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Leybold

Vacuum Measuring, Controlling

Vacuum

Vacuum Gauges

Calibration Service

260.00.02
Excerpt from the Leybold Full Line Catalog 2018
Catalog Part Vacuum - Measuring, Controlling

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Vacuum Measuring, Controlling

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Applications for Vacuum Gauges

Gauges	BOURDONVAC A	BOURDONVAC C	Capsule Vacuum Gauge	DIAVAC DV 1000	Handheld Measuring Instruments	CERAVAC Transmitter CTR	Lineare Pressure Sensors DI/DU	THERMOVAC Transmitter TTR	PENNINGVAC Transmitter PTR	IONIVAC Transmitter ITR	IONIVAC IM 540	Low Pressure Safety Switch PS 113 A	Pressure Switch PS 115	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)																
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																
TTR 101 (Pirani combined with capacitance diaphragm)									$5 \cdot 10^{-5}$							1500
TTR 91 / 91 N									$5 \cdot 10^{-5}$							1000
TTR 96 S / 96 N S									$5 \cdot 10^{-5}$							1000
TTR 911 / 911 N								$1 \cdot 10^{-5}$								1000
TTR 911 CC / 911 N C S									$5 \cdot 10^{-5}$							1000
TTR 916 / 916 N									$5 \cdot 10^{-5}$							1000
Cold Cathode Ionization (according to Penning)																
PENNINGVAC-Transmitters																
PTR 90 / 90 N, DN 40 CF					$1 \cdot 10^{-8}$											1000
PTR 90 / 90 N, DN 40 ISO-KF					$1 \cdot 10^{-8}$											1000
PTR 90 / 90 N, DN 25 CF					$1 \cdot 10^{-8}$											1000
PTR 225 / 225 N, DN 25 ISO-KF					$1 \cdot 10^{-8}$					0,05						
PTR 237 / 237 N, DN 40 CF					$1 \cdot 10^{-8}$					0,05						
Hot Cathode Ionization																
IONIVAC-Transmitters (Bayard-Alpert combined with Pirani)																
ITR 90			$5 \cdot 10^{-10}$													1000
ITR 200 with and without display			$5 \cdot 10^{-10}$													1000
Linear Pressure Sensors [1]																
DI/DU 200 and 201												0,1			200	
DI/DU 2000 and 2001																
DI/DU 2001 rel.														-1000		+1000

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}
Handheld Measurement Instruments																
THERMOVAC Sensors																
TM 101									$5 \cdot 10^{-4}$							1200
Loadlock Transmitters																
TTR 200 N, DN 16 ISO-KF								$5 \cdot 10^{-5}$								1500
PTR 200 N, DN 16 ISO-KF					$1 \cdot 10^{-8}$											1500

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Gauges which is ideal for your Application

Operating Units for Active Sensors

	DISPLAY			GRAPHIX			
	ONE	TWO	THREE	ONE	TWO	THREE	IM 540
Part No. EU / US	230 001	230 024	230 025	230680V01	230681V01	230682V01	230 10
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
				1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	3, 4
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	
	1	1, 2	1, 2, 3	1	1, 2	1, 2, 3	
		1, 2	1, 2, 3	1	1, 2	1, 2, 3	
		1, 2	1, 2, 3	1	1, 2	1, 2, 3	
				1	1, 2	1, 2, 3	
				1	1, 2	1, 2, 3	
	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	
	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	
	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	1 (Only DU)	1,2 (Only DU)	1,2,3 (Only DU)	

1, 2, 3, 4 indicate the channel to which the sensor may be connected

[1] Possible

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																
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				1×10^{-9}						0.01						
PR 26				1×10^{-9}						0.01						
PR 27				1×10^{-9}						0.01						
PR 28				1×10^{-9}						0.01						
IONIVAC Sensors																
IE 414 (Bayard-Alpert)		2×10^{-11}								0.01						
IE 514 (Extractor)	1×10^{-12}							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}

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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 **Part No. Profibus**	– –	230 110 230 111	230 115 230 116				
		1, 2	1, 2				
		1, 2	1, 2				
		1, 2	1, 2				
		1, 2	1, 2				
		3					
		3					
		3					
		3					
	1, 2		3				
	1, 2		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.

