵ to Atmosphere (3.75 x 10 ⁻⁵ to Atmosphere) 1.0 x 10 ⁻⁵ to Atmosphere (0.75 x 10 ⁻⁵ to Atmosphere) [RS 232 / Display]
Measurement uncertainty of reading ¹⁾	mbar	5.0 x 10 ⁻⁴ to 1.0 x 10 ⁻³ ±10 % 1.0 x 10 ⁻³ to 100 ±5 % 100 to atm ±25 %
Repeatability of reading ¹⁾	mbar	1 x 10 ⁻³ to 100 ±2 %
Sensor		MEMS-Pirani
Measurement principle		Thermal conductivity according to Pirani
Supply voltage	V DC	9 - 30
Power consumption	W	< 1.2
Electrical connection		FCC 68, RJ45 (analog) / Sub-D 15 PIN (digital)
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$
Resolution	bit	1.1 to 10
Impedance	Ω	16
Update rate	Hz	100
Interfaces		FCC 68, RJ 45 (analog) / RS 232, EtherCAT, Profibus (digital)
Set point Range	mbar (Torr)	1.0 x 10 ⁻⁴ to 1000 (0.75 x 10 ⁻⁵ to 750) 2.7 x 10 ⁻⁴ to 1000 (2.0 x 10 ⁻⁴ to 750) [RS 232 / Display]
Relay		2 [Profibus / Display] / 2 [RS 232]
Relay contact rating		1 A @ 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		100 000
1.0 A @ 30 V DC load		2 000 000
0.2 A @ 30 V DC load		
Status indicators		LED-ring (360°)
Max. cable length	m	100
Overpressure limit (abs.)	bar	6 (10 bar for inert gases)
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature	°C (°F)	85 (185), non-operating
Max. rel. humidity	% n.c.	0 - 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®, Parylene-HT® (coated)
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.80
Weight (DN 16 ISO-KF, RS 232 w/o Display)	g	168
Protection class	IP	40
CE certification		EMC Directive 2014/30/EEC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 ° C

Ordering Information

THERMOVAC Transmitter TTR 911 N (C/S) / TTR 916 N

	Part No.
TTR 911 N, DN 16 ISO-KF, EtherCAT	230700V02
TTR 911 N C, DN 16 ISO-KF, EtherCAT, Parylene coated	230701V02
TTR 911 N S, DN 16 ISO-KF, RS 232	89660V02
TTR 911 N, DN 16 ISO-KF, with display, FCC 68 / RJ 45	89654V02
TTR 916 N C, DN 16 ISO-KF, Parylene coated, FCC 68 / RJ 45	89656V02
Replacement sensor, DN 16 ISO-KF TTR 91 N, Profibus TTR 91 N C, Profibus TTR 911 N, without Parylene coating TTR 916 N SC, TTR 911 NC, with Parylene coating	89650V02 89659V02 230650V02 230651V02
Calibration	See Section "Miscellaneous", paragraph "Leybold calibration service"
Operating Units DISPLAY ONE DISPLAY TWO DISPLAY THREE GRAPHIX ONE GRAPHIX TWO GRAPHIX THREE	230 001 230 024 230 025 230680V01 230681V01 230682V01
Connection cable, FCC 68 on both ends 5 m 10 m 15 m 20 m 30 m 50 m 75 m 100 m	Type A 124 26 230012 12427 12428 12429 12431 12432 12433
Optional accessories Spiral tube DN 16 ISO-KF	230 082

THERMOVAC-Transmitter TTR 101 N (S)



THERMOVAC Transmitter TTR 101 N, analog (left), EtherCat (middle), Display (right)

The THERMOVAC TTR 101 N models utilize a thermal conductivity MEMS-Pirani combined with a silicon membrane Piezo. They offer superior accuracy and gas type independent readings between 10 mbar and 1500 mbar.

Advantages to the User

- Wide measurement range combining two sensor technologies into a single output
- Extended measuring range up to 5×10^{-5} mbar and significantly higher accuracy compared to conventional sensors
- Robust MEMS-Pirani and Piezo solid state sensors resilient to vibration and shock venting
- Rapid cycling by fast and repeatable pressure measurements
- High reproducibility and high accuracy
- Gas type independent from 10 to 1500 mbar
- Autozero of Piezo
- Individually temperature compensated to ensure stable measurements
- Measurement signal insensitive to mounting position
- Available with display for pressure units, set point parameters and operation status
- Available with up to three set point relays for improved process control
- LED ring to indicate status of the sensor

Typical Applications

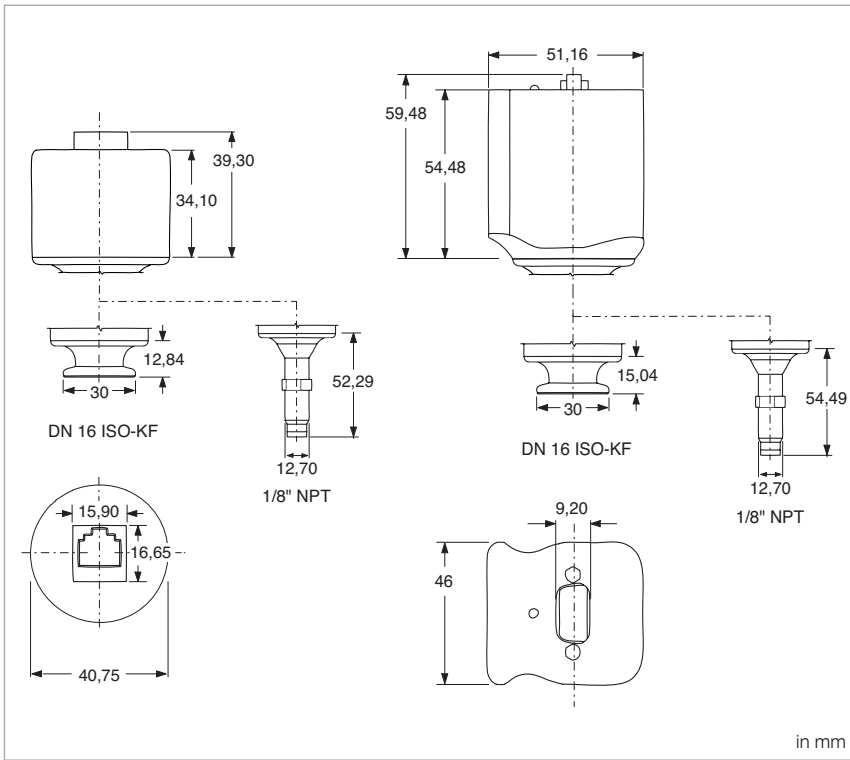
The THERMOVAC TTR 101 N transmitters can be used in any application that requires absolute pressure measurement and switching capabilities.

- General vacuum measurement and control from low to medium vacuum pressure
- Safety circuits in vacuum systems
- Control of high vacuum ionization gauges
- Analytical Instrumentation
- Research and development
- Vacuum Drying
- System process control
- Vacuum furnaces and sintering
- Coating
- Process industry

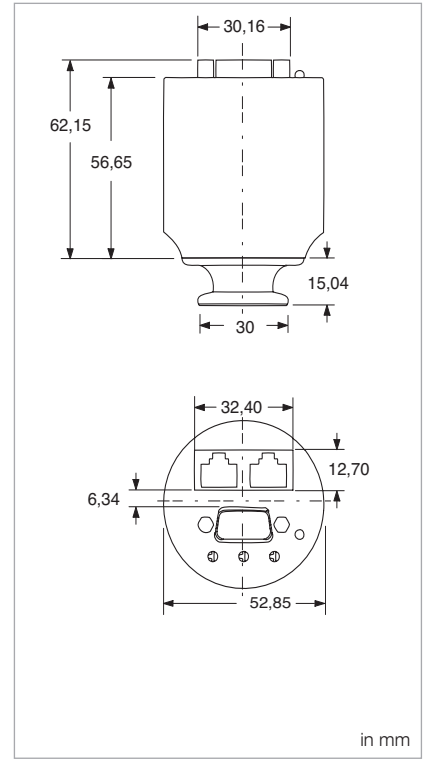
Sensor

Dust and other particles may cause measurement errors and reduced lifetime. Therefore we recommend the installation of a fine filter in critical applications.

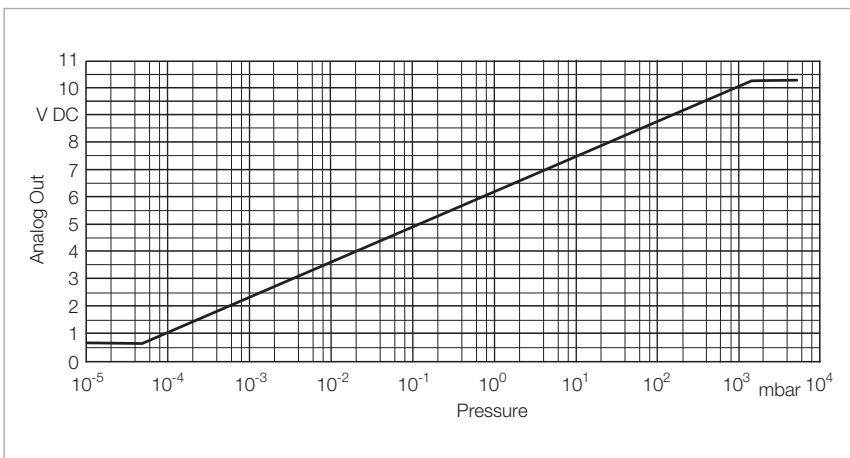
Fine filters are listed in chapter "General", para. "Connection Accessories for Small Flanges".



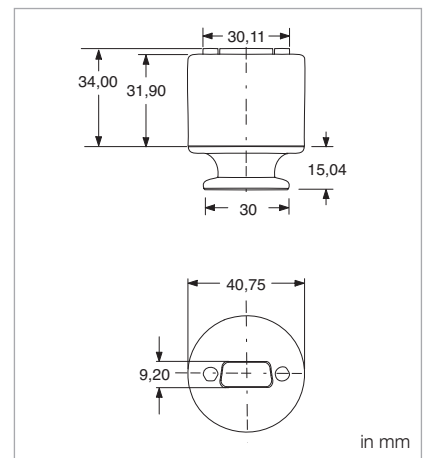
Dimensional drawing for the THERMOVAC Transmitters TTR 101 N (S) (left) and TTR 101 N Display (right)



Dimensional drawing for the TTR 101 N (EtherCAT)



Characteristic of the THERMOVAC Transmitters TTR 101 N (S)



Dimensional drawing for the TTR 101 N (RS 232)

Technical Data

THERMOVAC Transmitter TTR 101 N (S)

Measurement range	mbar (Torr)	5 x 10 ⁻⁵ to 1500 (3.75 x 10 ⁻⁵ to 1125) 1 x 10 ⁻⁵ to 2000 (0.75 x 10 ⁻⁵ to 1500) [RS 232 / Display / EtherCAT]
Measurement uncertainty of reading ¹⁾	mbar	5 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 10 ±5 % 11 to 1333 ±0.75 % 1333 to 2000 ±2 %
Repeatability of reading ¹⁾	mbar	5 x 10 ⁻⁴ to 10 ±2 % 11 to 1067 ±0.2 %
Sensor Measurement principle		MEMS-Pirani and Piezo
Supply voltage	V DC	9 - 30
Power consumption	W	< 1.2 [2 for EtherCAT]
Electrical connection		FCC 68, RJ 45 (analog) / Sub-D 15 PIN (digital)
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 0.61 to 10.23
Resolution	bit	16
Impedance	Ω	100
Update rate	Hz	16
Interfaces		FCC 68, RJ 45 (analog) / RS 232, EtherCAT, Profibus (digital)
Set point Range	mbar (Torr)	2.7 x 10 ⁻⁴ to 1000 (2.7 x 10 ⁻⁴ to 750) / 1.0 x 10 ⁻⁴ to 1000 (0.75 x 10 ⁻⁴ to 750)
Relay		2 / 3
Relay contact rating		1 A @ 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		100 000
1.0 A@ 30 V DC load		2 000 000
0.2 A@ 30 V DC load		
Status indicators		LED-ring (360°)
Max. cable length	m	100
Overpressure limit (abs.)	bar	2
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature	°C (°F)	85 (185), non-operating
Max. rel. humidity	% n.c.	0 - 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.8
Weight (DN 16 ISO-KF)	g	168
Protection class	IP	40
CE certification		EMC Directive 2014/30/EEC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 ° C

Ordering Information

THERMOVAC Transmitter TTR 101 N (S)

	Part No.
TTR 101 N, DN 16 ISO-KF, FCC 68 / RJ 45	230350V02
TTR 101 N, 1/8" NPT, FCC 68 / RJ 45	230351V02
TTR 101 N, DN 16 ISO-KF, 2SP, FCC 68 / RJ 45	230352V02
TTR 101 N, 1/8" NPT, 2SP, FCC 68 / RJ 45	230353V02
TTR 101 N, DN 16 ISO-KF, Display, FCC 68 / RJ 45	230354V02
TTR 101 N, 1/8" NPT, Display	230355V02
TTR 101 N, DN 16 ISO-KF, Display, 2SP, FCC 68 / RJ 45	230356V02
TTR 101 N, DN 16 ISO-KF, 2SP, Profibus	230358V02
TTR 101 N, DN 16 ISO-KF, 3SP, RS 232	230366V02
TTR 101 N, DN 16 ISO-KF, 2SP, EtherCAT	230702V02
Replacement sensor Flange DN 16 ISO-KF Flange 1/8" NPT	230361V02 230362V02
Centering ring with fine filter 16 ISO-KF	883 96
Calibration	See Section "Miscellaneous", paragraph "Leybold calibration service"
Operating Units DISPLAY ONE DISPLAY TWO DISPLAY THREE GRAPHIX ONE GRAPHIX TWO GRAPHIX THREE	230 001 230 024 230 025 230680V01 230681V01 230682V01
Connection cable, FCC 68 on both ends ¹⁾ 5 m 10 m 15 m 20 m 30 m 50 m 75 m 100 m	Type A 124 26 230012 12427 12428 12429 12431 12432 12433
Optional accessories Spiral tube DN 16 ISO-KF Connection cable, RS 232 ¹⁾ 5 m 10 m 15 m 20 m	230 082 Type G 230550V01 230551V01 230552V01 230553V01

¹⁾ See chapter «Connection cables for Active Sensors»

PENNINGVAC-Transmitter PTR 90 N



PENNINGVAC Transmitter PTR 90 N analog (left); digital (middle), with Display (right)

The PENNINGVAC transmitter combines the cold cathode ionization principle with the MEMS-Pirani sensor. This allows the complete coverage of the measurement range from 1×10^{-8} mbar to atmosphere by a single transmitter. The compact design, broad measurement range and cost efficiency make this transmitter the perfect gauge for several applications.

Advantages to the User

- Enhanced reliability through automatically turning on the cold cathode by the MEMS-Pirani
- Significantly higher accuracy in the upper range by using the MEMS Pirani
- Longer lifetime due to low cold cathode turn on pressure
- High reproducibility
- Available with display for pressure units, set point parameters and operation status
- Wide measurement range combining two sensor technologies into a single output
- Ease of serviceability by modular design of the cold cathode
- Automatic zeroing during pump down cycle for improved accuracy
- LED ring to indicate status of the sensor
- Measurement signal insensitive to mounting position

Typical Applications

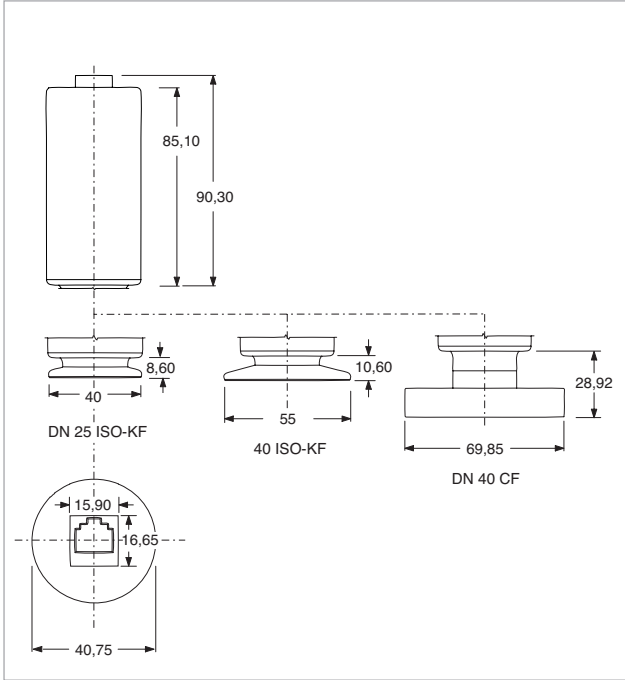
Typical Applications within the measurement range from 1×10^{-8} mbar to atmosphere are:

- General vacuum base pressure measurement
- Sputtering and coating technology
- Analytical technology (e. g. mass spectrometer control)
- Vacuum Furnaces
- Multipurpose pressure measurement and control up to the high vacuum range
- Metallurgy
- Scanning electron microscopes
- Process industry

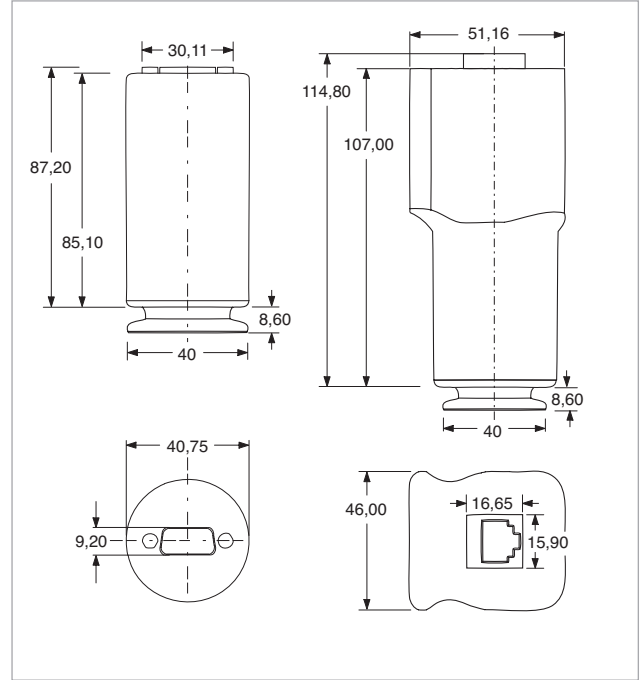
Option

For protection of the sensor PTR 90 N against contamination, radiation and other disturbing factors the installation of a baffle is recommended.

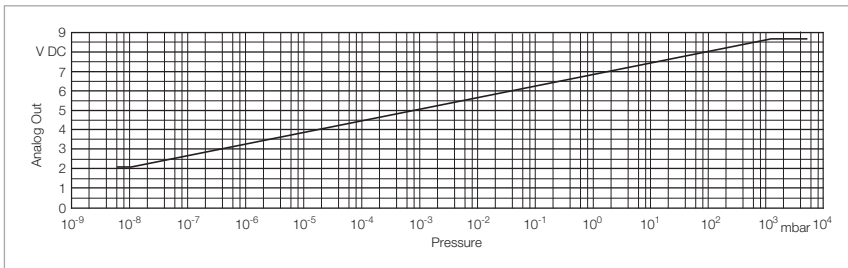
Two types of baffles are available: A build-in version for CF connections is mounted in the sensor; the baffle for ISO-KF connections is integrated in a centering ring.



Dimensional drawing for the PENNINGVAC transmitter PTR 90 N



Dimensional drawing for the PENNINGVAC transmitters PTR 90 N, RS 232 (left) and PTR 90 N, EtherCAT (right)



Characteristics of the PENNINGVAC Transmitters PTR 90 N

Technical Data

PENNINGVAC Transmitter PTR 90 N

Measurement range	mbar (Torr)	1.0 x 10 ⁻⁸ to 1000 (0.75 x 10 ⁻⁸ to 750)
Measurement uncertainty of reading (typical) ¹⁾		
Cold cathode	mbar	1 x 10 ⁻⁸ to 5 x 10 ⁻⁴ ±30 %
MEMS Pirani	mbar	5 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to 1000 ±25 %
Repeatability of reading (typical) ¹⁾	mbar	1 x 10 ⁻³ to 100 ±2 %
Sensor Measurement principle		Cold cathode and MEMS Pirani Cold cathode ionization and thermal conductivity
Supply voltage	V DC	9 - 30
Power consumption	W	< 2
Electrical connection		FCC 68, RJ 45 (analog) / Sub-D 15 PIN (digital)
Analog output	V DC	$V_{out} = \log 0.6 (P_{mbar}) + 6.8$ 2.0 to 8.668 / 2.0 to 8.667 [RS 232]
Resolution	bit	16
Impedance	Ω	100
Update rate	Hz	16
Interfaces		FCC 68, RJ 45 (analog) / RS232, EtherCAT (digital)
Set point		
Range	mbar (Torr)	1.0 x 10 ⁻⁸ to 1000 (0.75 x 10 ⁻⁸ to 750)
Relay		0 / 2 [RS 232]
Relay contact rating		1 A @ 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		
1.0 A@ 30 V DC load		100 000
0.2 A@ 30 V DC load		2 000 000
Status indicators		LED-ring (360°)
Max. cable length	mt	100
Overpressure limit	bar	6
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature (power off)	°C (°F)	85 (185)
Max. rel. humidity	% n.c.	0 - 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, 403 stainless steel, Ceramic (Al ₂ O ₃), Tin, Gold, Viton®, Titanium
Dead volume (DN 25 ISO-KF), approx.	cm ³	28.6
Weight (DN 25 ISO-KF)	g	321
Protection class	IP	40
CE certification		EMC Directive 2014/30/EEC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 ° C

Ordering Information

PENNINGVAC Transmitter PTR 90 N

	Part No.
PTR 90 N	
DN 25 ISO-KF, FCC 68 / RJ 45	230070V02
DN 25 ISO-KF, Display, FCC 68 / RJ 45	230085V02
DN 25 ISO-KF, 2 SP, RS 232	230088V02
DN 40 ISO-KF, FCC 68 / RJ 45	230071V02
DN 40 CF, FCC 68 / RJ 45	230072V02
Replacement cathode plate for PTR 90 N / PTR 225 N	EK16291V02
Replacement anode ring for PTR 90 N / PTR 225 N	20028711V02
Baffle, with centering ring (FPM (FKM))	
DN 25 ISO-KF	230 078
DN 40 ISO-KF	230 079
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Operating Units	
DISPLAY ONE	230 001
DISPLAY TWO	230 024
DISPLAY THREE	230 025
GRAPHIX ONE	230680V01
GRAPHIX TWO	230681V01
GRAPHIX THREE	230682V01
Connection cable, FCC 68 on both ends ¹⁾	Type A
5 m	124 26
10 m	230 012
15 m	124 27
20 m	124 28
30 m	124 29
50 m	124 31
75 m	124 32
100 m	124 33
Connection cable, RS 232 ¹⁾	Type G
5 m	230550V01
10 m	230551V01
15 m	230552V01
20 m	230553V01

¹⁾ See chapter «Connection cables for Active Sensors»

PENNINGVAC Transmitters

PTR 225 N / PTR 237 N



PENNINGVAC Transmitter PTR 225 N analog (left), PTR 225 N digital (middle), PTR 237 N analog (right)

The PENNINGVAC Transmitters are based on the cold cathode measurement principle. The compact design and broad measuring range of the PTR 225 N, makes it well suited for easy system integration and process control from medium to high vacuum pressure. Options include various serial interfaces and programmable setpoint relays, making it an ideal transmitter for control systems.

Advantages to the User

- Good performance to price ratio
- Available with up to three setpoints
- Ease of serviceability by modular design of the cold cathode
- High reproducibility and high accuracy
- Available with display for pressure units, set point parameters and operation status
- LED ring to indicate status of the sensor
- Measurement signal insensitive to mounting position
- Optional Computer interfaces: EtherCAT and RS 232

Typical Applications

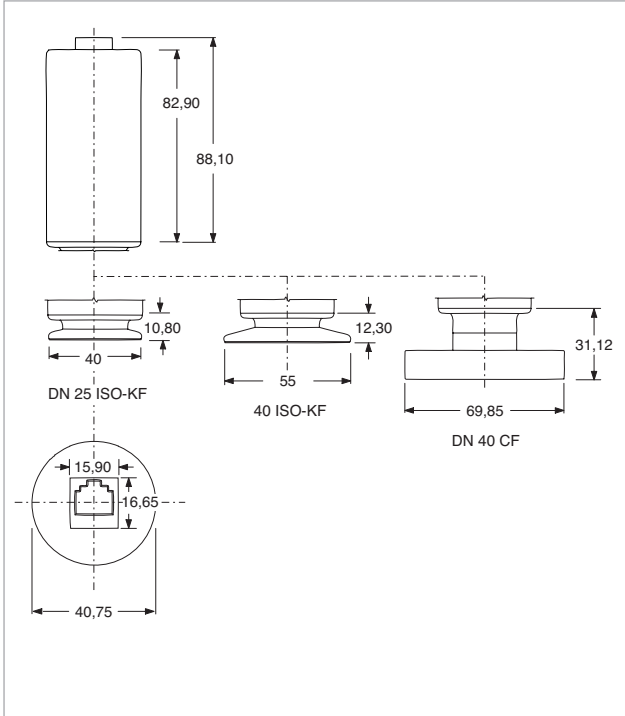
- Analytical Instrumentation
- Scanning electron microscopes
- Evaporation and sputtering systems
- High vacuum systems
- Coating systems
- Vacuum furnaces
- Cryo processes
- Systems control in the medium and high vacuum range

Option

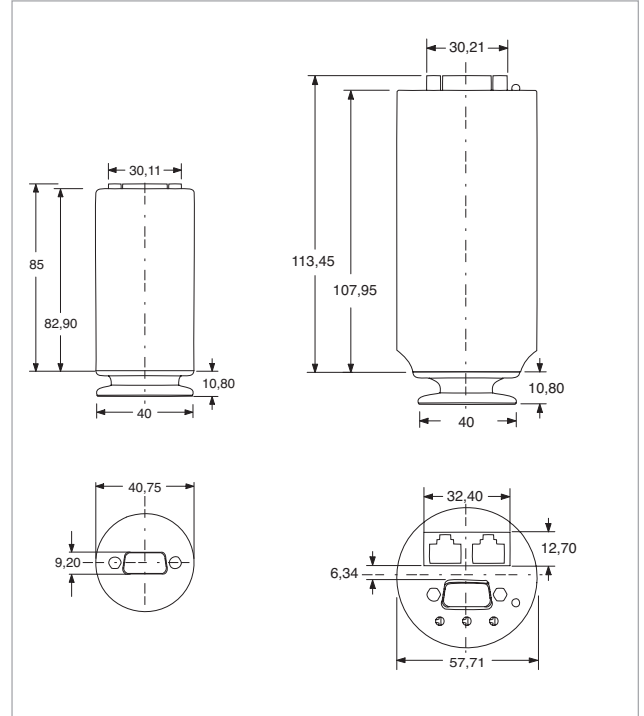
For protection the PTR sensors against contamination, radiation and other disturbing factors the installation of a baffle is recommended.



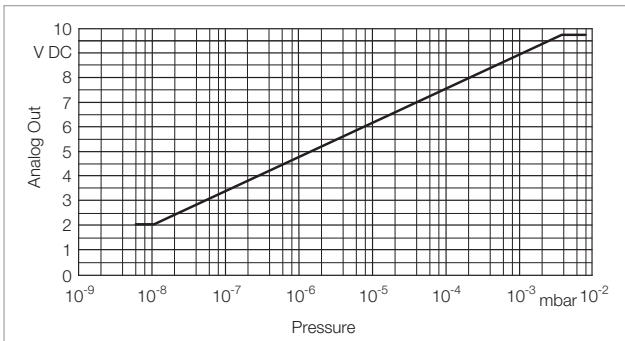
Baffle DN 25 ISO-KF, with centering ring, Part No. 230 078



Dimensional drawing for the PENNINGVAC transmitters PTR 225 N and PTR 237 N



Dimensional drawing for the PENNINGVAC transmitters PTR 225 N, RS 232 (left) and PTR 225 N, EtherCAT (right)



Characteristic of the PENNINGVAC transmitters PTR 225 S/237

Technical Data

PENNINGVAC Transmitter PTR 225 N / PTR 237 N

Measurement range	mbar (Torr)	1.0×10^{-8} to 5×10^{-3} (0.75×10^{-8} to 3.75×10^{-3}) 1.0×10^{-8} to 6.7×10^{-3} (0.75×10^{-8} to 5.0×10^{-3}) [RS 232/EtherCAT]
Measurement uncertainty of reading ¹⁾		
Cold cathode	mbar	1×10^{-8} to $1 \times 10^{-3} \pm 30\%$
Repeatability of reading ¹⁾	mbar	1×10^{-8} to $1 \times 10^{-3} \pm 30\%$
Sensor Measurement principle		Cold cathode Cold cathode ionization
Supply voltage	V DC	9 - 30
Power consumption	W	< 2
Electrical connection		FCC 68 / RJ 45, RS 232
Analog output	V DC	$V_{out} = 1.33 \times \log_{10}(P_{mbar}) + 12.66$ 2.0 to 9.6
Resolution	bit	16
Impedance	Ω	100
Update rate	Hz	16
Interfaces		FCC 68 / RJ 45
Set point		
Relay range	mbar (Torr)	1×10^{-8} to 5×10^{-3} (0.75×10^{-8} to 3.75×10^{-3}) 2 [RS 232]
Relay		
Relay contact rating		1 A @ 30 V AC/DC, resistive load
Relay contact resistance	m Ω	100
Relay contact endurance, min.		
1.0 A @ 30 V DC load		100 000
0.2 A @ 30 V DC load		2 000 000
Status indicators		LED-ring (360°)
Max. cable length	m	100
Overpressure limit	bar	6
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature (power off)	°C (°F)	85 (185)
Max. rel. humidity	% n.c.	0 - 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, 403 stainless steel, Ceramic (Al ₂ O ₃), Viton®, Titanium
Dead volume (DN 25 ISO-KF), approx.	cm ³	25.6
Weight (DN 25 ISO-KF)	g	318
Protection class	IP	40
CE certification		EMC Directive 2014/30/EC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 °C

Ordering Information

PENNINGVAC Transmitter PTR 225 N / PTR 237 N

	Part No.
PTR 225 N	
DN 25 ISO-KF, FCC 68 / RJ 45	15734V02
DN 25 ISO-KF, 3 SP, RS 232	89642V02
DN 25 ISO-KF, EtherCAT	230703V02
PTR 237 N	
DN 40 CF, FCC 68 / RJ 45	15736V02
Replacement cathode plate for PTR 90 N / PTR 225 N	EK16291V02
Replacement anode ring for PTR 90 N / PTR 225 N	20028711V02
Baffle, with centering ring (FPM (FKM)) DN 25 ISO-KF	230 078
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Operating Units	
DISPLAY TWO	230 024
DISPLAY THREE	230 025
GRAPHIX ONE	230680V01
GRAPHIX TWO	230681V01
GRAPHIX THREE	230682V01
Connection cable, FCC 68 on both ends ¹⁾	Type A
5 m	124 26
10 m	230 012
15 m	124 27
20 m	124 28
30 m	124 29
50 m	124 31
75 m	124 32
100 m	124 33
Connection cable, RS 232 ¹⁾	Type G
5 m	230550V01
10 m	230551V01
15 m	230552V01
20 m	230553V01

¹⁾ See chapter «Connection cables for Active Sensors»

Loadlock Transmitter

THERMOVAC TTR 200 N PENNINGVAC PTR 200 N



THERMOVAC Transmitter TTR 200 N (left) and PENNINGVAC Transmitter PTR 200 N (right)

The TTR 200 N and PTR 200 N combine different measurement technologies in one housing making them the perfect gauges for load lock applications. The transmitters offer a wide absolute measurement range and a differential range of -1013 to 1013 mbar (relative to ambient pressure). The highly accurate differential sensor is ideal for loadlock control since it is insensitive to changes in ambient pressure conditions. Efficient loadlock control will improve throughput due to reduced cycle time.

Advantages to the User

- Fast, accurate and repeatable pressure measurements reduce process cycle time
- Gas type independent pressure measurements from 50 mbar to 1500 mbar
- Combination of absolute and differential measurements offer unprecedented loadlock control
- Three integrated setpoints
- Up to three sensors in one housing for a wide measurement range
- Measurement signal insensitive to mounting position
- Ease of operation via analog output and digital communication
- LED ring to indicate status of the sensor

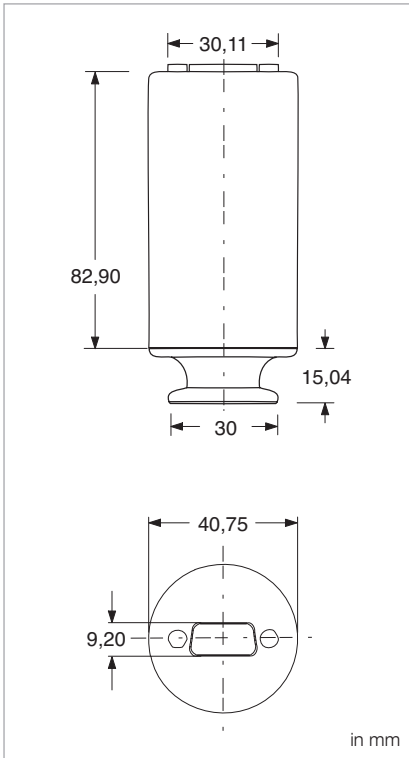
Typical Applications

- Load lock applications
- Chamber over and under pressure control relative to ambient
- Coating Systems (e. g. UNIVEX)
- Vacuum chamber production
- Processes requiring both absolute pressure measurement and atmospheric switching capabilities
- Analytical equipment (e. g. mass spectrometer control)
- Scanning electron microscopes

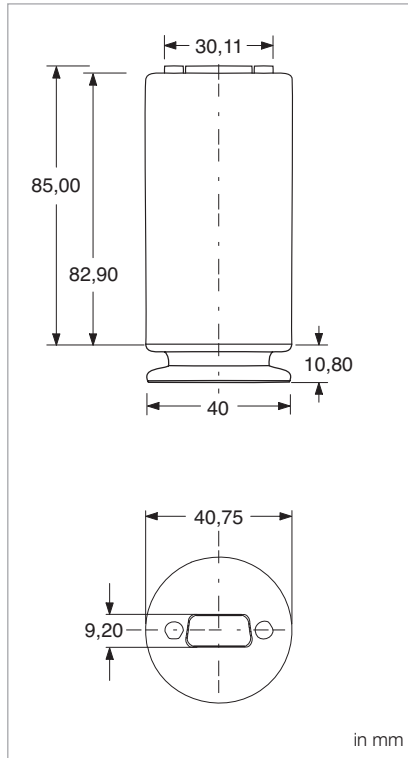
Option

For protection of the sensor TTR 200 N and PTR 200 N against contamination, radiation and other disturbing factors the installation of a baffle is recommended.

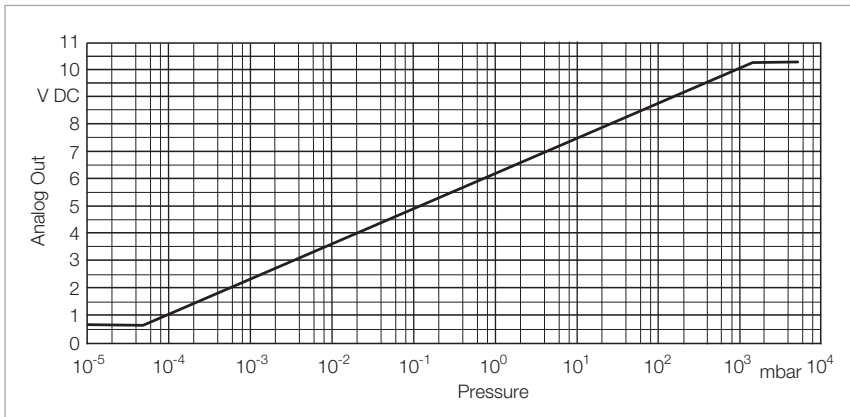
Two types of baffles are available: A build-in version for CF connections is mounted in the sensor; the baffle for ISO-KF connections is integrated in a centering ring.



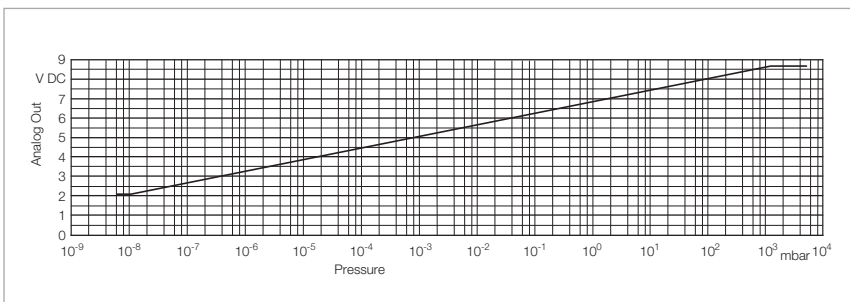
Dimensional drawing for the THERMOVAC transmitter TTR 200 N



Dimensional drawing for the PENNINGVAC transmitter PTR 200 N



Characteristic of the THERMOVAC Transmitter TTR 200 N



Characteristic of the PENNINGVAC transmitter PTR 200 N

Technical Data

Loadlock Transmitter

TTR 200 N

PTR 200 N

Measurement range (N ₂ and air) absolute	mbar (Torr)	5.0 x 10 ⁻⁵ to 1500 (3.75 x 10 ⁻⁵ to 1125)	1.0 x 10 ⁻⁸ to 1500 (0.75 x 10 ⁻⁵ to 1125)
differential	mbar (Torr)	5 x 10 ⁻⁵ to 1500 [RS 232] (3.75 x 10 ⁻⁵ to 1125) [RS 232]	1 x 10 ⁻⁸ to atm. [RS 232] (0.75 x 10 ⁻⁹ to atm.) [RS 232]
	mbar (Torr)	-1013 to 1013 [RS 232] (-760 to 760) [RS 232]	-1013 to 1013 [RS 232] (-760 to 760) [RS 232]
Measurement uncertainty of reading (typical) ¹⁾			
Cold cathode	mbar	-	1 x 10 ⁻⁸ to 1 x 10 ⁻³ ±30 % 1 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to atm. ±25 %
MEMS-Pirani	mbar	1 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to atm. ±25 %	1 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to atm. ±25 %
Diff. Piezo	mbar	-10 to 10 ±10 % ±0.67 mbar -100 to -10 ±8 % -1013 to -100 ±1 % 10 to 100 ±5 %	10 to 10 ±10 % ±0.67 mbar -100 to -10 ±8 % -1013 to -100 ±1 % 10 to 100 ±5 %
Repeatability of reading (typical) ¹⁾			
Penning	mbar	1 x 10 ⁻³ to 100 ±2 %	1 x 10 ⁻⁸ to 1 x 10 ⁻³ ±30 %
MEMS-Pirani	mbar	1 x 10 ⁻³ to 100 ±2 %	1 x 10 ⁻³ to 100 ±2 %
Diff. Piezo	mbar	-1013 to 10 ±1 %	-1013 to -10 ±1 %
Sensor Measurement principle		MEMS-Pirani and Diff. Piezo Thermal conductivity, combined with Piezo	Cold cathode, MEMS-Pirani and Diff. Piezo Thermal conductivity, combined with Piezo and cold cathode ionization
Supply voltage	V DC	9 - 30	9 - 30
Power consumption	W	< 1.2	< 2
Electrical connection		D-Sub 15 pin	D-Sub 15 pin
Analog output		$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 0.61 to 10.23	$V_{out} = \log_{10}(P_{mbar}) + 6.8$ 2.0 to 8.667
Resolution	V DC bit	16	16
Impedance	Ω	100	100
Update rate	Hz	16	16
Interfaces		RS 232	RS 232
Set point Range			
Absolute	mbar (Torr)	1 x 10 ⁻⁴ to 1333 (0.75 x 10 ⁻⁴ to 1000)	1 x 10 ⁻⁸ to 1333 (0.75 x 10 ⁻⁸ to 1000)
Differential	mbar (Torr)	-1013 to 133 (-775 to 100)	-1013 to 133 (-775 to 100)
Relay		3	3
Relay contact rating		1 A @ 30 V AC/ DC, resistive load	1 A @ 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100	100
Relay contact endurance, min.			
1.0 A @ 30 V DC load		100 000	100 000
0.2 A @ 30 V DC load		2 000 000	2 000 000
Status indicators		LED-ring (360°)	LED-ring (360°)
Max. cable length	m	20	20
Overpressure limit (abs.)	bar	2	2
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)	-20 to +65 (-4 to 149)
Max. bakeout temperature (power off)	°C (°F)	85 (185)	85 (185)
Max. rel. humidity	% n.c.	0 - 95	0 - 95
Installation orientation		Any	Any
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton [®] ,	304 stainless steel, Ceramic (Al ₂ O ₃), Tin, Gold, Viton [®] , Titanium,
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.8	28.6
Weight (DN 16 ISO-KF)	g	305	321
Protection class	IP	40	40
CE certification		EMC Directive 2014/30/EC	EMC Directive 2014/30/EC
Controller type		-	-

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40-60 ° C

Ordering Information

Loadlock Transmitter

TTR 200 N

PTR 200 N

	Part No.	Part No.
THERMOVAC TTR 200 N DN 16 ISO-KF, 3SP	230365V02	-
PENNINGVAC PTR 200 N DN 25 ISO-KF, RS 232, 3 SP	-	230087V02
Replacement cathode plate	-	EK16991V02
Replacement anode ring	-	20028711V02
Baffle, with centering ring (FPM (FKM)) DN 25 ISO-KF	-	230 078
Centering ring with fine filter DN 16 ISO-KF	883 96	-
Optional accessories		
Connection cable, RS 232 ¹⁾	Type G	Type G
5 m	230550V01	23055V01
10 m	230551V01	230551V01
15 m	230552V01	230552V01
20 m	230553V01	230553V01

¹⁾ See chapter «Connection cables for Active Sensors»

IONIVAC Transmitter ITR 90



The ITR 90 is an optimized combination transmitter. The combination of a hot cathode ionisation sensor according to Bayard-Alpert and a Pirani sensor permits vacuum pressure measurements of nonignitable gases and gas mixtures in the pressure range from 5×10^{-10} to 1000 mbar.

The ITR 90 can be ordered with integrated display or Profibus interface.