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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	–	–

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Notes

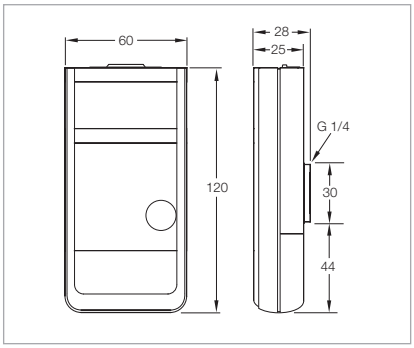
Products

Handheld Measuring Instruments

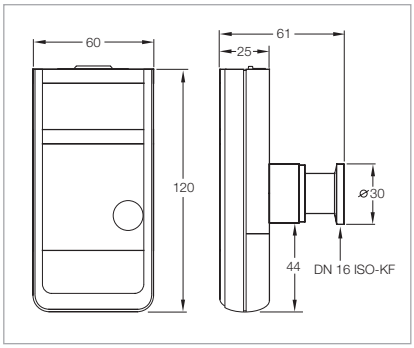
Digital PIEZOVAC Sensor PV 101
Digital THERMOVAC Sensor TM 101



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



Dimensional drawings PIEZOVAC PV 101 (mm)



Dimensional drawings THERMOVAC TM 101 (mm)

The 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.

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. With a measuring rate of minimum 50 ms, you are informed in short process times on the current pressure.

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 $5x10^{-4}$ 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

Typical Applications

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

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Technical Data

	PIEZOVAC Sensor PV 101	THERMOVAC Sensor TM 101
Measurement principle	Piezo-resistive	Piezo-resistive (gas type independent) and thermal conductance Pirani
Indicated units of measurement	mbar, Torr, microns, hPa	mbar, Torr, microns, hPa
Measurement range mbar (Torr)	1200 to 0,1 (900 to 0,075)	1200 to 5 x 10^{-4} (900 to 3.75 x 10^{-4})
Maximum overload bar abs.	2	2
Maximum overload 1200 – 10 mbar (900 to 75 Torr) 10 – 2 x 10^{-3} mbar (7.5 to 1.5 x 10^{-3} Torr) < 2 x 10^{-3} mbar (< 1.5 x 10^{-3} Torr)	 ±0,3 % of full-scale - -	 ±0,3 % of full-scale 10 % of measured value < factor 2 of measured value
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 (50 ms, from 2018 series)	1.0
Data storing rate s	0.1 to 6000	1 to 6000
Operating temperature Sensor °C Battery °C	 +5 to +50 -20 to +45	 +5 to +50 -20 to +45
Storage temperature Sensor °C Battery °C	 -20 to +60 +10 to +25	 -20 to +60 +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 > 200 mbar (> 150 Torr) mW	 2 2	 60 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, removable)	DN 16 ISO-KF
PC interface	Mini USB-B connector	Mini USB-B connector
Dimensions mm mm	60 x 120 x 50 (DN 10 ISO-KF) 60 x 120 x 28 (G 1/4)	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 AlMn 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 AlMn 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 (left) und CERAVAC Transmitter CTR 101 N (right)

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

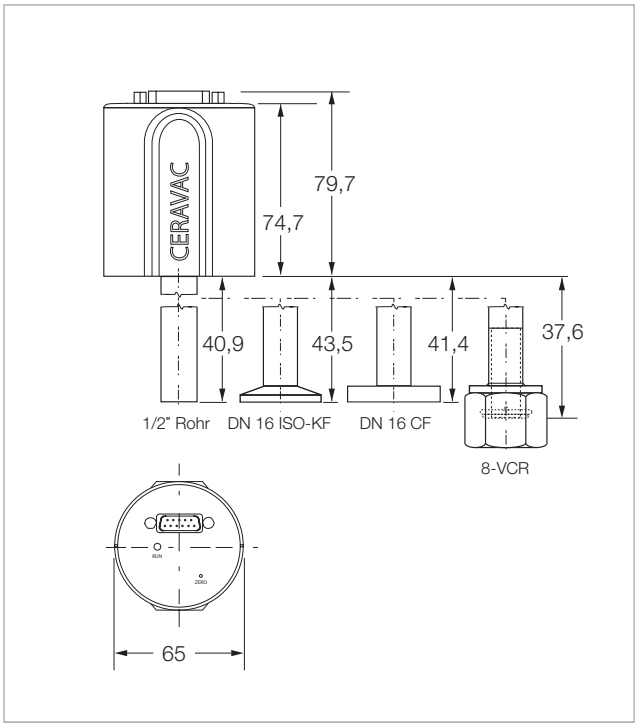
- Excellent accuracy and long-term stability
- Very good temperature compensation regardless of ambient conditions
- Highly resistant against corrosion and aggressive gases
- Fast and accurate response to pressure changes
- Improved reliability by high overpressure rating
- Serial Interface (RS 232 protocol)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