Advantages to the User

- Continuous pressure measurements from 10^{-10} mbar to atmospheric pressure
- High degree of reproducibility within the typical range for process pressures of 10^{-2} to 10^{-8} mbar
- Controlled switching on and off sequencing through the integrated double Pirani optimized the service life of the yttrium coated iridium cathodes
- Compact design
- Enclosed, rugged electrode geometry in a rugged metal housing
- Efficient degassing by electron bombardment
- Simple fitting of the sensor
- Extension for higher bake out temperatures during the measurements
- One signal covering 13 decades
- One flange joint for 13 decade
- ITR 90 model with built-in display for stand-alone operation without additional display components
- RS 232 C interface

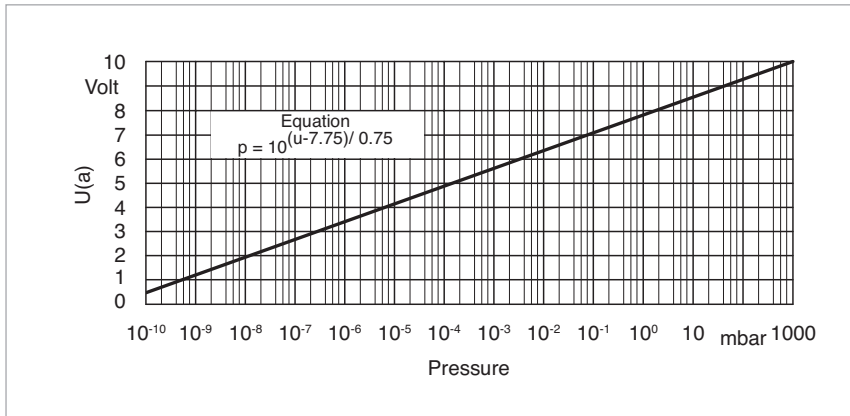
Typical Applications

- Analytical
- Evaporation and coating
- Vacuum furnaces
- General purpose pressure measurements in the fine and high vacuum ranges

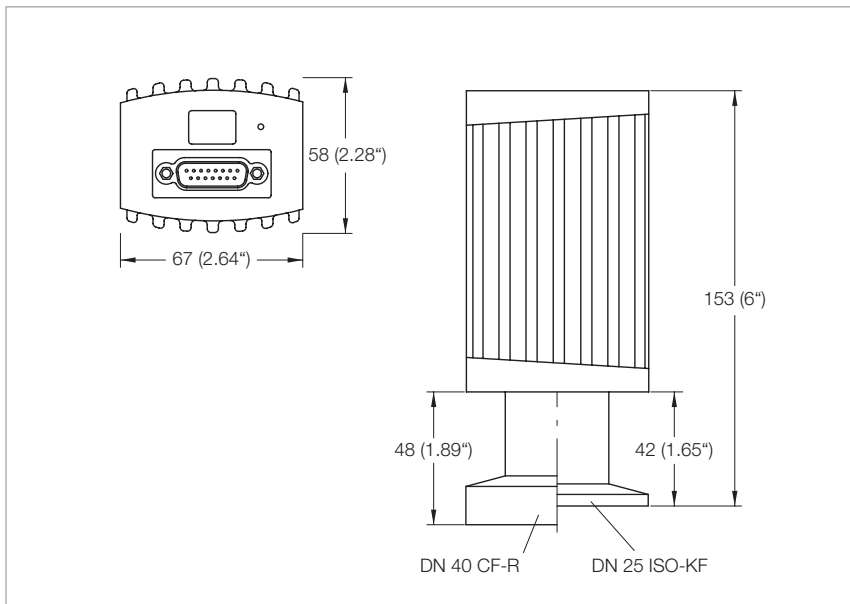
Sensor

The sensor of the ITR 90 contains a dual filament Pirani system as well as a Bayard-Alpert measurement system.

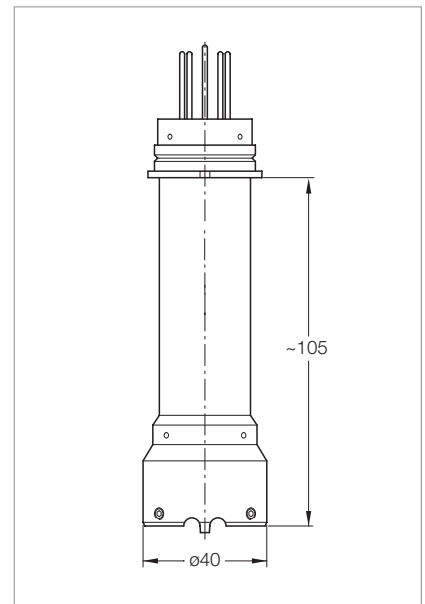
When using the bake out extension, measurements will be possible also at flange temperatures up to 150 °C.



Characteristic of the ITR 90



Dimensional drawing for the ITR 90; dimensions in brackets () are in inch



Dimensional drawing for the bake out extension

Technical Data

IONIVAC-Transmitter

ITR 90

Measurement range	mbar (Torr)	5 x 10 ⁻¹⁰ to 1000 (3.75 x 10 ⁻¹⁰ to 750)
Measurement uncertainty, 10 ⁻¹ - 1000 mbar		≥ 15% of the meas. value
Measurement uncertainty, 10 ⁻⁸ - 10 ⁻² mbar		15% of the meas. value
Reproducibility, 10 ⁻⁸ - 10 ⁻² mbar		5% of the meas. value
Principles of measurement		Hot cathode ionization according to Bayard-Alpert combined with thermal conductivity according to Pirani
Degas		Electron bombardment 3 minutes, max.
Supply voltage		20 to 28 V DC, typ. 24 V DC16
Power consumption, max.	W	16
Storage / nominal temperature range	°C	-20 to +70 / 0 to +50
Protection class		IP 30
Weight, approx.		
ITR 90, DN 25 ISO-KF	kg (lbs)	0.285 (0.64)
ITR 90, DN 40 CF	kg (lbs)	0.550 (1.24)
Sensor		Fully sealed, exchangeable
Degassing temperature, max.	°C	150 ¹⁾
Dead volume, approx.	cm ³	24 at DN 25 ISO-KF 34 at DN 40 CF
Materials in contact with the medium		Cu, W, Glass, NiFe, Mo, Stainless steel, Aluminum, Iridium, Yttrium, NiCr
Overpressure rating (abs.)	bar	2
Signal output (R _s ≥ 10 kΩ)		
Measurement signal		0 - 10 V, 0.774 - 10 V, 0.75 V pro decade
Error signal		< 0,5 V
Interface (standard / optional)		RS 232 C / ProfiBus
Electrical connection		15-way Sub-D male connector / pin contacts
Cable length, max.	m	100 / 30 at RS 232 C

¹⁾ Flange temperature when using the bake out extension

Ordering Information

IONIVAC-Transmitter ITR 90

without Display

with Display

	Part No.	Part No.
ITR 90, DN 25 ISO-KF	120 90	120 91
ITR 90, DN 25 ISO-KF, Profibus interface	230 030	-
ITR 90, DN 40 CF-R, rotatable CF flange	120 92	120 94
ITR 90, DN 40 CF-R, rotatable CF flange Profibus interface	230 031	-
Power supply for IONIVAC transmitter 100 - 240 V AC / 24 V DC incl. 5 m connection cable and 5 m RS 232 C cable	121 06	121 06
Bake out extension (100 mm, approx.)	127 06	127 06
Baffle, DN 25 ISO-KF, with Installation baffle for CF/ISO-KF variant	121 07	121 07
Replacement sensor IE 90, DN 25 ISO-KF ¹⁾	E 121 02	E 121 02
IE 90, DN 40 CF-R ¹⁾	E 121 03	E 121 03
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Connection cable	see chapter "Products", para. "Connection Cable for Active Sensors"	see chapter "Products", para. "Connection Cable for Active Sensors"

¹⁾ Including hex. socket screw key

IONIVAC Transmitter ITR 200 S



The ITR 200 S is an optimized dual cathode combination transmitter on the basis of the well proven ITR 90. The combination of a hot cathode ionization sensor according to Bayard-Alpert and a Pirani sensor allows vacuum pressure measurements of non-ignitable gases and gas mixtures in the pressure range from 5×10^{-10} to 1000 mbar.

Upon request, the pressure can be displayed on an integrated display.

Advantages to the User

- Service life increase and increased operational reliability through integration of a second hot cathode
- Full coverage of the pressure range from 5×10^{-10} mbar to atmospheric pressure
- High repeatability within the typical process pressure range of 10^{-2} to 10^{-8} mbar
- Controlled switching on and switching off through the integrated dual Pirani optimized the service life of the yttrium-coated iridium cathodes
- Compact design
- Enclosed, stable electrode geometry in rugged metal casing
- Efficient degassing through electron bombardment
- Simple to install
- ITR 200 S version with built-in display allows for stand-alone operation without the necessity for additional displays
- RS 232 C interface

Typical Applications

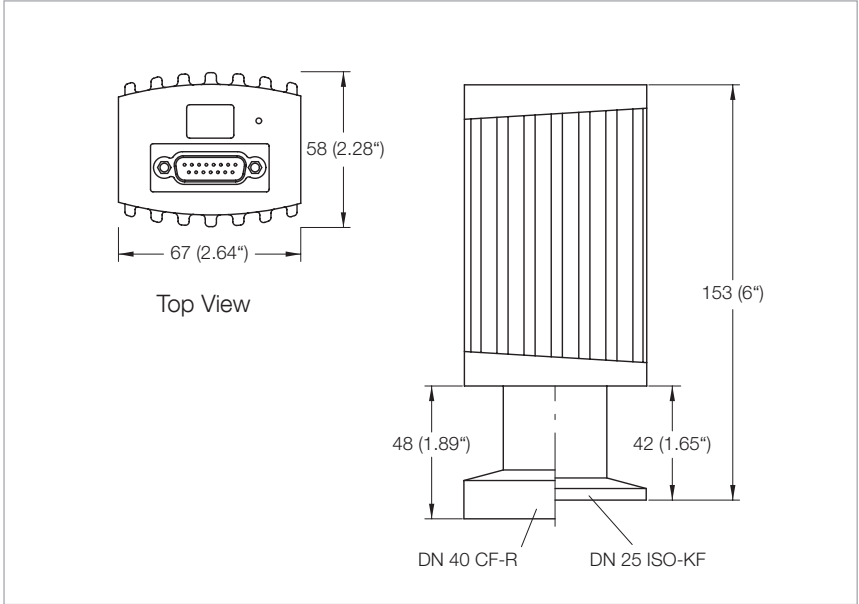
- Analytical engineering
- Sputtering and coating technology
- Vacuum furnaces
- Multipurpose pressure measurement in the medium and high vacuum range

Options

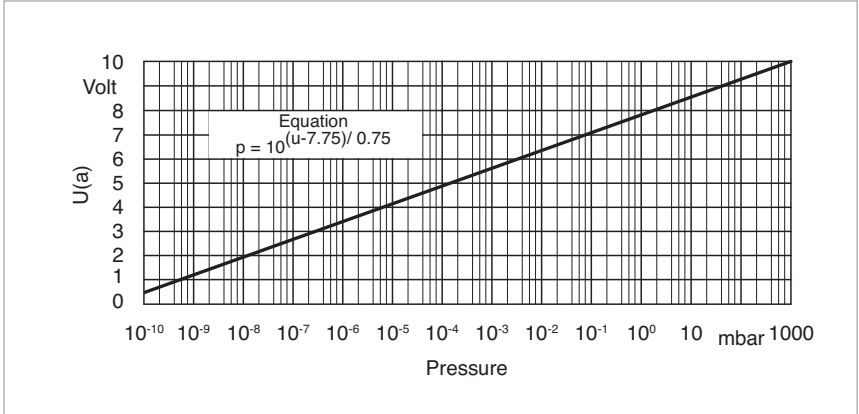
Upon request, the ITR 200 S can be supplied with an integrated display or a Profibus interface.

Sensor

The sensor of the ITR 200 S includes besides the Pirani system a dual cathode measurement system according to Bayard-Alpert. If one of the hot cathodes should burn out during operation, then the second cathode is automatically switched on. Moreover, each sensor contains a memory chip with the relevant system data. Thus after having exchanged a sensor, an automatic alignment is performed between sensor and operating electronics (plug and play).



Dimensional drawing for the ITR 200 S; dimensions in brackets () are in inch



Characteristic of the ITR 200 S

Technical Data

IONIVAC-Transmitter

ITR 200 S

Measurement range	mbar (Torr)	5 x 10 ⁻¹⁰ to 1000 (3.75 x 10 ⁻¹⁰ to 750)
Measurement uncertainty, 10 ⁻¹ - 1000 mbar		≥ 15% of the meas. value
Measurement uncertainty, 10 ⁻⁸ - 10 ⁻² mbar		15% of the meas. value
Reproducibility, 10 ⁻⁸ - 10 ⁻² mbar		5% of the meas. value
Principles of measurement		Hot cathode ionization according to Bayard-Alpert combined with thermal conductivity according to Pirani
Degas		Electron bombardment 3 minutes, max.
Supply voltage		20 to 28 V DC, typ. 24 V DC
Power consumption, max.	W	20
Storage / nominal temperature range	°C	-20 to +70 / 0 to +50
Protection class		IP 30
Weight, approx.		
ITR 200 S, DN 25 ISO-KF	kg (lbs)	0.50 (1.10)
ITR 200 S, DN 40 CF	kg (lbs)	0.75 (1.65)
Sensor		Fully sealed, exchangeable
Degassing temperature, max.	°C	150 ¹⁾
Dead volume, approx.	cm ³	24 at DN 25 ISO-KF 34 at DN 40 CF
Materials in contact with the medium		Cu, W, Glass, NiFe, Mo, Stainless steel, Iridium, Yttrium, NiCr
Overpressure rating (abs.)	bar	2
Signal output (R _a ≥ 10 kΩ)		
Measurement signal		0 - 10 V, 0.774 - 10 V, 0.75 V pro decade
Error signal		< 0,5 V
Interface (standard / optional)		RS 232 C / Profibus
Switching function		
Standard		1 normally open contact
Profibus		2 normally open contacts
Electrical connection		15-way Sub-D male connector / pin contacts
Cable length, max.	m	100 / 30 at RS 232 C

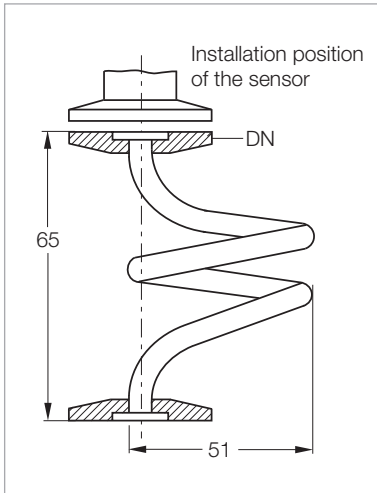
¹⁾ Flange temperature when using the bake out extension

Ordering Information

IONIVAC-Transmitter ITR 200 S without Display with Display

	Part No.	Kat.-Nr
ITR 200 S, DN 25 ISO-KF 1 switching function	230 250	230 251
ITR 200 SP, DN 25 ISO-KF, Profibus interface, 2 switching functions	230 252	-
ITR 200 S, DN 40 CF-R, rotatable CF flange 1 switching function	230 254	230 255
ITR 200 SP, DN 40 CF-R, rotatable CF flange Profibus interface, 2 switching functions	230 256	-
Options		
Power supply for IONIVAC transmitter 100 - 240 V AC / 24 V DC incl. 5 m connection cable and 5 m RS 232 C cable	121 06	121 06
Baffle, DN 25 ISO-KF, with Installation baffle for CF/ISO-KF variant	121 07	121 07
Replacement sensor		
IE 200, DN 25 ISO-KF ²⁾	240 020	240 020
IE 200, DN 40 CF-R ²⁾	240 021	240 021
IE 200 SL ¹⁾ , DN 40 CF-R ²⁾	-	240 022
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Connection cable	see chapter "Products", para. "Connection Cable for Active Sensors"	see chapter "Products", para. "Connection Cable for Active Sensors"
¹⁾ SL = long version (bake out version)		
²⁾ Including hex. socket screw key		

Spiral Tube



Dimensional drawing for the spiral tube

Advantages to the User

Pressure sensors may through the use of the spiral tube be better protected against contamination like condensate, vapours and dusts. Thus measurement accuracy is improved and a longer service life of the pressure sensors is attained.

Installation is recommended in connection with

- measurement system TTR (preferred)
- CERAVAC CTR

Operating Principle

Through the specially developed geometry which provides a constant slope, possibly occurring contamination is removed.

Maintenance

Depending on the type of application regular maintenance on the spiral tube is recommended.

Note

- Measurement errors caused by the increased conductance of the component need to be taken into account
- Low vibration mounting must be ensured
- The sensor must be connected at the upper end

Technical Data

Materials	Stainless steel
------------------	-----------------

Spiral Tube

Ordering Information

Spiral Tube

	Part No.
Spiral Tube	
DN 16 ISO-KF	230 082
DN 25 ISO-KF	230 083
DN 40 ISO-KF	230 084

Connection Cables for Active Sensors

Active Sensors

Operating Units for Active Sensors

DISPLAY ONE

DISPLAY TWO DISPLAY THREE

GRAPHIX ONE GRAPHIX TWO GRAPHIX THREE

THERMOVAC Transmitter (FCC 68) TTR 91 N, TTR 91 NS, TTR 96 NS a. o. TTR 101 N, TTR 101 NS2 TTR 911 N, TTR 916 N	Type A	Type A	Type A
THERMOVAC Transmitter (RS 232) TTR 911 N, TTR 101 N, TTR 200 N	-	-	Type G
PENNINGVAC Transmitter (FCC 68) PTR 90 N, PTR 225 N, PTR 237 N	Type A (only PTR 90)	Type A	Type A
PENNINCVCAC Transmitter (RS 232) PTR 90 N, PTR 225 N, PTR 200 N	-	-	Type G
CERAVAC Transmitter (RS 232) CTR 100 N, CTR 101 N (digital signal)	-	-	Type C
IONIVAC Transmitter (RS 232) ITR 90, ITR 200 S	-	-	Type C

Active Sensors

Operating Units for Active Sensors

IONIVAC IM 540 (Channel 3 and 4)

CMove

Bare wire ends

THERMOVAC Transmitter (FCC 68) TTR 91 N, TTR 91 NS, TTR 96 NS a. o. TTR 101	Type A	Type A	-
CERAVAC Transmitter (RS 232) CTR 91 N, CTR 100 N, CTR 101 N (analog signal)	Type B	Type B	Type E
IONIVAC Transmitter (RS 232) ITR 90, ITR 200 S	-	Type C	Type E

Active Sensors

Operating Unit for Active Sensors VACVISION

THERMOVAC Transmitter (FCC 68) TTR 91 N, TTR 91 NS, TTR 96 NS a. o. TTR 101 N	Type F
PENNINGVAC Transmitter (FCC 68) PTR 90 N, PTR 225 N, PTR 237 N	Type F

Technical Data

Connection Cable

Sensor side

Controller-/Customer side

Cable	Sensor side	Controller-/Customer side
Type A	FCC 68 (RJ45) on both ends, 8-way, shielded	FCC 68 (RJ45) on both ends, 8-way, shielded
Type B	Sub-D 15-way female 8-way, shielded	FCC 68 (RJ45), 8-way, shielded
Type C	Sub-D 15-way female, shielded	Sub-D 15-way male, shielded
Type E	Sub-D 15-way female shielded	bare wire ends, shielded
Type F	FCC 68 (RJ45), shielded	Sub-D 15-way male, shielded
Type G	Sub-D 15-way HD female shielded	Sub-D 15-way male, shielded

Ordering Information

Connection Cable

Type A

Type B

	Part No.	Part No.
Cable length		
5 m	124 26	230 013
10 m	230 012	230 014
15 m	124 27	230 015
20 m	124 28	230 016
30 m	124 29	230 017
50 m	124 31	230 019
75 m	124 32	230 020
100 m	124 33	230 021

Measuring,
controlling

Ordering Information

Connection Cable

Type C

Type E

	Part No.	Part No.
Cable length		
5 m	124 55	124 63
10 m	230 022	163 69
15 m	124 56	124 64
20 m	124 57	124 65
30 m	124 58	–
50 m	230 345 V01	–

Ordering Information

Connection Cable

Type F

	Part No.
Cable length	
5 m	230 032 V01
10 m	230 033 V01

Operating Units for Active Sensors

DISPLAY ONE



Cost-effective, compact single channel display unit for the transmitters from the THERMOVAC series and for PTR 90.

Advantages to the User

- Power supply voltage for the transmitters
- Four digit mantissa in the range from 5×10^{-9} to 2000 mbar
- Readout selectable between mbar, Torr or Pascal
- 0 to 10 V chart recorder output via plug-in screw terminals
- The switching threshold of the transmitters has been looped through to plug-in terminals
- The transmitter switching threshold settings are displayed
- Compact bench top enclosure (1/4 19", 2 HU)
- For fitting into 19", 3 HU racks
- Supply voltage 100 - 240 V

Connectable Sensors

THERMOVAC

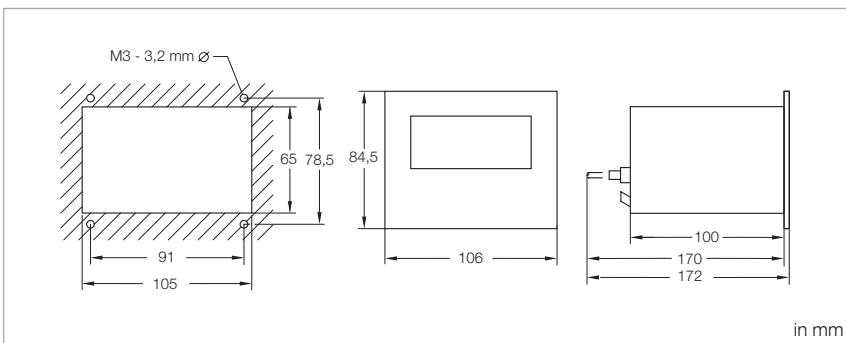
- TTR 100 *)
- TTR 101 / TTR 101
- TTR 101 S / TTR 101 N S
- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 90 S *)
- TTR 91 / TTR 91 N
- TTR 91 S / TTR 91 N S
- TTR 96 S / TTR 96 N S
- TTR 911 / TTR 911 N
- TTR 916 / TTR 916 N

PENNINGVAC

- PTR 90 / PTR 90 N

Linear pressure sensor

- DU 200
- DU 201
- DU 2000
- DU 2001
- DU 2001 rel.



Dimensional drawing and panel cut-out for the DISPLAY ONE

*) Connecting of older sensors possible

Technical Data

DISPLAY ONE

Number of measurement channels	1		
Display for measured values	digital, 7 segment LED		
Measurement range	mbar (Torr)	5 x 10 ⁻⁹ to 2000 (3.8 x 10 ⁻⁹ to 1500)	
Unit of measurement (selectable)	mbar, Torr, Pa		
Switching thresholds	from the transmitter are run to a terminal strip		
Chart recorder output (R _a > 2,5 kΩ)	0 - 10 Volt, characteristic corresponds to the connected transmitter		
Mains connection			
EURO version	V AC / Hz	100 - 240 / 50/60	
US version	V AC / Hz	100 - 240 / 50/60	

Ordering Information

DISPLAY ONE

	Part No.
DISPLAY ONE with mains cord (EURO and US)	230 001
THERMOVAC Transmitter PENNINGVAC Transmitter PTR 90	see chapter "Products", para. "Active Sensors"
Linear pressure sensors DU	see chapter "Products", para. "Additional Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A)	see chapter "Products", para. "Connection Cables for Active Sensors"
Adapter panel for installation in a 2 HU, 19" rack	230 005

DISPLAY TWO / THREE



Cost-effective, operating and display units for the transmitters from the THERMOVAC and PENNINGVAC series.

All channels are displayed simultaneously.

Advantages to the User

- Power supply voltage for the transmitters
- Display range from 1×10^{-9} to 2000 mbar (0.75×10^{-9} to 1500 Torr)
- Readout selectable between mbar, Torr or Pascal
- Adjustable switching thresholds with variable hysteresis, floating change-over contacts and visual indication of the switching status in the display
- Option of entering gas correction factors
- Separate chart recorder outputs 0 - 10 V for each measurement channel
- Compact bench top enclosure (1/4 19", 3 HU)
- For fitting into 19", 3 HU racks

Connectable Sensors

THERMOVAC

- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 91 / TTR 91 N
- TTR 96 S / TTR 96 N S
- TTR 100 *)
- TTR 100 S *)
- TTR 101 / TTR 101 N
- TTR 101 S / TTR 101 N S
- TTR 911 / TTR 911 N
- TTR 916 / TTR 916 N

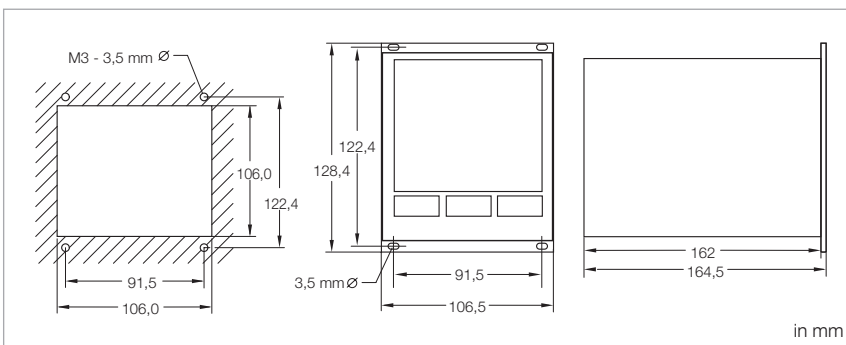
PENNINGVAC

- PTR 90 / PTR 90 N
- PTR 225 / PTR 225 N
- PTR 225 S / PTR 225 N S
- PTR 237 / PTR 237 N

Linear pressure sensor

- DU 200
- DU 201
- DU 2000
- DU 2001
- DU 2001 rel.

*) Connecting of older sensors possible



Dimensional drawing and panel cut-out for the DISPLAY TWO and THREE

Technical Data

DISPLAY TWO

DISPLAY THREE

Number of measurement channels	2	3
Display for measured values	2 (1 per channel)	3 (1 per channel)
Measurement range mbar (Torr)	1 · 10 ⁻¹⁰ to 2000	1 · 10 ⁻¹⁰ to 2000
Unit of measurement (selectable)	adjustable	adjustable
Gas type correction (for PTR)	4 floating changeover contacts	6 floating changeover contacts
Sensor connection	60 V, 1 A DC / 30 V, 1 A AC	60 V, 1 A DC / 30 V, 1 A AC
Sensor power supply V DC	1 per channel,	1 per channel,
Electrical outputs	configurable as 2nd switching threshold	configurable as 2nd switching threshold
Switching thresholds Number Adjustment range Hysteresis Relay contact Load rating Ready signal relay	2 (1 per channel) sensor dependent adjustable 4 floating changeover contacts 60 V, 1 A DC / 30 V, 1 A AC 1 per channel, configurable as 2nd switching threshold	3 (1 per channel) sensor dependent adjustable 6 floating changeover contacts 60 V, 1 A DC / 30 V, 1 A AC 1 per channel, configurable as 2nd switching threshold
Error message Relay contact Load rating	normally open contact 60 V, 1 A DC / 30 V, 1 A AC	normally open contact 60 V, 1 A DC / 30 V, 1 A AC
Chart recorder output (R _s > 10 kΩ)	0 - 10 V per measurement channel, output characteristic corresponds to the connected transmitter	0 - 10 V per measurement channel, output characteristic corresponds to the connected transmitter
Control input	PENNINGVAC PTR: high voltage on	PENNINGVAC PTR: high voltage on
Mains connection V AC / Hz	85 - 240 / 50/60	85 - 240 / 50/60
Power consumption W	< 10	< 15
Nominal temperature range °C	+5 to +50	+5 to +50
Weight kg (lbs)	1.3 (2.87)	1.4 (3.09)
Protection class IP	40	40

Ordering Information

DISPLAY TWO

DISPLAY THREE

	Part No.	Part No.
DISPLAY TWO / THREE with mains cord (EURO and US)	230 024	230 025
THERMOVAC Transmitter	see chapter "Products", para. "Active Sensors"	see chapter "Products", para. "Active Sensors"
PENNINGVAC Transmitter	see chapter "Products", para. "Active Sensors"	see chapter "Products", para. "Active Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A)	see chapter "Products", para. "Connection Cables for Active Sensors"	see chapter "Products", para. "Connection Cables for Active Sensors"

Controller for Active Sensors

GRAPHIX ONE / TWO / THREE



Controller GRAPHIX with different displays and rear panel (right)

Universal 1 to 3 channel display and operating unit with persistent display of all measurement channels, suited for the active sensors of the THERMOVAC, CERA VAC, linear sensors (DU series), PENNINGVAC and IONIVAC series.

Advantages to the User

- Display range from 1×10^{-10} to 2000 mbar
- 3.5" touch screen display with intuitive menu interface
- Graphic display of the measurement data
- Internal and external (front side USB) storing of measurement data and configuration files
- Leak rate indication based on the pressure rise method
- 6 adjustable variable hysteresis switching thresholds, floating changeover contacts and visual indication of the switching status in the display area, freely assignable to the individual measurement channels
- Different visualisation options (graphs and decimal display with zoom function)
- For connection of all active sensors of other brands
- Degas function for ITR transmitters
- Zero alignment for CTR transmitters
- 3 separate chart recorder outputs 0 to 10 V for each measurement channel (analogue output)
- 4th programmable chart recorder output optional
- RS 232 C / RS 485 C interface with adjustable baud rate
- Relay output for error indication
- Display selectable between mbar, Torr, micron, Pascal or psi
- Compact installation and benchtop enclosure (1/4 19" 3 HU)
- Software update via USB optional
- Languages: English, German, Chinese, Japanese, French; Italian, Spanish, Korean
- Visualisation through LEYASSIST



running on a PC

Connectable Sensors

THERMOVAC

- TTR 211 / TTR 216 S
- TTR 90 / TTR 91 / TTR 91 N
- TTR 96 S / TTR 96 N S
- TTR 100 / TTR 100 S2
- TTR 101 / TTR 101 N / TTR 101 S2 / TTR 101 N 2S
- TTR 911 / TTR 911 N
- TTR 916 / TTR 916 N

CERA VAC

- CTR 90 / CTR 91
- CTR 100 / CTR 100 N
- CTR 101 / CTR 101 N

Linear pressure sensors

- DU 200 / DU 201
- DU 2000 / DU 2001
- DU 2001 rel.

PENNINGVAC

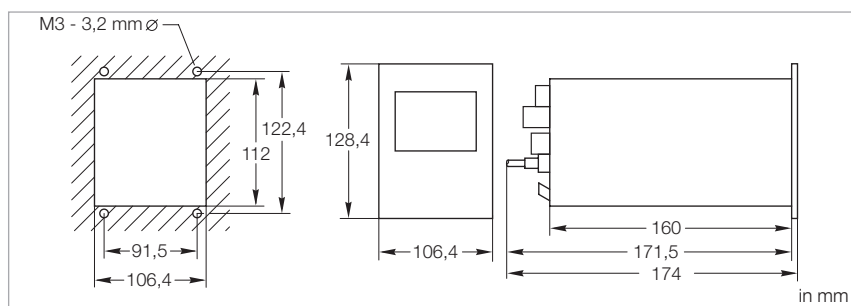
- PTR 90 / PTR 90 N
- PTR 225 / PTR 225 N
- PTR 225 S / PTR 225 N S
- PTR 237 / PTR 237 N

IONIVAC

- ITR 90 / ITR 90 N
- ITR 200 S / ITR 200 N S
- ITR 200 N SL

Other brands

- Active sensors with linear or logarithmic output



Front panel cut-out and dimensional drawing for the controller GRAPHIX ONE to THREE

Technical Data

GRAPHIX ONE

GRAPHIX TWO

GRAPHIX THREE

Number of measurement channels		1	2	3
Measured values display	3.5" graph. TFT touch display			
Display range	mbar (Torr)	1 x 10 ⁻¹⁰ to 2000 (0.75 x 10 ⁻¹⁰ to 1500)		
Unit of measurement (selectable)	mbar, Torr, microns, Pa, Psi			
Gas type correction	factor adjustable			
Sensor connection	15-way Sub-D socket and FCC68 (RJ45)			
Sensor power supply	V DC	24 +/- 5%		
Relay inputs and outputs	25-way Sub-D socket			
Switching threshold	freely assignable to the measurement channels			
Number	6			
Adjustment range	sensor dependent			
Hysteresis	adjustable			
Relay contact	floating changeover contact			
Load rating	1 A / 30 V AC / 30 V DC			
Error message				
Relay contact	floating normally open contact			
Load rating	1 A / 30 V AC / 30 V DC			
Chart recorder output (R _a > 10 kΩ)	0 to 10 V per measurement channel, output characteristic corresponds to the connected sensor, additionally one further chart recorder output can be programmed			
Control input	PTR: high voltage on, ITR 90/200: emission on			
Interface RS 232 C / RS 485 C	9-way Sub-D socket			
Mains connection	V AC / Hz	100 - 240 / 50/60		
Power consumption	W	< 50	< 70	< 100
Nominal temperature range	°C	+5 to +45		
Weight	kg (lbs)	1.7 (3.75)		
Protection class	20			
Possible languages	English, German, Chinese, Japanese, French, Italian, Spanish, Korean			

Ordering Information

GRAPHIX ONE

GRAPHIX TWO

GRAPHIX THREE

	Part No.	Part No.	Part No.
GRAPHIX controller including 2 m EURO- and US mains cord	230680V01	230681V01	230682V01
THERMOVAC, PENNINGVAC, CERA VAC, linear sensors (DU) and IONIVAC transmitter	see chapter "Products", para. "Active Sensors"	see chapter "Products", para. "Active Sensors"	see chapter "Products", para. "Active Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A), CERA VAC (Type B analog, Type C digital and IONIVAC (Type C)	see chapter "Products", para. "Connection Cables for Active Sensors"	see chapter "Products", para. "Connection Cables for Active Sensors"	see chapter "Products", para. "Connection Cables for Active Sensors"
Screw connection for the 9-way Sub-D socket	230006	230006	230006
Adapter USB/RS 232 C	800110V0103	800110V0103	800110V0103
LEYASSIST GRAPHIX visualisation and operating software, including data storage and export (CSV file)	230440V01	230440V01	230440V01

LabView® ¹⁾ driver, online via download available

¹⁾ LabView is a registered trademark of the company National Instruments

Ultra High Vacuum Operating Units and Passive Sensors

COMBIVAC CM 51/CM 52



The COMBIVAC CM 51 covers the complete pressure range between 10^{-9} and 1000 mbar by combining two measurement principles - THERMOVAC and PENNINGVAC - providing both monitoring and control functions.

The COMBIVAC CM 52 offers by combining two UHV principles of measurement (THERMOVAC absolute pressure sensor and Bayard-Alpert measurement system IE 414 or extractor measurement system IE 514) measurements of vacuum pressures in the range between 10^{-12} and 1000 mbar.



Rear side of the COMBIVAC CM 51 (left) and CM 52 (right)

Advantages to the User

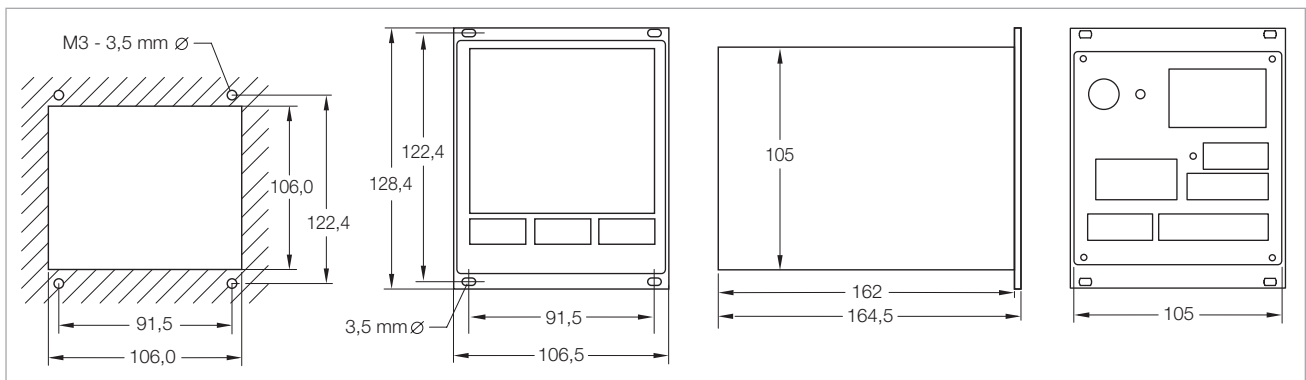
- Compact 3 channel operating unit for a pressure range for passive sensors of
 - 10^{-9} to 1000 mbar (CM 51)
 - 10^{-12} to 1000 mbar (CM 52)
- Automatic switchover from THERMOVAC operation to
 - Penning (cold cathode) operation (CM 51)
 - UHV sensors (Bayard-Alpert measurement system IE 414 or extractor measurement system IE 514) (CM 52)
- Measurement cable lengths up to 100 meters are possible depending on the type of application
- Easy to operate
- Keyboard locking through SOFT-LOCK
- Two adjustable switching thresholds with a relay contact for each measurement channel
- Logarithmic chart recorder output 0 - 10 V or 2 - 10 V
- Wide range power supply 100 - 240 V
- Unit of pressure selectable between mbar, Torr und Pascal
- Compact, rugged Penning sensor insensitive to operation at high pressures (see para. "Sensors")
- Aligned and temperature compensated THERMOVAC sensors (see para. "Sensors")
- Cost-effective replacement sensors and electrodes
- Error message for each channel, for example in the case of broken filament, defective sensor line or failed plasma discharge
- Compact benchtop enclosure (1/4 19", 3 HU) made of metal for installation in front panel cut outs and 19" racks
- RS 232 C and Profibus interface
- CE mark
- RoHS-compliant

Typical Applications

- Universal monitoring the operation of high vacuum pump systems like:
 - Turbomolecular pump systems
 - Diffusion pump systems
 - Cryogenic pump systems
- Annealing, melting, brazing and hardening furnaces
- Coating systems
- Analytical instrumentation
- Deployment in thermal radiation resistant and degassable systems is possible
- Particle accelerators

Connectable Sensors

- THERMOVAC
- TR 211
 - TR 211 NPT
 - TR 212
 - TR 216
- PENNINGVAC (only CM 51)
- PR 25
 - PR 26
 - PR 27
 - PR 28
- IONIVAC (only CM 52)
- IE 414
 - IE 514



Front panel cut-out (left) and dimensional drawing (right) for the COMBIVAC CM 51 and CM 52

Technical Data

COMBIVAC

CM 51

CM 52

		3	3
Number of measurement channels		3	3
Measurement range			
Channel 1, 2 (THERMOVAC)	mbar (Torr)	5 x 10 ⁻⁴ to 1000 (3.5 x 10 ⁻⁴ to 750)	5 x 10 ⁻⁴ to 1000 (3.5 x 10 ⁻⁴ to 750)
Channel 3 (PENNINGVAC)	mbar (Torr)	10 ⁻⁹ to 10 ⁻² (10 ⁻⁹ to 10 ⁻²)	–
Channel 3			
(IE 414 Bayard-Alpert)	mbar (Torr)	–	2 x 10 ⁻¹¹ to 1 x 10 ⁻² (1.5 x 10 ⁻¹¹ to 0.75 x 10 ⁻²)
(IE 514 Extractor)	mbar (Torr)	–	2 x 10 ⁻¹² to 1 x 10 ⁻⁴ (1.5 x 10 ⁻¹² to 0.75 x 10 ⁻⁴)
Unit of measurement (selectable)		mbar, Torr, Pa	mbar, Torr, Pa
Measurement uncertainty			
THERMOVAC		≤ 20% of the measured value in the range 10 ⁻³ to 10 ⁻² mbar (± 20%) in the range 10 ⁻² to 10 ² mbar (± 15%)	≤ 20% of the measured value in the range 10 ⁻³ to 10 ⁻² mbar (± 20%) in the range 10 ⁻² to 10 ² mbar (± 15%)
PENNINGVAC		± 30% of the measured value in the range 10 ⁻⁸ to 10 ⁻⁴ mbar	–
IE 414/514		–	± 10% of the displayed value (however, this value may increase depending on the type of application)
Measurement cable	m	up to 100 (application dependent)	up to 100 (application dependent)
Display for measured values		digital, 7 segment LED, 4 digit mantissa and 2 digit exponent	digital, 7 segment LED 4 digit mantissa and 2 digit exponent
Type of gas (selectable)		factor adjustable	factor adjustable
Switching thresholds		2 per channel	2 per channel
Operating mode		single, interval-trigger	single, interval-trigger
Adjustable switching thresholds			
THERMOVAC	mbar (Torr)	5 x 10 ⁻³ to 500 (5 x 10 ⁻³ to 375)	5 x 10 ⁻³ to 500 (5 x 10 ⁻³ to 375)
PENNINGVAC	mbar (Torr)	1 x 10 ⁻⁸ to 9.9 x 10 ⁻³ (0.75 x 10 ⁻⁸ to 7.4 x 10 ⁻³)	–
Bayard-Alpert	mbar (Torr)	–	1 x 10 ⁻⁸ to 5 x 10 ⁻³ (0.75 x 10 ⁻⁸ to 3.75 x 10 ⁻³)
Extractor	mbar (Torr)	–	1 x 10 ⁻¹¹ to 1 x 10 ⁻¹¹ (0.75 x 10 ⁻¹¹ to 0.75 x 10 ⁻¹¹)
Switching relay hysteresis		10% of the trigger value (default), freely adjustable for THERMOVAC and PENNINGVAC	10% of the trigger value (default), freely adjustable for THERMOVAC and IE 414 or 514
Relay contact load rating		AC/DC, max. 30 V / 1 A	AC/DC, max. 30 V / 1 A
Chart recorder output (default)			
THERMOVAC		0 to 10 V, log. divisions linear: 3 decades, approximately 10.5 V in case of a failure, logarithmic: (1 x 10 ⁻³ mbar), 1.67 V/decade	0 to 10 V, log. divisions linear: 3 decades, approximately 10.5 V in case of a failure logarithmic: (1 x 10 ⁻³ mbar), 1.67 V/decade
PENNINGVAC		logarithmic: (1 x 10 ⁻⁹ mbar), 1.43 V/ decade	–
IE 414 or 514		–	logarithmic: (1 x 10 ⁻¹² mbar), 1.00 V/decade
Interface		RS 232 C, RS 485 and Profibus	RS 232 C, RS 485 and Profibus
Mains connection 50/60 Hz	V AC	100 - 240	100 - 240
Power consumption	W	< 10	65
Storage temperature range	°C	-20 to +60	-20 to +65
Nominal temperature range	°C	+5 to +50	+5 to +50
Max. rel. humidity	% n.c.	80	80
Weight	kg (lbs)	1.4 (3.09)	1.4 (3.09)
Dimension (W x H x D)	mm	106.4 x 128.5 x 164.5	106.4 x 128.5 x 164.5
Installation depth	mm	approx. 220	approx. 220
Protection class	IP	40	40

Ordering Information

COMBIVAC

	CM 51	CM 52
	Part No.	Part No.
Operating unit COMBIVAC CM 51/52 including EURO and US mains cord, 2 m with RS 232 C / 485 with Profibus DB	230 110 230 111	230 115 230 116
Cable adapter CM 31 - CM 51	230 112 V01	-
Options		
19" installation frame	161 00	161 00
1/4 19" blank panel	161 02	161 02
THERMOVAC sensors for CM 51/52		
TR 211, DN 16 ISO-KF	157 85	157 85
TR 211, 1/8" NPT	896 33	896 33
TR 212, DN 16 ISO-KF	158 52	158 52
TR 212, DN 16 CF	157 86	157 86
TR 216, DN 16 ISO-KF	157 87	157 87
Gauge head cables for TR sensors		
5 m	162 26	162 26
10 m	162 27	162 27
15 m	124 34	124 34
20 m	162 28	162 28
30 m	124 35	124 35
50 m	124 37	124 37
75 m	124 38	124 38
100 m	124 39	124 39
PENNINGVAC sensors for CM 51		
PR 25, DN 25 ISO-KF	157 52	-
PR 26, DN 40 ISO-KF	136 46	-
PR 27, DN 40 CF	136 47	-
PR 28, DN 40 CF, bakeable	136 48	-
Gauge cables for PR sensors		
5 m	162 88	-
10 m	162 89	-
15 m	124 49	-
20 m	157 56	-
30 m	124 50	-
50 m	124 52	-
75 m	124 53	-
100 m	124 54	-
IONIVAC sensors for CM 52		
IE 414, DN 40 CF	-	158 66
IE 514, DN 40 CF	-	158 67
Mains cable		
3 m (US)	800 102 V1002	800 102 V1002
Gauge head cables for IE sensors		
5 m	-	158 68
10 m	-	150 88
15 m	-	230 670 V01
5 m, bakeable to 200 °C	-	158 44
10 m, bakeable to 200 °C	-	230 671 V01
Extension cables for IE 414/514		
10 m	-	245 002
20 m	-	200 02 937
50 m	-	245 010 V01
up to 100 m (application dependent)	-	upon request

THERMOVAC Sensors

TR 211 / TR 211 NPT / TR 212 / TR 216



These passive sensors use thermal conductivity technology according to Pirani.