Typical Applications

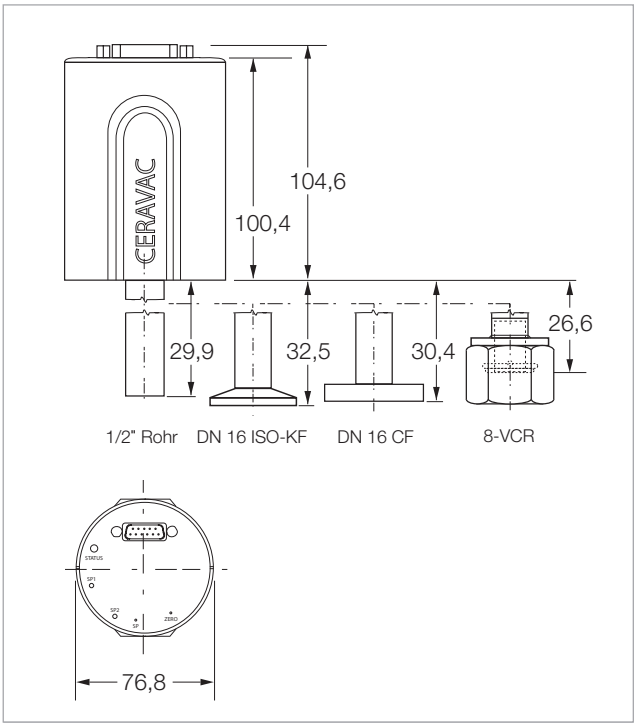
- General vacuum measurement and control with very low measurement uncertainty
- Fore and medium vacuum pressure measurement
- Research & Development
- System process control
- Chemical and Semiconductor processes
- LED and solar cell manufacturing
- Physical Vapor Deposition (PVD)
- Reference sensor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

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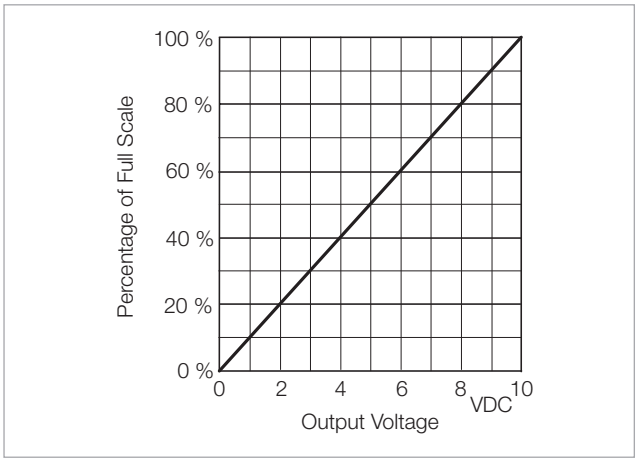
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Dimensional drawing for the CERAVAC Transmitter CTR 100 N (mm)



Dimensional drawing for the CERAVAC Transmitter CTR 101 N (mm)