Advantages to the User

- Measurement range 5×10^{-4} to 1000 mbar (3.75×10^{-4} to 750 Torr)
- Tungsten or platinum filament
- Cost-effective sensing cell
- Fully aligned and temperature compensated 0 to +40 °C
- Constant filament temperature

TR 211

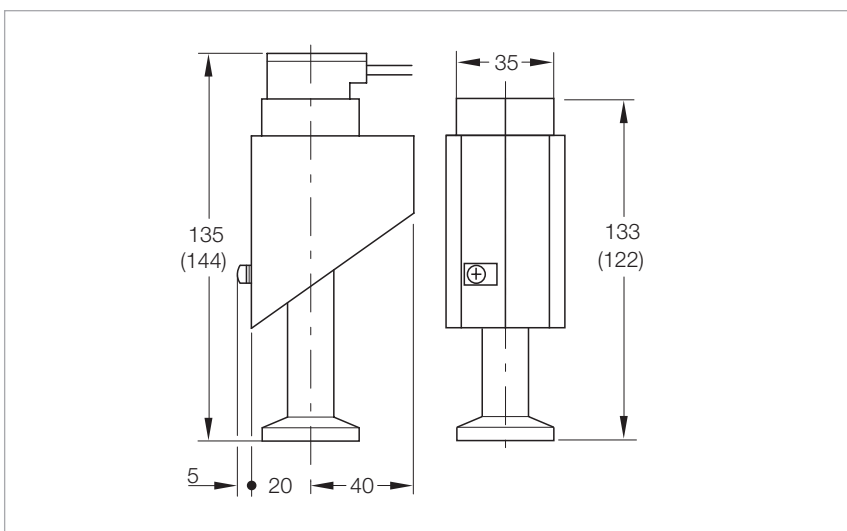
- Aluminum sensing cell with tungsten filament
- Improved temperature compensation

TR 211 NPT/TR 212

- Stainless steel sensing cell with tungsten filament
- Overpressure resistant

TR 216

- Stainless steel sensing cell with platinum filament and ceramics feed through
- Well suited for corrosive processes and water vapor atmospheres



Dimensional drawing for the TR 211, TR 212 and TR 216; TR 211 NPT in brackets

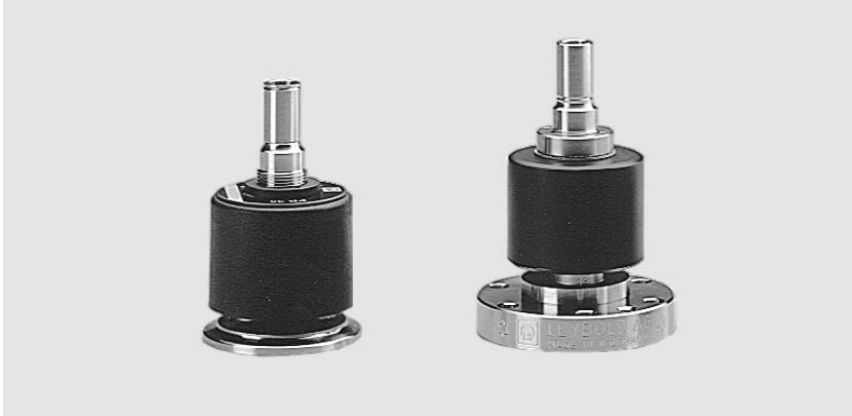
Technical Data
TR 211
TR 211 NPT
TR 212
TR 216

Measurement range	mbar (Torr)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)
Operating temperature range (compensated)	°C	0 to +40	0 to +40	0 to +40	0 to +40
Storage temperature range, max.	°C	80	80	80	80
Filament		Tungsten	Tungsten	Tungsten	Platin
Filament temperature	°C	110	110	110	110
Permissible overload (abs.), max.	bar	3	3	10	10
Volume of the sensing cell, approx.	cm ³	11	11	11	11
Vacuum connection	DN	16 ISO-KF	1/8" NPT	16 ISO-KF/16 CF	16 ISO-KF
Materials in contact with the medium		Aluminum, Vacon, Glass, Tungsten CrNi 8020,	Stainless steel, Vacon, Glass, Tungsten CrNi 8020 epoxy cement	Stainless steel, Vacon, Glass, Tungsten CrNi 8020	Stainless steel 1.4301 (SS 304), Al ₂ O ₃ , CrNi 8020, Platinum
Operating units		THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20	THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20	THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20	THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20

Ordering Information
TR 211
TR 211 NPT
TR 212
TR 216

	Part No.	Part No.	Part No.	Part No.
THERMOVAC sensors Series 200				
DN 16 ISO-KF	157 85	-	158 52	157 87
DN 16 CF	-	-	157 86	-
DN 1/8" NPT	-	896 33	-	-
Replacement sensing cell	E 157 75	E 896 34	-	E 157 77

PENNINGVAC Sensors PR 25 / PR 26 / PR 27 / PR 28



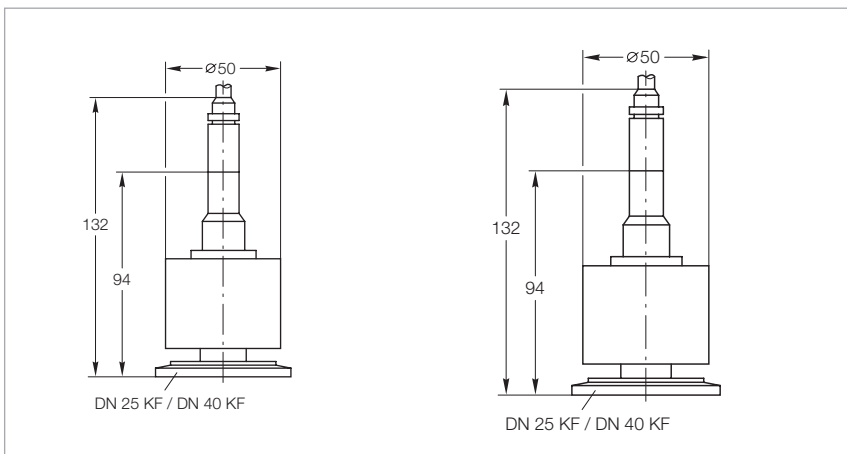
These passive sensors use cold cathode ionization technology according to Penning.

Advantages to the User

- Rugged
- Insensitive to air inrushes and vibrations
- Easy disassembly and cleaning of the measurement system
- Exchangeable cathode plate
- Improved ignition characteristic through titanium cathodes

Option

For protection of the PENNINGVAC sensors against contamination, radiation and other disturbing factors the installation of a baffle is recommended.



Dimensional drawing for the PENNINGVAC PR sensors

Technical Data
PR 25
PR 26
PR 27
PR 28

Measurement range	mbar (Torr)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)
High voltage supply (anode potential)					
Trigger voltage	kV	3.3	3.3	3.3	3.3
Operation voltage	kV	1.6	1.6	1.6	1.6
Storage temperature range	°C	-25 to +80	-25 to +80	-25 to +80	-25 to +80
Nominal temperature range	°C	0 to +80	0 to +80	0 to +80	0 to +200
Bake out temperature (flange)	°C	-	-	-	200
Permissible overload (abs.)	bar	6 ¹⁾	6 ¹⁾	6 ¹⁾	6 ¹⁾
Dead volume	cm ³	21	21	21	21
Materials in contact with the medium		Stainless steel, Nichrome, Ceramics, Titanium	Stainless steel, Nichrome, Ceramics, Titanium	Stainless steel, Nichrome, Ceramics, Titanium	Stainless steel, Nichrome, Ceramics, Titanium
Weight, approx.	kg (lbs)	0.75 (1.66)	0.75 (1.66)	0.8 (1.66)	0.8 (1.66)
Vacuum connection	DN	25 ISO-KF	40 ISO-KF	40 CF	40 CF
Operating units		COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31	COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31	COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31	COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31

Ordering Information
PR 25
PR 26
PR 27
PR 28

	Part No.	Part No.	Part No.	Part No.
PENNINGVAC sensors	157 52	136 46	136 47	136 48
Replacement cathode plate, titanium (5 pcs., incl. 5 ceramics discs)	EK 162 91	EK 162 91	EK 162 91	EK 162 91
Replacement anode ring	200 28 711	200 28 711	200 28 711	200 28 711
Baffle, with centering ring (FPM (FKM))				
DN 25	230 078	-	-	-
DN 40	-	230 079	-	-

¹⁾ When using an ultra sealing gasket at the vacuum connection

Note:

PR 26 replaces PR 31, 32, 35

PR 27 replaces PR 36

IONIVAC IM 540



The 3-channel display and operating unit IONIVAC IM 540 offers, by combination of up to 4 different principles of measurement - Pirani, capacitive, Bayard-Alpert and Extractor -, complete coverage and control of the vacuum pressure in the range between 10^{-12} mbar and atmospheric pressure.

Advantages to the User

- Precise UHV pressure measurements with the Bayard-Alpert sensor IE 414 (offering excellent longterm stability) or the Extractor sensor IE 514 (offering an extremely low X-ray limit of $< 1 \times 10^{-12}$ mbar)
- 1 measurement channel for IONIVAC sensor (Bayard-Alpert or Extractor)
- Possibility of simultaneously connecting a second IONIVAC sensor
- Degassing of the anode through electron bombardment with time-limit
- Continuous UHV measurement also during the degassing phase (up to $+250$ °C with bakeable gauge head cable)
- 2 measurement channels for direct connection of transmitters from the series THERMOVAC TTR and CERAVAC CTR
- Selectable pressure units (mbar, Torr, Pascal, Micron)
- Display of a single measurement channel with pressure trend through analogue bargraph or simultaneous display of all measurement channels
- Two adjustable thresholds with adjustable hysteresis and freely assignable to the measurement channels

- Compact benchtop enclosure (1/2 19", 3 HU)
- RS 232 C interface provided as standard
- Simple software updates possible through the RS 232 interface
- Profibus interface (optional)
- CE mark

Typical Applications

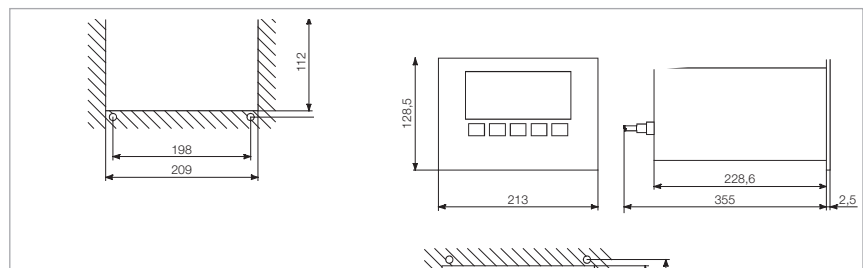
- Pressure measurement and control in the UHV range
- Measurement of ultimate pressure in UHV systems
- Checking of ultimate pressure in semiconductor production
- Total pressure measurements in the area of cryo technology
- Total pressure measurements in calibration systems

Connectable Sensors

- Bayard-Alpert sensor IE 414
- Extractor sensor IE 514 (see Chapter "Additional Sensors") combined with
- THERMOVAC TTR 211, TTR 216 S, TTR 90, TTR 91 and TTR 96 S
- CERAVAC CTR 90, CTR 91 and CTR 100 (see Chapter "Active Sensors")

Two passive sensors working with ionization technology (IE 414 and/or IE 514) could be connected simultaneously to the IONIVAC IM 540 while only one is in operation.

A pressure dependent emission control of these sensors is possible if a THERMOVAC TTR or CERAVAC CTR 100/CTR 91 of suitable range overlap is connected



Front panel cut-out (left) and dimensional drawing (right) for the IONIVAC IM 540

Technical Data

IONIVAC IM 540

Number of measurement channels		3
Bayard-Alpert / Extractor		Channel 1 or 2
THERMOVAC / CERAVAC		Channel 3 and 4
Measurement range	mbar (Torr)	1×10^{-12} to 1100 (0.75×10^{-12} to 825)
Measurement range Extractor	mbar (Torr)	1×10^{-12} to 1×10^{-4} (0.75×10^{-12} to 0.75×10^{-4})
Measurement range Bayard-Alpert	mbar (Torr)	1×10^{-11} to 1×10^{-2} (0.75×10^{-11} to 0.75×10^{-2})
Measurement range switching		automatic or decade pre-select
Units of measurement (selectable)		mbar, Torr, microns, Pa
Measurement uncertainty	%	± 10 of the value displayed
Trend indication		bargraph
Measurement value display rate		1×10^{-10} to 1×10^{-2} mbar, 5 s^{-1} 1×10^{-12} to 1×10^{-10} mbar, 0.5 s^{-1}
Emission current		
Extractor sensor	mA	1.6
Bayard-Alpert sensor	mA	0.1 to 10; automatic control
Emission current shutdown at		$p > 1 \times 10^{-2}$ mbar, broken cathode, short-circuit, interruption of the electric circuit
Bake out power		
Extractor / Bayard-Alpert	W	20 / 40
Sensor power supply, potential for		anode Extractor / Bayard-Alpert: 220 V, cathode Extractor / Bayard-Alpert: 100 V/80 V, Reflector Extractor: 205 V
Sensor connections		Bayard-Alpert and Extractor - single operation is possible 2 x Bayard-Alpert or Extractor (redundant operation)
Measurement system detection		automatically
Measurement system switchover		automatically, pressure dependent, error dependent
Chart recorder outputs		logarithmic 0 to 10 V (1 V / dec.) or linear 0 to 10 Volt error indication $U > 10.5 \text{ V}$
Extractor / Bayard-Alpert ($R_a = 2,5 \text{ k}\Omega$)		
Interface (standard / optional)		RS 232 C / Profibus
Switching thresholds (single operation or interval)		2 with floating changeover contact
Mains connection	V AC / Hz	90 - 264 / 50/60
Storage temperature range	°C	-40 to +60
Nominal temperature range	°C	+5 to +50
Dimensions of the benchtop instrument (W x H x D)	mm	213 x 128,5 x 250
Weight, approx.	kg (lbs)	3.0 (6.62)

Ordering Information

IONIVAC IM 540

	Part No.
IONIVAC IM 540 with mains cord 2 m (EURO and US)	230 100
Options Profibus DP interface	230 101
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"
IONIVAC sensors	
IE 414, DN 40 CF	158 66
Replacement cathode IE 414	158 63
IE 514, DN 40 CF	158 67
Replacement cathode IE 514	158 61
Gauge head cables for IE 414/514	
5 m	158 68
10 m	150 88
15 m	230 670 V01
5 m, bakeable to 200 °C	158 44
10 m, bakeable to 200 °C	230 671 V01
Extension cables for IE 414/514	
10 m	245 002
20 m	200 02 937
THERMOVAC transmitter TTR	see chapter "Products", para. "Active Sensors"
Connection cable for THERMOVAC (Type A)	see chapter "Products", para. "Connection Cable for Active Sensors"
CERAVAC transmitter CTR	see chapter "Products", para. "Active Sensors"
Connection cable for CERAVAC (Type B)	see chapter "Products", para. "Connection Cable for Active Sensors"

IONIVAC Sensors IE 414 and IE 514



These passive sensors use hot cathode ionization technology.

IE 414

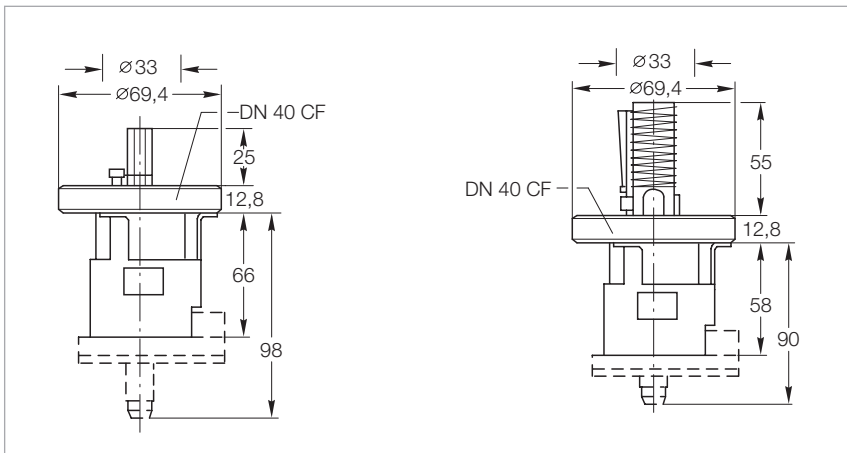
- Bayard-Alpert sensing system
- Measurement range to 2×10^{-11} mbar (1.5×10^{-11} Torr)
- Protection shield welded in place

IE 514

- Extractor sensing system
- Reliable to 1×10^{-12} mbar (0.75×10^{-12} Torr)
- Significant reduction of X-ray and ion desorption effects

Advantages to the User

- Exchangeable cathode
- High accuracy of the measurements due to individually calibrated sensing system



Dimensional drawing for the IE 414 (left) and IE 514 (right)

Technical Data

IE 414

IE 514

Measurement range	mbar (Torr)	2×10^{-11} to 10^{-2} (1.5×10^{-11} to 10^{-2})	10^{-12} to 1×10^{-4} (10^{-12} to 7.5×10^{-5})
X-ray limit	mbar (Torr)	$\leq 10^{-11}$ ($\leq 10^{-11}$)	$\leq 10^{-12}$ ($\leq 10^{-12}$)
Operating temperature range	°C	0 to +80	0 to +80
Degassing temperature at the flange, max.	°C	200 ¹⁾ / 350 ²⁾	200 ¹⁾ / 350 ²⁾
Material			
Cathode		Iridium with yttric oxid coating	Iridium with yttric oxid coating
Feedthrough pins		NiFe 42	NiFe 42
Anode		Pt/Ir 90/10/pt wire	Mo and CoNiCr
Vacuum connection	DN	40 CF	40 CF
Adjustment data			
Ion detector potential	V	0	0
Cathode potential	V	80	100
Anode potential	V	220	220
Emission current	mA	0.06 to 0.6	1.6
Heating current for the hot cathode	A	1.4	1.4
Heating current for the hot cathode	V	.7	3.7
Heating current for the hot cathode	mbar ⁻¹	17.0	6.6
Bake out operation, Electron bombardment	V / mA	700 / 30	700 / 30
Operating units		IM 540, CM 52	IM 540, CM 52

Ordering Information

IE 414

IE 514

	Part No.	Part No.
IONIVAC sensors	158 66	158 67
Replacement cathode	158 63	158 61

¹⁾ With bakeable gauge head cable

²⁾ With gauge head cable detached

Additional Sensors

Linear Pressure Sensors DI/DU 200, DI/DU 201, DI/DU 2000, DI/DU 2001, DI/DU 2001 rel.



DI 200 (left) and DI 2000 (right), DU similar

Piezo or capacitive pressure sensor based on ceramics technology. Available as absolute alternatively relative pressure sensor.

Advantages to the User

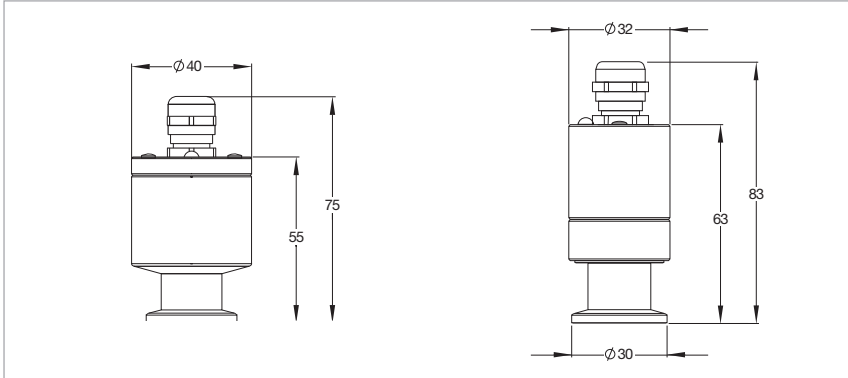
- Absolute pressure ranges from 0.1 to 200 mbar or 1 to 2000 mbar
- Relative pressure range from -1000 mbar to +1000 mbar
- Excellent overload characteristic due to the Al_2O_3 ceramics dia-phragm
- Highly corrosion resistant
- Independent of the type of gas
- Vibration resistant
- 2-wire pressure sensor (DI)
- 4-wire pressure sensor (DU)
- Supply voltage range
12 to 30 V DC (DI)
14.5 to 30 V DC (DU)
- Linear output signal 4 to 20 mA (DI)
- Linear output signal 2 to 10 V (DU)
- Compact design
- Digital zero adjustment possible via pushbutton
- IP 54 rated stainless steel housing (DI/DU 200 und DI/DU 201),
IP 54 rated aluminum housing (DI/DU 2000 und DI/DU 2001)
- DN 16 ISO-KF connection with female G 1/4" inside thread

Typical Applications

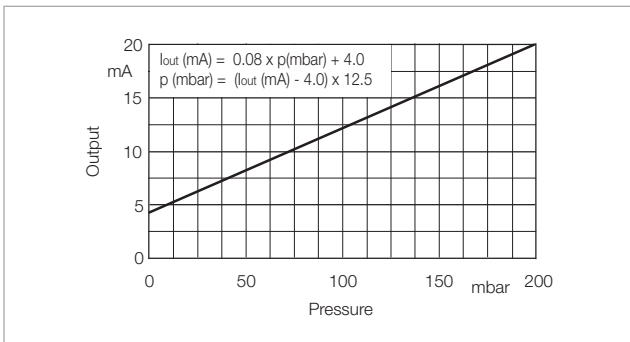
- Pressure measurements in the rough vacuum range, and for corrosive media (Solar, coating)
- Chemical process engineering
- Vacuum packaging
- Drying processes
- Casting resin technology (degassing of potting compounds)
- Measurement of operating and filling pressure, during the production of lamps
- Filling systems for brake fluids (DI 201/DI 2001)
- Filling systems for refrigerants
- Measurement of pressure relative to atmospheric pressure (DI/DU 2001 rel.)