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 x 10^{-5} to 0.1 Torr 1 Torr / 1 x 10^{-4} to 1 Torr 10 Torr / 1 x 10^{-3} to 10 Torr 20 Torr / 2 x 10^{-3} to 20 Torr 100 Torr / 0.01 to 100 Torr 1000 Torr / 0.1 to 1000 Torr	0.1 Torr / 1 x 10^{-5} to 0.1 Torr 1 Torr / 1 x 10^{-4} to 1 Torr 10 Torr / 1 x 10^{-3} to 10 Torr – 100 Torr / 0.01 to 100 Torr 1000 Torr / 0.1 to 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 lenght	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 Span of reading	% / °C % / °C	0.005 (1000/100/20/10 Torr) 0.015 1 Torr) 0.02 (0.1 Torr) 0.01 (1000/100/20/10/1 Torr) 0.03 (0.1 Torr)	0.0025 (1000/100/10/1 Torr) 0.005 (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)

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Ordering Information

	CERAVAC Transmitter CTR 100 N	CERAVAC Transmitter 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	**Type C**	**Type C**
5 m	**124 55**	**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**

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 or 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 diaphragm
- 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

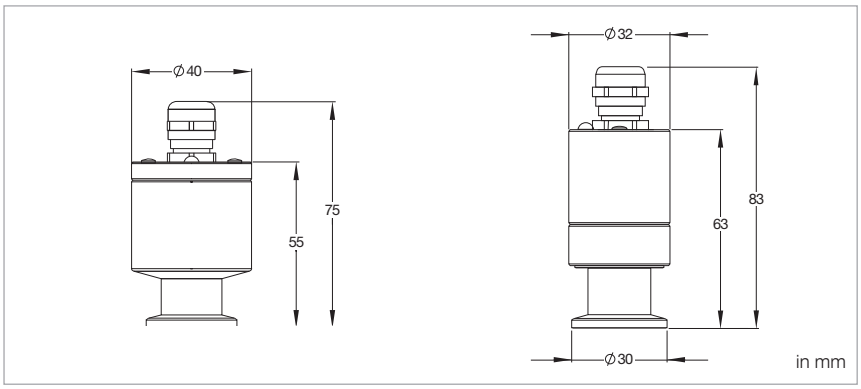
DISPLAY

- ONE
- TWO
- THREE

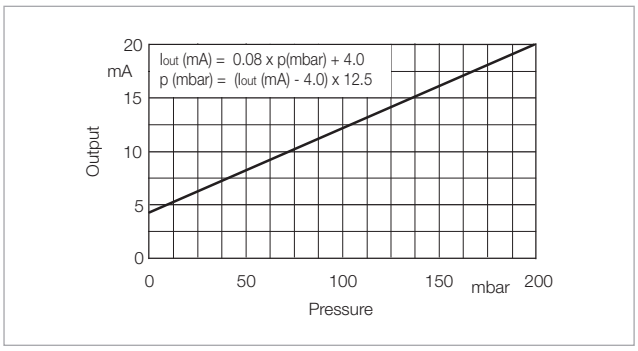
CENTER / GRAPHIX

- ONE
- TWO
- THREE

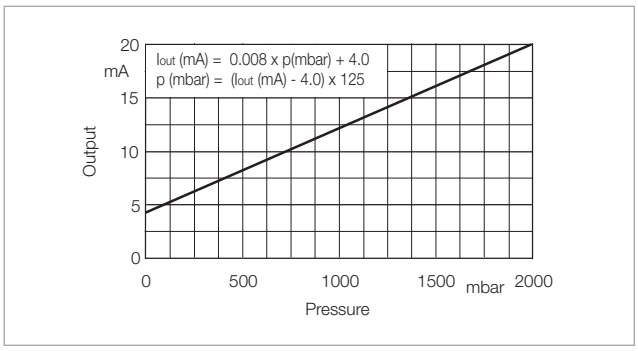
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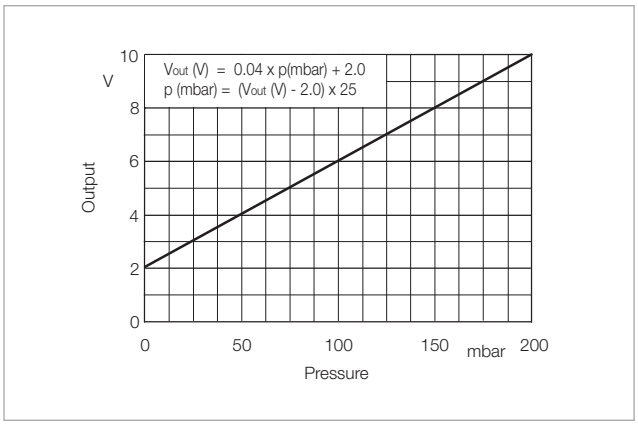
Dimensional drawing for the sensors
DI/DU 200 and DI/DU 201 (left), DI/DU 2000, DI/DU 2001 and DI/DU 2001 rel. (right)