Operating Units for DU sensors

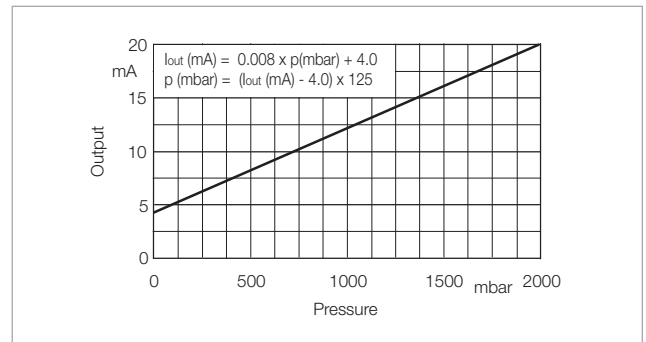
- DISPLAY
- ONE
 - TWO
 - THREE
- CENTER / GRAPHIX
- ONE
 - TWO
 - THREE



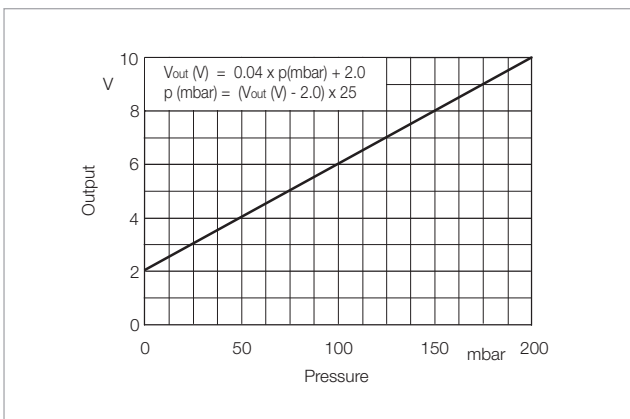
Dimensional drawing for the sensors
DI/DU 200 and DI/DU 201 (left), DI/DU 2000 and DI/DU 2001 (right)



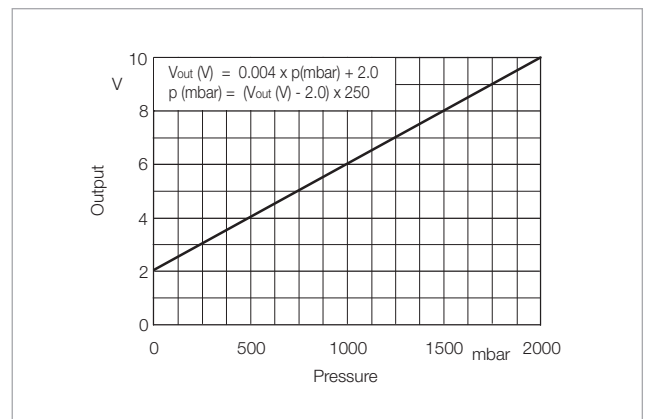
Characteristic of the DI 200 and DI 201 Sensors



Characteristic of the DI 2000 and DI 2001 Sensors



Characteristic of the DU 200 and DU 201 Sensors



Characteristic of the DU 2000 and DU 2001 Sensors

Technical Data

DI/DU 200

DI/DU 201

DI/DU 2000

DI/DU 2001

DI/DU 2001 rel.

Measurement range	mbar (Torr)	0.1 to 200 (0.075 to 150)	0.1 to 200 (0.075 to 150)	1 to 2000 (0.75 to 1500)	1 to 2000 (0.75 to 1500)	-1000 to +1000 (-750 to +750) relative pressure
Overload range, max. (flange side)	bar	6	6	5	5	5
Nominal temperature range	°C	0 to +60	0 to +60	0 to +60	0 to +60	0 to +60
Measurement uncertainty ¹⁾	% FS	0.25	0.25	0.25	0.25	0.25 ³⁾
Repeatability	% FS	0.05	0.05	0.05	0.05	0.05
Temperature error						
Zero drift	% FS/10°K	0.1	0.1	0.1	0.1	0.1
Sensitivity drift	% FS/10°K	0.15	0.15	0.15	0.15	0.15
Measurement principle, gas type independent		Capacitive	Capacitive	Piezoresistive	Piezoresistive	Piezoresistive
Sensing head supply						
DI		Two-wire system	Two-wire system	Two-wire system	Two-wire system	Two-wire system
DU		Four-wire system	Four-wire system	Four-wire system	Four-wire system	Four-wire system
Output signal						
DI	mA	4 to 20	4 to 20	4 to 20	4 to 20	4 to 20
DU	V	2 to 10	2 to 10	2 to 10	2 to 10	2 to 10
Supply voltage						
Operating range						
DI	V DC	12 to 30	12 to 30	12 to 30	12 to 30	12 to 30
DU	V DC	14.5 to 30	14.5 to 30	14.5 to 30	14.5 to 30	14.5 to 30
Dead volume	cm ³	3,9	3,9	1,8	1,8	1,8
Vacuum connection	DN	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF	16 ISO-KF
Electrical connection						
DI		diode plug 7pole, cable 5 m	diode plug 7pole, cable 5 m	diode plug 7pole, cable 5 m	diode plug 7pole, cable 5 m	diode plug 7pole, cable 5 m
DU		plug FCC 68, cable 5 m	plug FCC 68, cable 5 m	plug FCC 68, cable 5 m	plug FCC 68, cable 5 m	plug FCC 68, cable 5 m
Weight, approx.						
DI	kg (lbs)	0.36 (0.79)	0.36 (0.79)	0.26 (0.57)	0.26 (0.57)	0.26 (0.57)
DU	kg (lbs)	0.34 (0.75)	0.34 (0.75)	0.24 (0.53)	0.24 (0.53)	0.24 (0.53)
Protection class	IP	54	54	54	54	54
Materials in contact with the medium		Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics FPM (FKM)	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics EPDM	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics FPM (FKM)	Stainless Steel, 1.4305 Al ₂ O ₃ (96 %) Ceramics, EPDM	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics EPDM
Operating units						
DI series		–	–	–	–	–
DU series ²⁾		DISPLAY ONE, TWO, THREE CENTER ONE, TWO, THREE	DISPLAY ONE, TWO, THREE CENTER ONE, TWO, THREE	DISPLAY ONE, TWO, THREE CENTER ONE, TWO, THREE	DISPLAY ONE, TWO, THREE CENTER ONE, TWO, THREE	DISPLAY ONE, TWO, THREE CENTER ONE, TWO, THREE

¹⁾ Sum of linearity, hysteresis and reproducibility

²⁾ May possibly require a firmware update

³⁾ 0.25 % FS in the range of -1000 ... + 200 mbar / 0.5 % FS in the range of > +200 mbar

Ordering Information

DI 200

DI 201

DI 2000

DI 2001

DI 2001 rel.

	Part No.	Part No.	Part No.	Part No.	Part No.
Linear sensor DI complete with 5 m long connection cable and connecting plug (circular connector)	158 12V01	158 14V01	158 13V01	158 15V01	245 000V01
Extension cable circular connector, 7-pole socket/plug					
10 m	200 04 112	200 04 112	200 04 112	200 04 112	200 04 112
20 m	200 02 645	200 02 645	200 02 645	200 02 645	200 02 645

Ordering Information

DU 200

DU 201

DU 2000

DU 2001

DU 2001 rel.

	Part No.	Part No.	Part No.	Part No.	Part No.
Linear sensor DU complete with 5 m long connection cable and connecting plug (FCC68)	230500V01	230501V01	230502V01	230503V01	230504V01
Extension cable FCC68, socket/plug					
10 m	230505V01	230505V01	230505V01	230505V01	230505V01
20 m	230506V01	230506V01	230506V01	230506V01	230506V01
Operating unit					
DISPLAY ONE	230 001	230 001	230 001	230 001	230 001
DISPLAY TWO	230 024	230 024	230 024	230 024	230 024
DISPLAY THREE	230 025	230 025	230 025	230 025	230 025
CENTER ONE	see chapter "Products", "Operating Units for Active Sensors"				
CENTER TWO	see chapter "Products", "Operating Units for Active Sensors"				
CENTER THREE	see chapter "Products", "Operating Units for Active Sensors"				

Older Sensors / Replacement Sensors



Linear pressure sensor



Replacement sensor TTR 211



Replacement sensor TTR 216

Type

Corresponding Sensors/ Operating Units

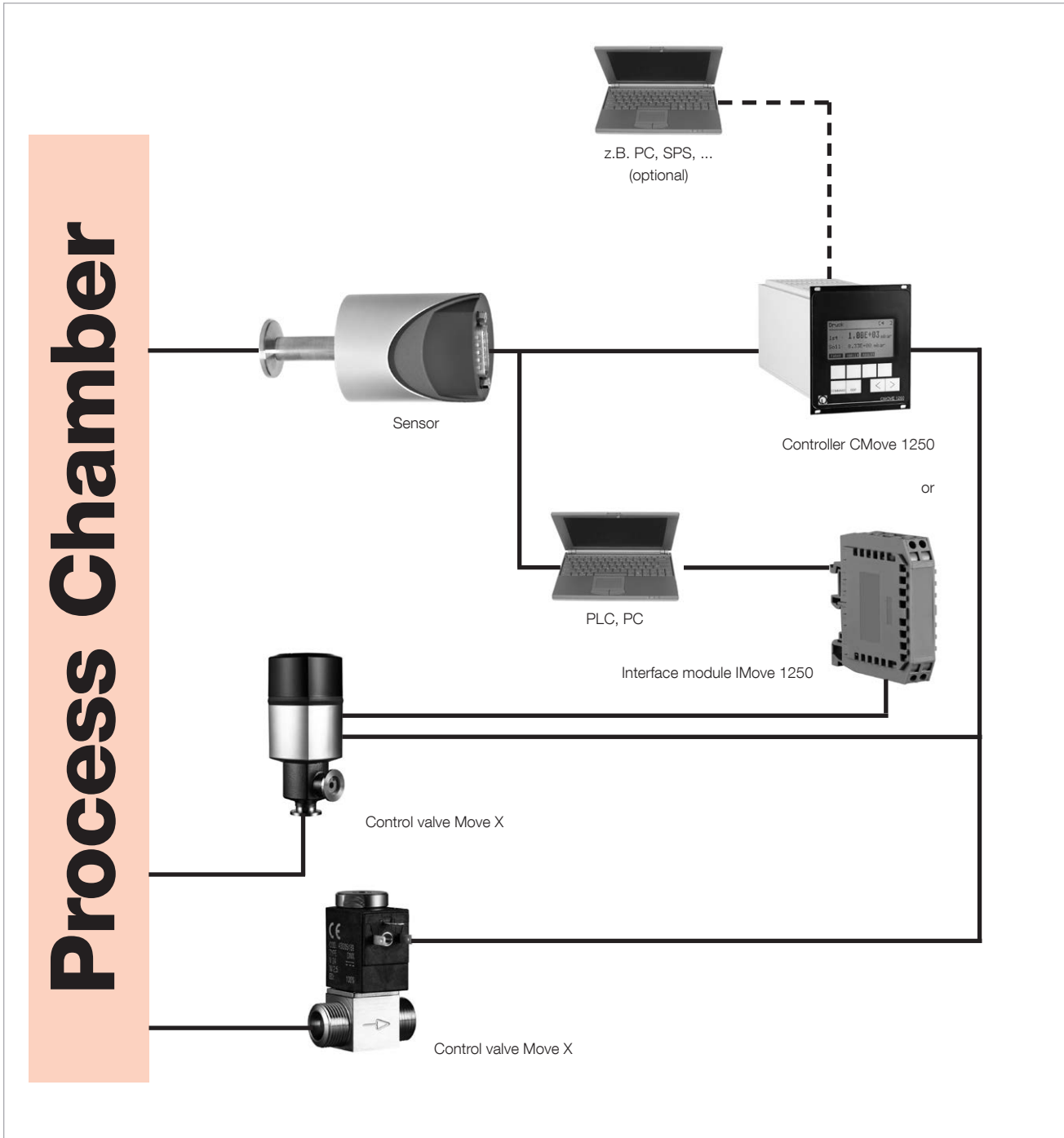
Ordering Information

		Part No.
Replacement sensor TTR 211	TTR 211 PB / D	E 157 75
Replacement sensor TTR 216	TTR 216 PB / D	E 157 77
Replacement spare sensor IE 100 DN 25 ISO-KF DN 40 CF	ITR 100 ITR 100	E 163 61 E 163 67
Replacement spare cathode IE 413	IM 510	158 63
Linear pressure sensor (Previous version)	DI 200 DI 201 DI 2000 DI-Adaptor for CENTER series ¹⁾ DI 2000 Adaptor	158 12 158 14 158 13 245009V01 245022V01

¹⁾ For all DI-Sensors

Pressure Switches and Control Instruments

Pressure Control System Move



Control Valves Move 1250 and Move X

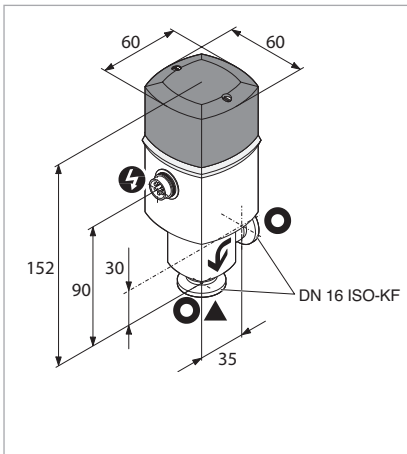


Control valve Move 1250

Control Valve Move 1250

Advantages to the User

- Extended control range from 1×10^{-6} to 1250 mbar x l/s
- High controllable gas throughput
- Corrosion resistant owing to FPM (FKM)/stainless steel
- In combination with CMove the valve closes automatically in the event of a power failure
- Valve driven either by the controller CMove 1250 or by a PC or a PLC through the IMove interface
- Electromotive pressure control with variable gas flow (upstream regulation) or with variable conductance (downstream regulation)



Dimensional drawing for the Move 1250

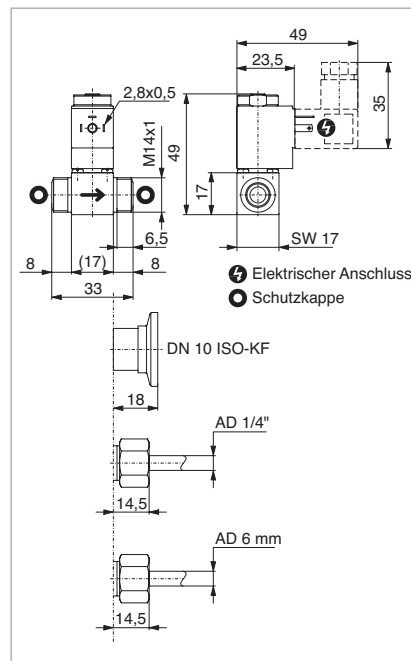


Control valve Move X

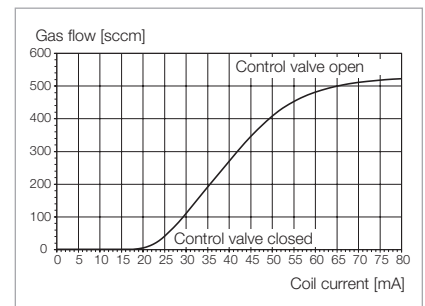
Control Valve Move X

Advantages to the User

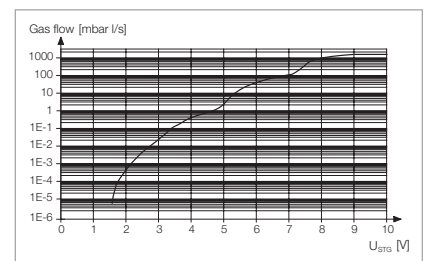
- 6 different valves for the gas flows ranging from 10 sccm FS to 5000 sccm FS
- Fast response
- Electromagnetic pressure regulation with variable gas flow (upstream regulation)
- Normally closed
- Many adapters are available



Dimensional drawing for the Move X with connection adapter



Example of a gas flow curve (mean value of 500 sccm FS) at a differential pressure of $\Delta p = 1$ bar for Move X



Gas flow curve of the Move 1250

Technical Data

Control Valve

Move 1250

Move X

Vacuum connection		DN 16 ISO-KF	Threaded connection M 14 x 1 for accepting of: Flange connection DN 10 ISO-KF Pipe connection Ø 1/4" Pipe connection Ø 6 mm
Mounting orientation		Any	Any, preferably vertical
Leak tightness	mbar x l/s	1×10^{-9}	1×10^{-9}
Pressure range		1×10^{-8} mbar to 2.5 bar (absolute)	1×10^{-8} mbar to 1000 mbar (max. pressure in closing direction 2 bar)
Gas flow ¹⁾ with filter, on the inlet side		5×10^{-6} to 1250 mbar x l/s	10 sccm FS ^{2), 3)} 50 sccm FS ^{2), 3)} 100 sccm FS ^{2), 3)} 500 sccm FS ^{2), 3)} 1000 sccm FS ^{2), 3)} 5000 sccm FS ^{2), 3)}
with filter, on the inlet and the vacuum side	mbar x l/s	5×10^{-6} to 1000	–
Power supply			
Operation voltage	V DC	24 ($\pm 10\%$)	0 to 24
Power consumption	VA	12	2.5 max.
Current consumption	mA	500, 20 to 30 (closed circuit current)	–
Actuation		Step motor	Coil
Digital		CMove or IMove 1250	CMove 1250
Analog	V DC	0 to 10	–
Type of protection	IP	40	51
Closing time / opening time	s	3 / 4	–
Response time	ms	–	< 30
Ambient temperature	°C	+5 to +40	+5 to +50
Bake out temperature			
Valve body	°C	80	+5 to +50 (during operation)
Actuator	°C	60	(during operation)
Material			
Valve body		Stainless steel 1.4435	Stainless steel 1.4301
Valve needle, valve disc		Stainless steel 1.4301	–
Filter		Stainless steel 1.4404	–
Seals		FPM	FPM
Dosing sleeve		Fluorplastomer	–
Armature disc		–	Stainless steel 1.4510
Guide tube		–	Stainless steel 1.4105
Weight	kg (lbs)	0.5 (1.1)	0.08 (0.18)

¹⁾ For air at a differential pressure of $\Delta p = 1$ bar

²⁾ $1 \text{ sccm} = 1.69 \times 10^{-2} \frac{\text{mbar} \cdot \text{l}}{\text{s}}$

³⁾ Minimum flow: in each case 1% of FS (full-scale)

Ordering Information

Control Valve

	Move 1250	Move X
	Part No.	Part No.
Control Valve		
Move 1250	230 219	-
Move X with gas flow ¹⁾		
10 sccm	-	230 202
50 sccm	-	230 203
100 sccm	-	230 204
500 sccm	-	230 205
1000 sccm	-	230 206
5000 sccm	-	230 207
Accessories		
Flange DN 10 ISO-KF	-	284 50
Tube 1/4"	-	284 51
Tube 6 mm	-	284 52
Filter for the inlet or vacuum side consisting of filtering candle, O-ring and two securing rings	109 63	-
Filter set consisting of 10 filter discs and 10 circular springs	-	109 64
Connection cable		
CMove 1250 - Control valve Move 1250		
3 m	230 220	-
5 m	230 221	-
10 m	230 222	-
15 m	230 223	-
20 m	230 224	-
25 m	230 225	-
CMove 1250 - Control valve Move X		
3 m	-	230 210
5 m	-	230 211
10 m	-	230 212
15 m	-	230 213
20 m	-	230 214
25 m	-	230 215

¹⁾ To select the right components please ask us for information

Controller CMove 1250



Controller CMove 1250

Technical Applications

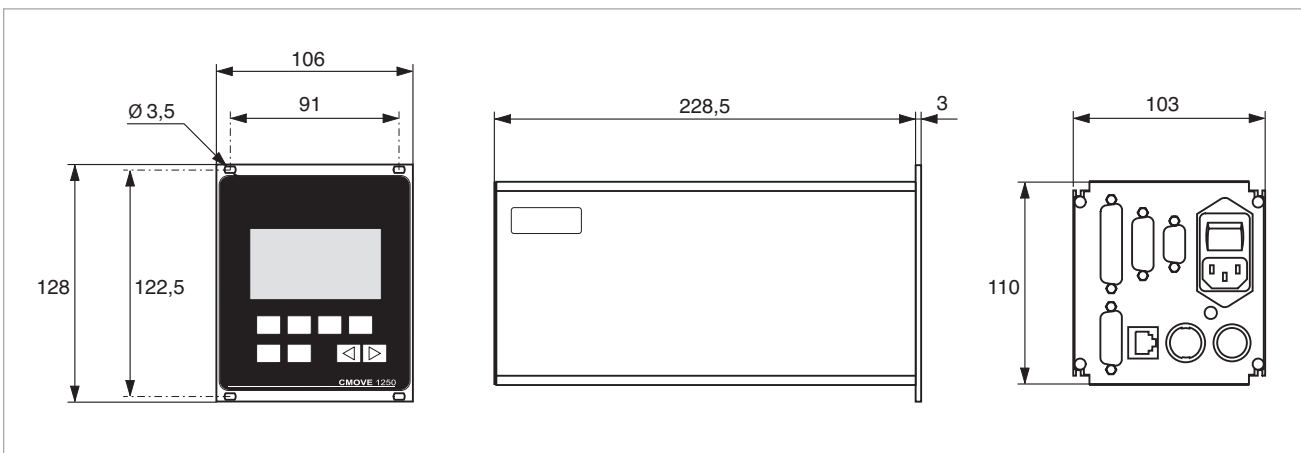
- Simple to operate
- Self-explanatory LCD display and function keys
- Analog/digital inputs/outputs and interfaces
- Digital input valve control, switch-over
- Pressure and gas flow adjustment
- Digital output valve control, error message
- Adjustable PID control algorithms
- 99 pre-programmed PI control algorithms for fast and simple operation
- For installation or tabletop use (1/4 19")

Typical Applications

The controller CMove in connection with the electric control valve Move 1250 or Move X is suited for applications in the areas like for example

- Semiconductor industry
- Analytical
- Coating
- Quality control
- Surface treatment

as well as in all applications where simple, fast and accurate pressure control is desired and necessary.



Dimensional drawing for the CMove 1250

Technical Data

Controller CMove 1250

Power supply		
Mains voltage, 50/60 Hz	V AC	90 - 250
Power consumption	VA	50
Control types		Auto = (PI) adjustable in 1 to 99 selectable steps PID = PID is user adjustable 0,5% F.S. sensor
Control accuracy ¹⁾		
Display		LCD 64 x 128 Pixel
Display units (selectable)		
Pressure		mbar, Torr, Pa, mV
Flow		mbar l/s, Torr l/s, Pa l/s, mV
Measurement range		
Pressure control		
CERAVAC		
THERMOVAC		
PENNINGVAC (not for PTR 90)		
IONIVAC		
Pressure control	mV	0 to 10.000
Flow control		
with MOVE 1250		CLOSED, 5.0×10^{-6} to $1.25 \times 10^{+3}$ mbar x l/s
with MOVE X		CLOSED, 1.0×10^{-5} to $1.0 \times 10^{+2}$ mbar x l/s
with analog output AA 2	mV	0 to 10 000
Operating mode		Gas flow regulation (upstream regulation) Pressure regulation (downstream regulation)
Operating		Local operation or remote control
Digital input		Flow matching, opening/closing of external valves / operating mode flow/regulation / switching on of emission/degas
Digital output		Valve position indication; valve fault; sensor fault; status message for sensor and valve; pressure regulation upstream/downstream
Analog input		0 to 10 V DC setpoint pressure/flow
Analog output		0 to 10 V DC, Pressure sensor signal, valve signal, valve position MOVE 1250
Serial interface		RS 232 C, RS 485 C
Housing		1/4 19", for installation or tabletop use
Weight	kg (lbs)	1.65 (3.64)
Temperature		
Operation	°C	+5 to +50
Storage	°C	-40 to +60
Protection class	IP	30 (EN 60 529)

¹⁾ Valid for sensor setting 0 to +10 V linear and analog output A02

Ordering Information

Controller CMove 1250

	Part No.
Controller CMove 1250	230 200
Control valve	
Move 1250	230 219
Move X with gas flow	
10 sccm	230 202
50 sccm	230 203
100 sccm	230 204
500 sccm	230 205
1000 sccm	230 206
5000 sccm	230 207
Connection cable	
CMove 1250 - Control valve Move 1250	
3 m	230 220
5 m	230 221
10 m	230 222
15 m	230 223
20 m	230 224
25 m	230 225
CMove 1250 - Control valve Move X	
3 m	230 210
5 m	230 211
10 m	230 212
15 m	230 213
20 m	230 214
25 m	230 215
Sensor cable	
TTR 90, TTR 100, TTR 101, TTR 211, TTR 216, PTR 225, PTR 237	
5 m	124 26
10 m	230 012
15 m	124 27
20 m	124 28
30 m	124 29
50 m	124 31
75 m	124 32
100 m	124 33
ITR 90, ITR 100, ITR 200	
5 m	124 55
10 m	230 022
15 m	124 56
20 m	124 57
30 m	124 58
CTR 90, CTR 91, CTR 100, CTR 101	
5 m	230 013
10 m	230 014
15 m	230 015
20 m	230 016
30 m	230 017
50 m	230 019
75 m	230 020
100 m	230 021

Interface Module IMove 1250 for Move 1250



Advantages to the User

- Status query and valve position

Typical Applications

The interface module IMove 1250 connects a RS 232C interface (for example from a computer or a PLC) to the digital interface of the Move 1250 control valve.

Technical Data

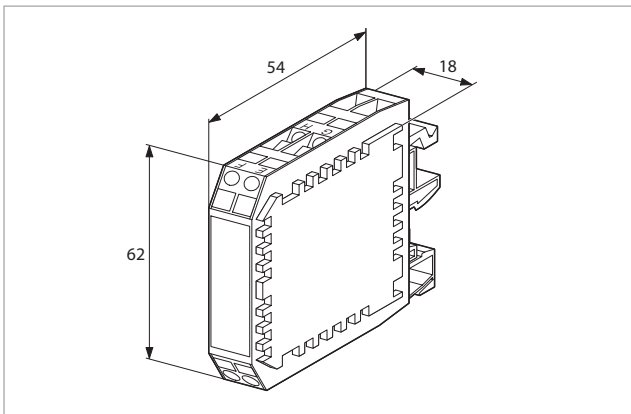
Interface Module IMove 1250

Temperature		
Operation	°C	+5 to +50
Storage	°C	-10 to +65
Protection class	IP	30
Operation voltage	V DC	24 ± 10%
Current consumption		
IMove 1250	mA	< 50 (own consumption)
Move 1250	mA	< 500
Provide upfront fusing		1 AT
Interface		RS 232 C
Mounting		
Support rails		EN 50022-35 (symmetrical) EN 50035-G32 (asymmetrical)
Weight	g	40 (0.09)

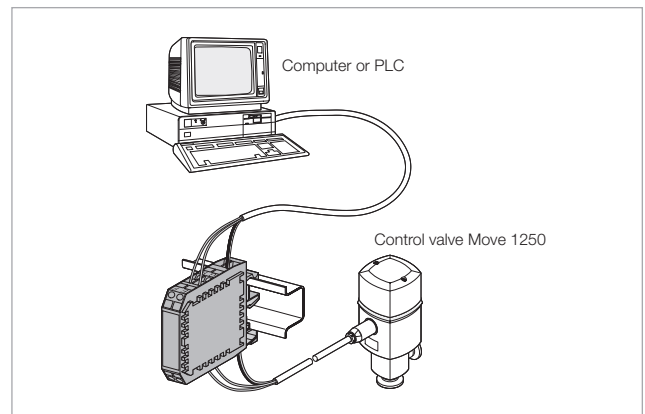
Ordering Information

Interface Module IMove 1250

	Part No.
Interface-Modul IMove 1250	230 201



Dimensional drawing for the IMove 1250



Connection of the IMove 1250

Low Pressure Safety Switch PS 113 A



Switch indicating whether or not the pressure has reached the level of the atmospheric pressure after venting. Preset diaphragm pressure switch set to a trigger of 6 mbar (4 Torr) below atmospheric pressure.

Advantages to the User

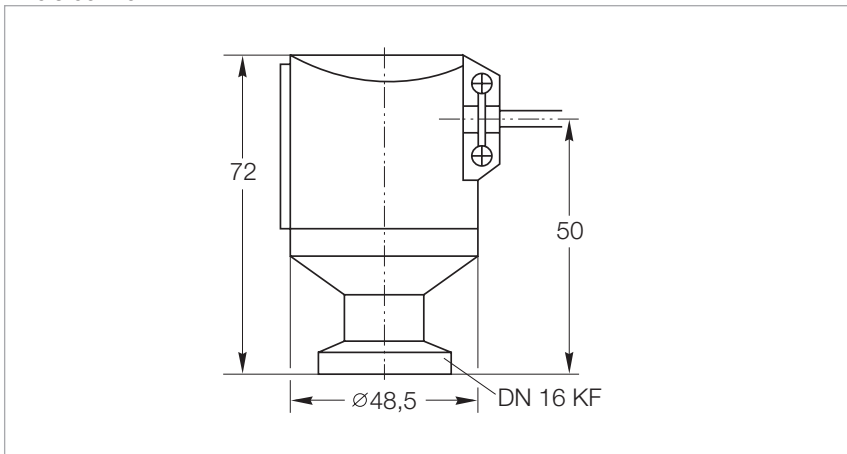
- Rugged design
- High switching capacity
- Corrosion protected
- Easy to use
- IP 44 protection
- Can be connected to a programmable control

Typical Applications

- Venting facilities
- Safety shutdown of vacuum systems
- Load locks
- Increased switching capacity when using the switching amplifier SV 110

Technical Note

Due to the diaphragm material used (EPDM) the PS 113 A is not suited for applications in which the process gas contains large quantities of helium. Owing to helium permeation, the leak rate of the diaphragm for helium amounts to values $\leq 1 \times 10^{-4}$ mbar x l/s.



Dimensional drawing for the low pressure safety switch PS 113 A

Technical Data

Low Pressure Safety Switch

Switching pressure	mbar (Torr)	Approx. 6 (4.5) below atmospheric pressure
Return switching pressure	mbar (Torr)	3 (2.3) below atmospheric pressure
Switching inaccuracy	mbar (Torr)	2 (1.5)
Max. permissible operating pressure (abs.)	mbar (Torr)	2000 (1500)
Storage temperature range	°C	-25 to +85
Nominal temperature range	°C	0 to +85
Switching contact		Changeover contacts, gold-plated, for prog. controls
Contact life		> 10 ⁵ switching cycles
Switching capacity		100 mA / 24 V AC 30 mA / 24 V DC
Electrical connection		6.3 mm flat plug
Vacuum connection	DN	16 ISO-KF
Helium permeation	mbar (Torr)	≤ 5 x 10 ⁻⁵
Dead volume	cm ³	2
Materials in contact with the medium		Stainless steel 1.4305, Stainless steel 1.4310, Stainless steel 1.4300 PTFE coated, EPDM
Weight	g	315 (0.70)
Protection class	IP	44

Ordering Information

Low Pressure Safety Switch

	Part No.
Low pressure safety switch PS 113 A, DN 16 ISO-KF; complete with 3 m long cable	230 011

Pressure Switch PS 115

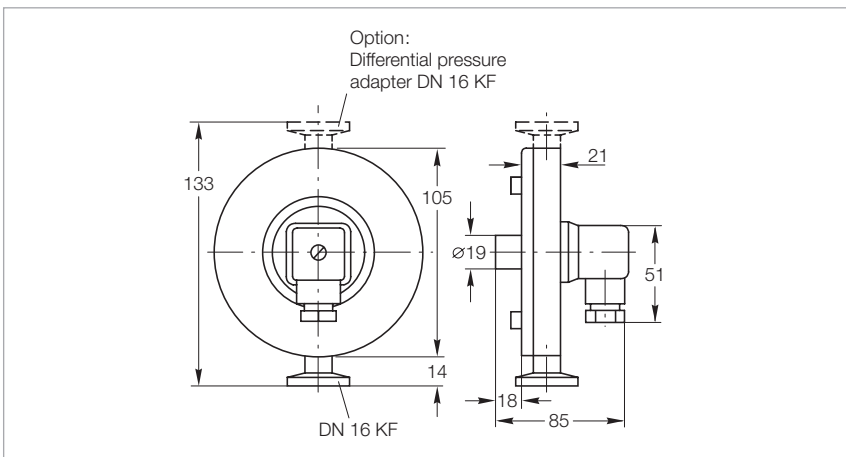


Rugged absolute pressure switch with electrical switching contact and an adjustable switching pressure between 0.5 and 2000 mbar (0.4 and 1500 Torr).

Through the differential pressure adapter (optional) the PS 115 pressure switch may be converted to operate as a differential pressure switch. The adapter consists of a DN 16 ISO-KF flange with screw-in thread and a sealing arrangement, and it is screwed into the PS 115 instead of the adjustment valve. The operating range extends to 2000 mbar (1500 Torr). Brief over-loading to 3000 mbar (2250 Torr) is permissible without impairing switching accuracy. In this operating range differential values of +5 to -20 mbar (+3.75 to -15 Torr) can be adjusted via the set screw.

Advantages to the User

- High switching accuracy (± 0.1 mbar)
- Stable long term operating characteristics
- Rugged, corrosion protected design
- Increased switching capacity (floating) when using the switching amplifier SV 110
- Switching contact (n.c.) in the reference chamber and thus protected against corrosion
- For operating pressures up to 3 bar
- For high ambient temperatures
- Upon request, the switching threshold may be set in the factory



Dimensional drawing for the pressure switch PS 115

Technical Data

Pressure Switch PS 115

Switching range	mbar (Torr)	0.5 to 2000 (0.375 to 1500)
Overload limit	mbar (Torr)	3000 (2250)
Sensitivity	mbar (Torr)	0.1 (0.75)
Switching hysteresis	mbar (Torr)	0.5 (0.375)
Temperature coefficient	%/°K	0.4 of the switching value
Nominal temperature range		
briefly (max. 8 h)	°C	120
continuous	°C	0 to +90
Switching contact		Plug
Switching voltage	V	24
Switching current (max.)	mA	10
Contact resistance, max.	kW	1
Electrical connection		Plug (DIN 43 650)
Protection class	IP	65
Vacuum connection	DN	16 ISO-KF
Materials in contact with the medium		
Measurement chamber		Stainless steel 1.4301; 1.4401; 1.4310; 1.3541; FPM /FKM)
Reference chamber		Stainless steel 1.4301; 1.4401; 1.3541; Glass; Gold
Volume of the measurement chamber approx.	cm ³	4
Volume of the reference chamber, approx.	cm ³	20
Weight	kg (lbs)	1.3 (2.87)

Ordering Information

Pressure Switch PS 115

	Part No.
Pressure Switch PS 115, DN 16 ISO-KF	160 04
Pressure switch adjustment	160 05
For floating installations without SV 110, Clamping ring DN 16 ISO-KF, plastic	200 28 306
Centering ring, DN 16 ISO-KF, plastic	200 28 307
Option Differential pressure adapter, DN 16 ISO-KF for connection to the PS 115	160 74
Spare parts kit PS 115	E 160 06
SV 110 switching amplifier	160 78

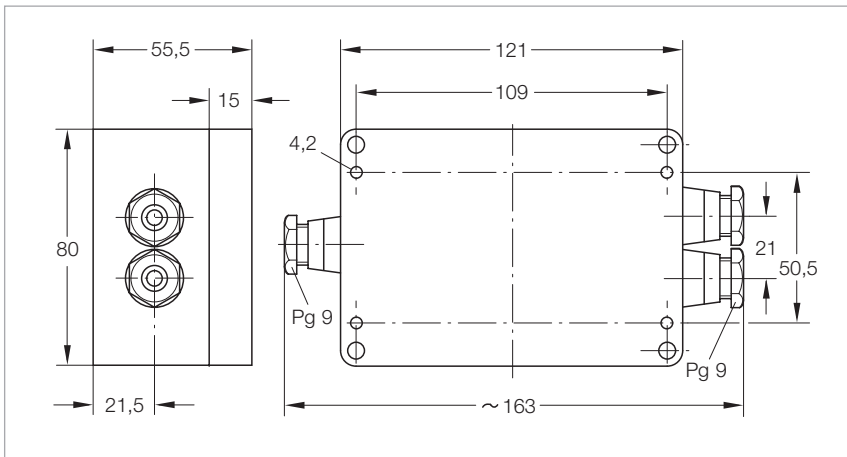
Switching Amplifier SV 110

The diaphragm contact of the pressure switches is connected on one side to ground and is rated to 24 V / 10 mA max. When wanting to switch higher voltages or currents, a switching amplifier will be needed. The switching amplifier is equipped with powerful floating changeover contacts. The output relay is energized as soon as the pressure drops below the switching threshold set up on the pressure switch.

The electrical connections are provided via screw terminals and are run out of the plastic enclosure through PG fittings.

Advantages to the User

- Increased ratings for the switch
- Changeover contact



Dimensional drawing for the switching amplifier SV 110

Technical Data

Switching Amplifier SV 110

Mains connection 50/60 Hz (selectable)		110/130/220/240 V
Power consumption	VA	3
Output relay		
Switching voltage / current	V / A	250 / 5
Switching power, max.	VA	500
Response time	ms	30
Release time	ms	7
Control circuit	V / mA	24 / 10
Ambient temperature, max.	°C	50
Weight, approx.	kg (lbs)	0.36 (0.79)

Ordering Information

Switching Amplifier SV 110

	Part No.
Switching amplifier SV 110	160 78

Diaphragm Pressure Regulators MR 16/MR 50



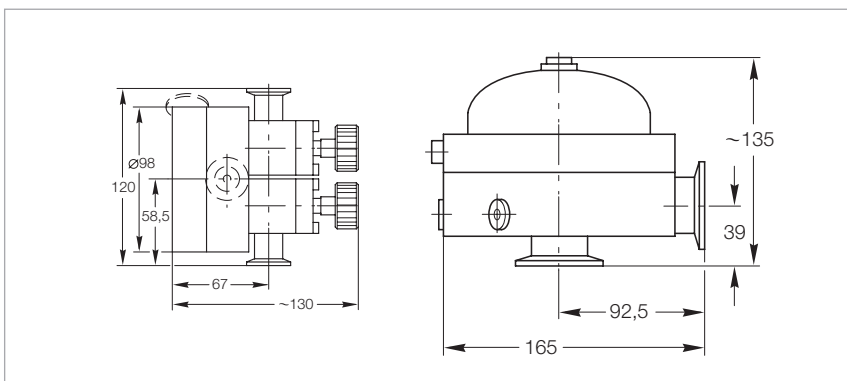
The MR 16/50 diaphragm regulators are absolute pressure regulators which automatically adapt the pumping speed of a vacuum pump depending on the amount of gas, without the need for an external power supply.

Advantages to the User

- Non-incremental, automatic pressure control
- Simple setting of the control pressures
- High control accuracy
- Corrosion protected stainless steel design
- Easy to disassemble for cleaning and maintenance
- Trouble-free operation in ex. areas
- Built-in isolation valves for the process connection and the vacuum pump (MR 16)

Typical Applications

- Distillation processes of all kinds
- Solvent recovery
- Drying processes
- Temperature control on bath cryostats
- Degassing of liquids and plastics



Dimensional drawing for the diaphragm regulator MR 16 (left) and MR 50 (right)

Technical Data

Diaphragm Pressure Regulator

MR 16

MR 50

		MR 16	MR 50
Control range	mbar (Torr)	10 to 1000 (7.5 to 750)	10 to 1000 (7.5 to 750)
Control inaccuracy		± 2% of the pressure control (10 - 90% of flow)	± 2% of the pressure control (10 - 90% of flow)
Throughput	m ³ /h	16	50
Nominal temperature range	°C	+5 to +100	+5 to +100
Storage temperature range	°C	-25 to +60	-25 to +60
Temperature coefficient	%/K	0.3	0.3
Setting time	ms	5	5
Permissible overload for brief periods	bar	3	3
Diaphragm material		FPM (FKM)/EPDM	FPM (FKM)/EPDM
Housing material		stainless steel 1.4571	stainless steel 1.4571
Installation orientation		Any	Any
Dimensions		see dimensional drawing	see dimensional drawing
Vacuum connection	2x DN	16 ISO-KF	40 ISO-KF
Measurement connection	3x thread R	1/8"	1/8"
Weight, approx.	kg (lbs)	2.7 (6.0)	8.0 (17.6)

Ordering Information

Diaphragm Pressure Regulator

MR 16

MR 50

	MR 16	MR 50
	Part No.	Part No.
Diaphragm pressure regulator		
MR 16, DN 16 ISO-KF	160 25	-
MR 50, DN 40 ISO-KF	-	160 27
Options		
Stainless steel measurement flange, DN 16 ISO-KF, for connection to a reference and/or process chamber or pumping stud KALREZ diaphragm	160 26 -	160 26 200 28 597
Spare Parts		
EPDM diaphragm and seal kit	EK 160 29	-
Viton diaphragm and seal kit	EK 160 31	-
Seal kit MR 50, incl. EPDM and Viton diaphragms	-	EK 160 32
Adjustment screw for the adjustable valve, complete with seal	-	240 00

Leybold Calibration Service



Calibration of vacuum gauges in the pressure range from 10^{-8} to 1000 mbar (10^{-8} to 750 Torr) as DAkkS or factory calibration.

Advantages to the User

- Clear reference to the reference quantities
- Reproducible measurements
- Constantly high quality over time
- Reliable checking of existing gauges
- Unambiguous description of the process

Since 1981 Leybold has been offering to all customers an impartial calibration service for gauges and sensors of any make. A DAkkS calibration certificate or a factory calibration certificate is issued for every calibration. Instruments with insufficient long-term stability or such instruments where the principle of measurement is not suited for calibration, can not be calibrated.

Typical Applications

Calibrated vacuum gauges are used under the following conditions:

- If the requirements concerning reproducibility and comparability of experiment runs are high

- If an unambiguous reference is required for a large number of pressure gauges
- If an unambiguous description for processes is required
- If for experiments and processes unambiguous traceability of the measured pressures to basic quantities is demanded by the authorities
- If testing to DIN/ISO 9000 is required in the following areas
 - Research
 - Thin-film engineering
 - Manufacture of systems
 - Military
 - Energy
 - Chemistry production
 - Production of pharmaceuticals and herbicides
 - Sputtering systems
 - Aircraft and space industry
 - Manufacture of lamp

DAkkS / Factory Calibration

It is the task of the Deutschen Akkreditierungsstelle (DAkkS) to ensure traceability of industrial measurements and testing to national standards.

The DAkkS is supported jointly by the Federal Institution for Physics and Technology (PTB), the industry, the Federal Minister for Economics and the Western European Metrology Club (WEMC).

The transfer standards in the DAkkS calibration facility used by Leybold are checked regularly (recalibrated) by the PTB.

Within the framework of the DAkkS, the calibration system at Leybold has been checked and approved by the PTB and the applied transfer standards have been calibrated by the PTB.