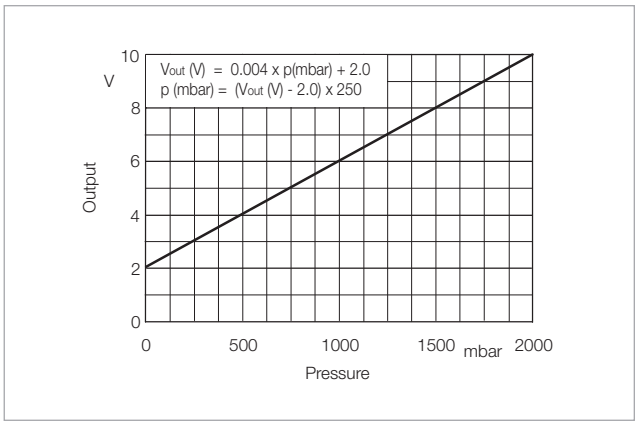
Characteristic of the DI 200 and DI 201 Sensors



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_2O_3 (96 %) Ceramics FPM (FKM)	Stainless Steel 1.4305 Al_2O_3 (96 %) Ceramics EPDM	Stainless Steel 1.4305 Al_2O_3 (96 %) Ceramics FPM (FKM)	Stainless Steel, 1.4305 Al_2O_3 (96 %) Ceramics, EPDM	Stainless Steel 1.4305 Al_2O_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

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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 20 m	**200 04 112** **200 02 645**	**200 04 112** **200 02 645**	**200 04 112** **200 02 645**	**200 04 112** **200 02 645**	**200 04 112** **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 20 m	**230505V01** **230506V01**	**230505V01** **230506V01**	**230505V01** **230506V01**	**230505V01** **230506V01**	**230505V01** **230506V01**
Operating unit GRAPHIX ONE / TWO / THREE DISPLAY ONE / TWO / THREE	please see chapter “Controller and Operating Units for Active Sensors” please see chapter “Controller and Operating Units for Active Sensors”				

THERMOVAC-Transmitter
TTR 91 N (S), TTR 96 N, TTR 911 N (C), TTR 916 N



THERMOVAC Transmitter TTR N analog (left); 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 x 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

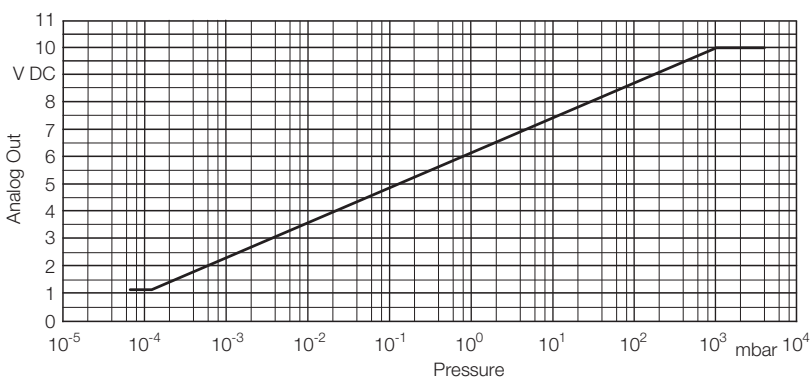
Typical Applications

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

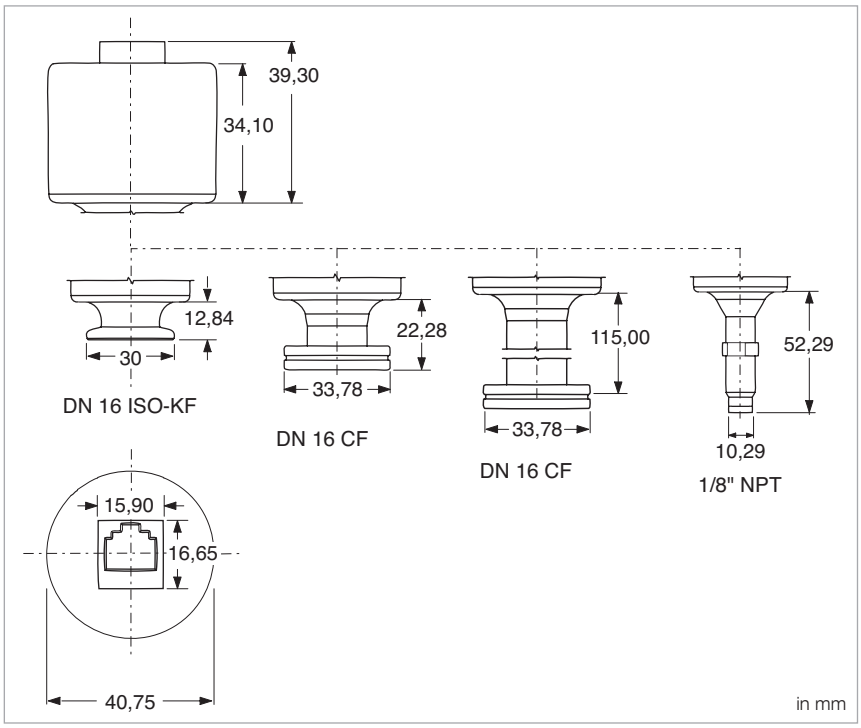
The THERMOVAC transmitters' measurement principle is based on thermal conductivity. The transmitters are equipped with a MEMS-Pirani sensing cell that consists of a silicon chip with a heated resistive element.
The THERMOVAC transmitters with the coated MEMS-Pirani are well suited for harsh processes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



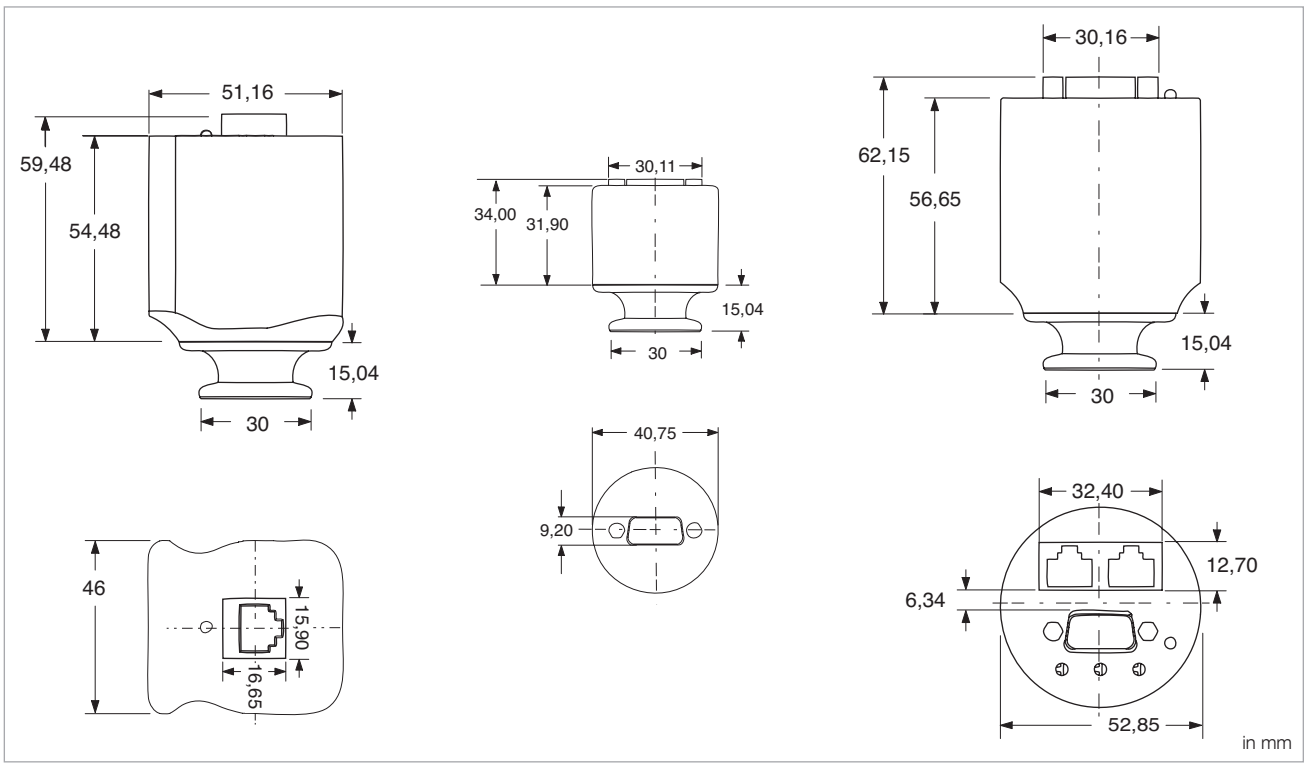
Characteristic of the THERMOVAC Transmitters TTR 91 N (S) / TTR 96 N and TTR 911 N (C) / TTR 916 N