Factory calibrations were performed with standards which have not been calibrated directly at the PTB; instead the transfer standards of the in-house calibration service are used. Thus traceability to national standards is ensured in both cases.

Technical Data**DAkkS Calibration**

Calibration range	mbar (Torr)	to 10 ⁻³	to 10 ⁻⁵	to 10 ⁻⁸
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Ordering Information**DAkkS Calibration**

	Part No.	Part No.	Part No.
DAkkS calibration	157 12	157 13	157 14

Technical Data**Factory Calibration**

Calibration range	mbar (Torr)	to 10 ⁻³	to 10 ⁻⁵	to 10 ⁻⁸
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Ordering Information**Factory Calibration**

	Part No.	Part No.	Part No.
Factory calibration	154 22	154 23	154 24

Calibration Systems are described in the Catalog Part "Vacuum Pump Systems".

Product VACVISION

Vacuum Controller for Monitoring and Controlling the entire Vacuum Process

Applications

Components supported by the VACVISION

Rotary Vane Vacuum Pumps TRIVAC and SOGEVAC	VACVISION	Dry Compressing Scroll Pumps SCROLLVAC and Diaphragm Vacuum Pumps DIVAC	VACVISION	Turbomolecular Pumps TURBOVAC with Mechanical Rotor Suspension and Frequency Converter	VACVISION
S 1,5	■	SCROLLVAC		TURBOVAC	
TRIVAC		SC 5 D	■	50	■
D 2.5 E	■	SC 15 D	■	151 (C)	■
D 4 B	■	SC 30 D	■	361 (C)	■
D 8 B	■	SC 60 D	●	600 C	■
D 16 B	■			1000 C	■
D 25 B	■	DIVAC		1100 C	■
D 40 B	●	0.6 to 2.2	■	T 1600 / T 1601 ²⁾	■
D 65 B, D 65 B ^{3)He}	●	0.6 L to 2.2 L	■	SL 80	■
D 16 B-DOT/ NT 16-DOT	■	1.2 L AD und 2.2 L AD	■	SL 300	■
D 16 B-Ex	■	0.8 T und 0.8 LT	■	SL 700	■
D 16 BCS, D 25 BCS	■	2.5 T und 2.5 VT	■	TW 250 S ³⁾	■
D 40 BCS	■	3.5 TC und 4.8 VT	■	TW 501	
D 65 BCS	●			TW 1600 ²⁾	■
D 16 + D 25 BCS-PFPE	■			TW 2401	
D 40 BCS-PFPE	●				
D 65 BCS-PFPE	●			Frequency Converter	
				TURBOTRONIK NT 10	▲
SOGEVAC				TURBO.DRIVE TD 20 classic	■
SV 16, SV 25	■			TURBO.DRIVE TD 300	■
SV 40, SV 65	■			TURBO.DRIVE TD 400	■
SV 100				TURBO.DRIVE TD 700	■
SV 200, SV 300	■			TURBO.DRIVE TD 35	
SV 500, SV 630, SV 750				TURBO.DRIVE TD 240	
SV 1200					
SV 10 B SV 16 B, SV 16 D	■				
SV 25 B, SV 25 D	■				
SV 40 B	●				
SV 65 B, SV 100 B, SV 120 B	●				
SV 300 B	●				
SV 500 B ¹⁾	●				
SV 630 B(F), SV 750 B(F)					
SV 16 BI, SV 28 BI, SV 40 BI	■				
SV 40 B Kategorie 1(i)/2(o) IIA	■				
SV 40 B Kategorie 1(i)/2(o) IIB + H2	■				
SV 40 B Kategorie 3(i)/3(o)	■				

²⁾ Integrated Frequency Converter
³⁾ With and without integrated Frequency Converter

- = Direct connection is possible
- = Connection through E-box
- ▲ = Direct connection is possible, function is restricted

¹⁾ Up to 11 kW

Components supported by the VACVISION

Turbomolecular Pumps TURBOVAC with Magnetic Rotor Suspension and Frequency Converter

	VACVISION
TURBOVAC MAG	
W 300 iP and W 400 iP	■
W 600 iP and W 700 iP	■
1500 CT	■
W 300 P and W 400 P	■
W 600 P and W 700 P	■
W 830 and 830 C	■
W 1300 and 1300 C	■
W 1500 CT	■
W 2000 C and W 2000 CT	■
W 2200 C/T and W 2200	■
W 2800 and C/CT	■
W 3200 and C/CT	■
Frequency Converter	
TURBO.DRIVE iS	■
MAG.DRIVE S	■
MAG.DRIVE digital	■

LEYCON Valves

	VACVISION
Small valves of the "micro" range	
Valves with ISO-KF flanges DN 16 to DN 50	
Right-angle valves, bellows-sealed, manually operated	
Straight-through valves, bellows-sealed, manually operated	
Right-angle valves, bellows-sealed, electropneumatically operated	■
Right-angle valves, bellows-sealed, pneumatically operated	■
Straight-through valves, bellows-sealed, electropneumatically operated	■
Straight-through valves, bellows-sealed, pneumatically operated	■
Right-angle valves, bellows-sealed, electromagnetically operated	■
Valves with ISO-K flanges DN 63 to DN 160	
Right-angle valves, bellows-sealed manually operated	
Right-angle valves, bellows-sealed, electropneumatically operated	■
Right-angle valves, bellows-sealed, electropneumatically operated (DN 250)	
SECUVAC valves	
Safety valves	
Power failure venting valves, DN 10 and 16 ISO-KF, electromagnetically operated	■
(Coarse) variable leak valves	
Venting valves, manually operated	
Venting valves, electromagnetically operated	■
Vacuum locks / sealing valves	
Right-angle valves according to DOT	
Pilot valves	
Purge gas and venting valves	■
UHV all metal right-angle valves	
UHV all metal variable leak valves	

Gate Valves

	VACVISION
Gate Valves	
Miniature UHV, ISO-KF, manually operated	
Miniature UHV, ISO-KF and CF, manually operated	
Miniature UHV, ISO-KF and CF, electropneumatically operated	■
HV, ISO-F, manually operated	
HV, ISO-F, electropneumatically operated	■
UHV, CF, manually operated	
UHV, ISO-F, electropneumatically operated	■
UHV, CF, electropneumatically operated	■

Measuring,
controlling

Active Sensors (Transmitter)

	VACVISION
Active Sensors	
CTR 100/101	
TTR 91/91S/96S	
TTR 100/100S2	
PTR 225/235S/237	
PTR 90	
ITR 90	
ITR 200S	

■ = Direct connection is possible

Products

Vacuum Controller for Monitoring and Controlling the entire Vacuum Process

VACVISION



VACVISION offers a platform capable of configuring vacuum systems in different ways and operating these with great flexibility.

The new compact **VACVISION** vacuum controller is equipped with a large TFT graphic display with touch panel.

The **VACVISION** offers intuitive operation, a guided configuration menu (wizard), simple hardware interfacing by colour-coded cable connections as well as a plug and play function.

The controller automatically detects up to 3 active vacuum gauge heads, five valves in total, and one each forevacuum and one high vacuum pump from Leybold.

In addition the **VACVISION** offers the possibility of connecting venting facility, seal gas, heaters and cooling at the turbomolecular pump.

The controlling functions include predefined, configurable process set-ups.

The signals from the forevacuum transmitters can be utilized to start up the turbomolecular pumps and the high vacuum transmitters.

The **VACVISION** can be installed in a 19" rack or used as a benchtop unit.

Advantages to the User

- Compact multipurpose vacuum controller
- Automatic control, controlling and regulating function of the vacuum system
- Simple configuration of vacuum systems with utmost flexibility
- Plug and play function
- Colour TFT graphic display 4.3", 480*272 pixel with touch panel
- USB interface (front panel) for software updates and process data transfers
- Interfaces: RS 232 C/485 C and Ethernet
- Relay options for heating pads, shutoff valve, switching signals, etc.
- Highly flexible to use
- Replaces existing PLCs and associated programming
- Short-circuit proof
- 24 V DC connection for uninterrupted power supply (UPS)
- Colour-coded and text identification on all cable sets

Typical Applications

- Research Universities Institutes
- Laboratories
- Analytics
- Process industry
- Quality control

Connectable Components

- Forevacuum pump
- High vacuum pump
- Active vacuum gauges (up to a total of three)
- Valves (up to 2 with checkback signalling and up to 3 without checkback signalling)



Full fore and high vacuum systems support

Technical Data

VACVISION

Power supply	V / Hz	100 - 240 +/-10% / 50/60
Power consumption without backing pump and TMP Heater	W	< 100
forevacuum pump connection, approx.	W	up to 750
heater connection	W	up to 150
continuous, max.	W	1000
Fuses (slow blow)		
F1 mains power input		10 A
F2 heater		2 A
F3 backing pump		8 A
Protection class	IP	30
Ambient temperature during operation	°C	+5 to +40
during storage	°C	-10 to +70
Max. rel. humidity	% n.c.	80
Dimensions of the bench top unit (W x H x D)	mm	213 x 128.5 x 350
Weight, approx.	kg (lbs)	4.5 (9.93)

Ordering Information

VACVISION

	Part No.
Vacuum controller VACVISION	230400V01
Mains cord set EU VACVISION US VACVISION	230415V01 230416V01
Cable set VACVISION 10 m Limited VACVISION , 5 m	230410V01 230411V01
Plug set	230420V01
Connecting cable Type F to PTR/TTR series 5 m 10 m	124 55 230 022
Connecting cable Type F to PTR/TTR series 5 m 10 m	230032V01 230033V01
VACVISION electrical box, 3 phases, 400 V to 11 kW (to control pumps > 750 W)	230421V01
VACVISION custom solutions	upon request

Accessories

Connection Cables

Technical Data

Mains cable set contains

- 1x EURO resp. IEC connector, male MAINS IN, ident. POWER IN, 3 m long
- 1x EURO resp. IEC connector, female for forepump, 1 m long
- 1x EURO resp. IEC connector, earthed plug, female for TMP heater, 1 m long

Mains Cable Set EU VACVISION

Ordering Information

	Part No.
Mains cable set EU VACVISION	230415V01

Mains Cable Set EU VACVISION

Technical Data

Mains cable set contains

- 1x mains cord, ident. POWER IN, 3 m long
- 1x mains cord, ident. forepump, 1 m long
- 1x mains cord, ident. heater, 1 m long

Mains Cable Set US VACVISION

Ordering Information

	Part No.
Mains cable set US VACVISION	230416V01

Mains Cable Set US VACVISION

Technical Data

The cable set contains 10 m of each cable

- 1x Fan extension, ident. FAN COOLER
- 1x TMP pump (all except Anybus CC), D-Sub 9-way female/male, ident. RS 232
- 1x TMP pump (Anybus CC), D-Sub 9-way female/male, ident. RS 232 Anybus
- 2x valve cables M12 male, ident. PURGE and Vent
- 2x valve cables D-Sub 9-way male (with position indicator), ident. Valve and VV Valve
- 2x valve cables Phoenix 8-way, ident. X3 and X4
- 2x gauge heads, D-Sub 15-way female/male, ident. Gauge CTR/ITR; type C
- 2x gauge heads, D-Sub 15-way male/RJ 45, ident. Gauge PTR/TTR; type F
- 1x UPS , M9 male, ident. X17 USV

Cable Set VACVISION 10 m

Ordering Information

	Part No.
Cable set VACVISION 10 m	230410V01

Cable Set VACVISION 10 m

Technical Data

Cable Set Limited VACVISION 5 m

The cable set contains 5 m of each cable

- 1x TMP pump (all except Anybus CC), D-Sub 9-way female/male, ident. RS 232
- 1x TMP pump (Anybus CC), D-Sub 9-way female/male, ident. RS 232 Anybus
- 1x valve cable M12 male, ident. Vent
- 1x valve cable D-Sub 9-way male (with position indicator), ident. Ven
- 1x gauge head, D-Sub 15-way female/male, ident. Gauge CTR/ITR; type C
- 2x gauge heads, D-Sub 15-way male/RJ 45, ident. Gauge PTR and TTR; type F and plug
- 1 x valve plug, D-Sub 9-way male
- 2 x analog/digital I/O, Phoenix plug
- 1 x valve plug, M12 male EMC

Ordering Information

Cable Set Limited VACVISION 5 m

	Part No.
Cable set Limited VACVISION 5 m	230411V01

Technical Data

Plug Set VACVISION

Plug set contains the following plugs

- 3 x valves without return signalling, M12 round plug
- 2 x valves with return signalling, D-Sub 9-way male
- 1 x RS 232 female, D-Sub 9-way female
- 1 x analog/digital I/O, Phoenix plug

Ordering Information

Plug Set VACVISION

	Part No.
Plug set VACVISION	230420V01

- 1a Mains power output X2.1 TMP heater
100 - 240 VAC, fuse F2 1 AT - 2 AT
- 1b Fuse F2
- 1c Fuse F3
- 1d Mains power output X2.2 Forepump
100 - 240 VAC, fuse F3 3 AT - 8 AT
- 1e Mains power inlet X1 100 - 240 V AC
- 1f Fuse F1
- 1g Mains switch S1
- 2a 24 V DC input, UPS
- 2b Protective ground conductor M4
- 2c Fuse F4 1.25 AT 24 VDC, for X3 and X4
- 3a FV active vacuum gauge X11
- 3b HV active vacuum gauge X10
- 3c HV active vacuum gauge, extended X12
- 4a RS485 serial interface X13
- 4b RS232 serial interface X14 TMP
- 4c Ethernet Interface X15
- 5a HV valve with return signalling X5
D-Sub socket 24 V DC/12 W
- 5b FV valve with return signalling X6
D-Sub socket 24 V DC/12 W
- 5c Purge gas valve without return signalling X7
M12 socket 24 V DC/12 W
- 5d Venting valve without return signalling X8
M12 socket 24 V DC/12 W
- 5e Cooler valve without return signalling X9
M12 socket 24 V DC/12 W
- 6a Terminal strip X4
(X3, X4 totalling 12 W)
- 6b Terminal strip X3
(X3, X4 totalling 12 W)

The image shows the rear panel of the VACVISION control unit. It features a variety of connectors and components labeled with callouts 1a through 6b. On the left, there are three large power outlets (1a, 1d, 1e) and a main power switch (1g). In the center, there are several D-sub connectors for gauges (3a, 3b, 3c), valves (5a, 5b, 5d, 5e), and a 24V DC input (2a). On the right, there are serial interfaces (4a, 4b, 4c) and terminal strips (6a, 6b). A warning triangle is visible on the left side of the panel.

Rear side of the VACVISION

**Ordering Information
for Components supported by the VACVISION**

	Part No.
Active Sensors CERAVAC Transmitters CTR 100/101 THERMOVAC Transmitters TTR 91/91S/96S THERMOVAC Transmitters TTR 101/101S2 PENNINGVAC Transmitters PTR 225/235S/237 (upon request) PENNINGVAC Transmitters PTR 90 IONIVAC Transmitters ITR 90 IONIVAC Transmitters ITR 200S	Part Nos. see Catalog Part "Vacuum measuring - controlling"
Forevacuum pumps (single phase (100 - 240 V for EU and US) to 750 W) ¹⁾ Rotary Vane Vacuum Pumps TRIVAC S 1,5 types D 2,5 E types D 4 B to D 25 B types	Part Nos. see Catalog Part "Oil Sealed Vacuum Pumps", Section "Rotary Vane Vacuum Pumps TRIVAC"
Rotary Vane Vacuum Pumps SOGEVAC ¹⁾ SV 10 B types	Part Nos. see Catalog Part "Oil Sealed Vacuum Pumps", Section "Rotary Vane Vacuum Pumps SOGEVAC"
Scroll Vacuum Pumps SCROLLVAC ¹⁾ SC 5 D to SC 30 D types	Part Nos. see Catalog Part "Dry Compressing Vacuum Pumps", Section "SCROLLVAC"
Scroll Vacuum Pumps SCROLLVAC ¹⁾ 0.6 to 2.2 types 0.6 L to 2.2 L types 1.2 LAD and 2.2 LAD types 1.4 HV3 and 3.8 HV3 types	Part Nos. see Catalog Part "Dry Compressing Vacuum Pumps", Section "DIVAC"
LEYCON Vacuum Valves (high and forevacuum and Venting Valves 24 V DC / 6 W) Right-Angle Valves, electropneumatically operated; DN 16 to 50 ISO-KF, AL and SS Right-Angle Valves, pneumatically operated; DN 16 to 50 ISO-KF, AL and SS Straight-Through Valves, electropneumatically operated; DN 16 to 50 ISO-KF, AL and SS Straight-Through Valves, pneumatically operated; DN 16 to 50 ISO-KF, AL and SS Right-Angle Valves, electromagnetically operated; DN 16 to 40 ISO-KF, AL and SS Right-Angle Valves, bellows-sealed, electromagnetically operated; DN 63 to 160 ISO-K, AL and SS Power Failure Venting Valves, electromagnetically actuated: DN 10 and 16 ISO-KF Venting Valves, electromagnetically operated; DN 16 ISO-KF Purge Gas and Venting Valves; 0.2 and 0.4 mbar x l x s ⁻¹ , DN 10 ISO-KF; as well as 1/4" or DN 16 ISO-KF	Part Nos. see Catalog Part "Vacuum Valves"
Gate Valves Miniature UHV Gate Valves, electropneumatically operated; DN 40 ISO-KF, AL and SS; as well as DN 40 CF, SS HV Gate Valves, electropneumatically operated; DN 63 to 250 ISO-F UHV Gate Valves, electropneumatically operated; DN 100 to 250 ISO-F UHV Gate Valves, electropneumatically operated; DN 63 to 200 CF	Part Nos. see Catalog Part "Vacuum Valves"

¹⁾ The electrical box is required for pumps > 750 W

**Ordering Information
for Components supported by the VACVISION**

	Part No.
Electronic Frequency Converters	
MAG.DRIVE S	410300V0202
MAG.DRIVE S with display	410300V0212
TURBO.DRIVE TD 20 <i>classic</i>	
without Service interface	800075V0001
with RS 232 C interface	800075V0002
with RS 485 C interface	800075V0004
with Profibus	800075V0003
with 25-pole I/O	800075V0005
TURBO.DRIVE TD 300	
RS 232	800072V0001
RS 232 and Profibus DP	800072V0004
TURBO.DRIVE TD 400	
with USB interface	800073V0008
RS 232 C interface	800073V0002
RS 485 C interface	800073V0003
Profibus	800073V0004
TURBO.DRIVE TD 700	
with RS 232 C interface	800074V0001
RS 485 C interface	800074V0003
Profibus	800074V0004
TD S	
without RS 232 (only X1 (24 V DC)) [only restricted function]	800070V001
RS 232	800070V002
without RS 232 (X1) [only restricted function]	800070V004
RS 232, with heat sink	800070V005
without RS 232 (X1) [only restricted function]]	800070V006
Turbomolecular pumps with mechanical rotor suspension (control via RS 232 C)	
TURBOVAC SL 80	
with compound stage	
DN 40 ISO-KF	800002V3004
DN 63 ISO-K / DN 16 ISO-KF	800002V3001
DN 63 ISO-K / DN 16 ISO-KF (SL 80 H)	800002V3005
DN 63 CF / DN 16 ISO-KF	800002V3002
DN 63 CF / DN 16 ISO-KF (SL 80 H)	800002V3006
without compound stage	
DN 63 ISO-K / DN 16 ISO-KF (SL 80 C)	800002V3008
TURBOVAC SL 300	
DN 100 ISO-K / DN 16 ISO-KF	800170V3005
DN 100 CF / DN 16 ISO-KF	800170V3006
TURBOVAC SL 700	
DN 160 ISO-K / DN 25 ISO-KF	800051V3001
DN 160 CF / DN 25 ISO-KF	800051V3002
TURBOVAC TW 1600	
DN 200 ISO-F / DN 40 ISO-KF, water-cooled, RS 232	800041V2144
DN 250 ISO-F / DN 40 ISO-KF, water-cooled, RS 232	800041V2444
DN 250 CF / DN 40 ISO-KF, water-cooled, RS 232	800041V2844

Measuring,
controlling

**Ordering Information
for Components supported by the VACVISION**

	Part No.
Turbomolecular pumps with magnetic rotor suspension (control via RS 232 C) with integrated or separate electronic frequency converter MAG.DRIVE iS or MAG.DRIVE S	
TURBOVAC MAG W 300 iP DN 100 ISO-K DN 100 CF	410300V0505 410300V0506
TURBOVAC MAG W 400 iP DN 160 ISO-K DN 160 CF	410400V0505 410400V0506
TURBOVAC MAG W 600 iP DN 160 ISO-K DN 160 CF	410600V0505 410600V0506
TURBOVAC MAG W 700 iP DN 200 ISO-K DN 200 CF	410700V0505 410700V0506
TURBOVAC MAG W 300 P DN 100 ISO-K DN 100 CF	410300V0005 410300V0006
TURBOVAC MAG W 400 P DN 160 ISO-K DN 160 CF	410400V0005 410400V0006
TURBOVAC MAG W 600 P DN 160 ISO-K DN 160 CF	410600V0005 410600V0006
TURBOVAC MAG W 700 P DN 200 ISO-K DN 200 CF	410700V0005 410700V0006
TURBOVAC MAG W 1500 CT DN 200 ISO-F DN 250 ISO-F DN 250 CF	400026V0002 400027V0002 400030V0002
Turbomolecular pumps with magnetic rotor suspension (control via RS 232 C) with separate electronic frequency converter MAG.DRIVE iS, MAG.DRIVE S or MAG.DRIVE digital	Part Nos. see Catalog Part "High Vacuum Pumps" Section "Turbomolecular Pumps TURBOVAC MAG"
TURBOVAC MAG 1500 CT TURBOVAC MAG W 830 (C) TURBOVAC MAG W 1300 (C) TURBOVAC MAG W 2000 C/CT TURBOVAC MAG W 2000 TURBOVAC MAG W 2200 C/CT TURBOVAC MAG W 2800 C/CT TURBOVAC MAG W 3200 C/CT	

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