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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

Leybold Quality In Stock 2018 - Vacuum Measuring Controlling

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_{out} = log10 (P_{mbar}) x 1.286 + 6.143		
	V DC	0.61 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 at 30 V AC/ DC, resistive load		
Relay contact resistance, max.	mΩ	100		
Relay contact endurance, min.				
1.0 A at 30 V DC load		100 000		
0.2 A at 30 V DC load		2 000 000		
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

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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^{-6} 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} = log10 (P_{mbar}) x 1.286 + 6.143
Resolution	bit	0.61 to 10
Impedance	Ω	16
Update rate	Hz	100 16
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 at 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		
1.0 A at 30 V DC load		100 000
0.2 A at 30 V DC load		2 000 000
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

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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 911 N, without Parylene coating TTR 916 N SC, TTR 911 NC, with Parylene coating	**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 RS232 / USB Converter for setpoint definition of RS232 gauges	 **230 082** **230399V02**

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 x 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

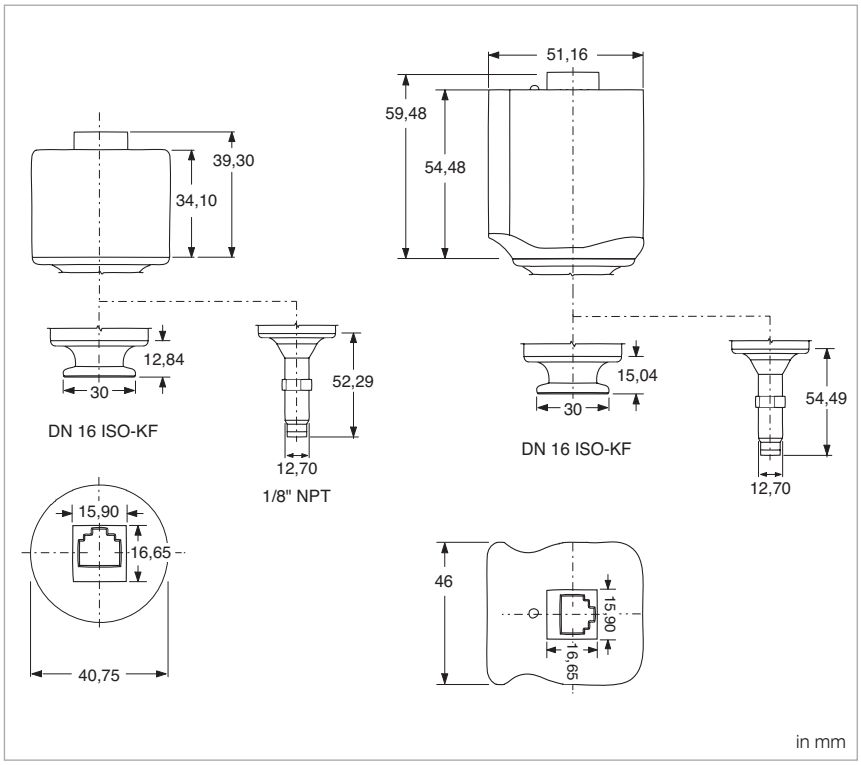
The THERMOVAC TTR 101 N transmitters can be used in any application that requires absolute pressure measurement and switching capabilities.

- 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

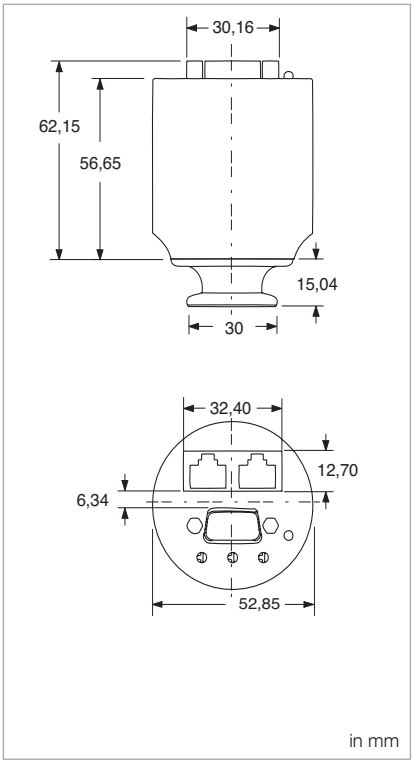
Sensor

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”.

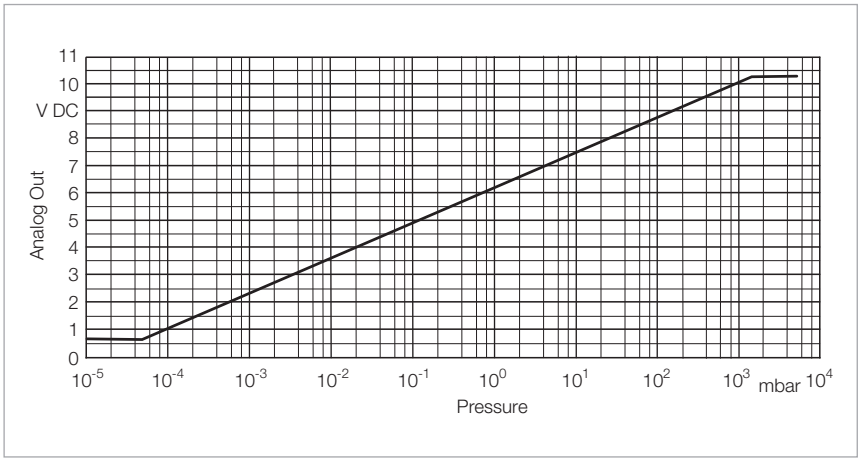
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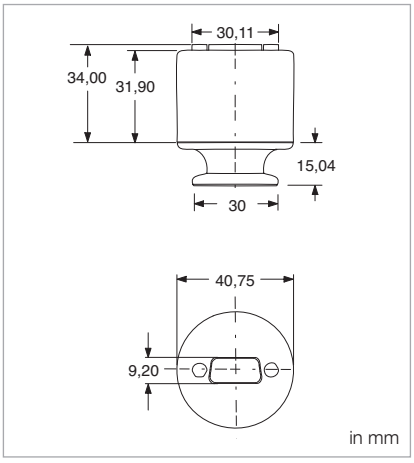
Dimensional drawing for the THERMOVAC Transmitters TTR 101 N (S) (left) and TTR 101 N Display (right)



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 Resolution Impedance Update rate	V DC bit Ω Hz	V_{out} = log10 (P_{mbar}) x 1.286 + 6.143 0.61 to 10.23 16 100 16
Interfaces		FCC 68, RJ 45 (analog) / RS 232, EtherCAT, Profibus (digital)
Set point Range Relay Relay contact rating Relay contact resistance, max. Relay contact endurance, min. 1.0 A at 30 V DC load 0.2 A at 30 V DC load	 mbar (Torr) mΩ 	 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) 2 / 3 1 A at 30 V AC / DC, resistive load 100 100 000 2 000 000
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

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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, 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 RS232 / USB Converter for setpoint definition of RS232 gauges	 **230 082** **Type G** **230550V01** **230551V01** **230552V01** **230553V01** **230399V02**

[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 x 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 x 10^{-8} mbar to atmosphere are:

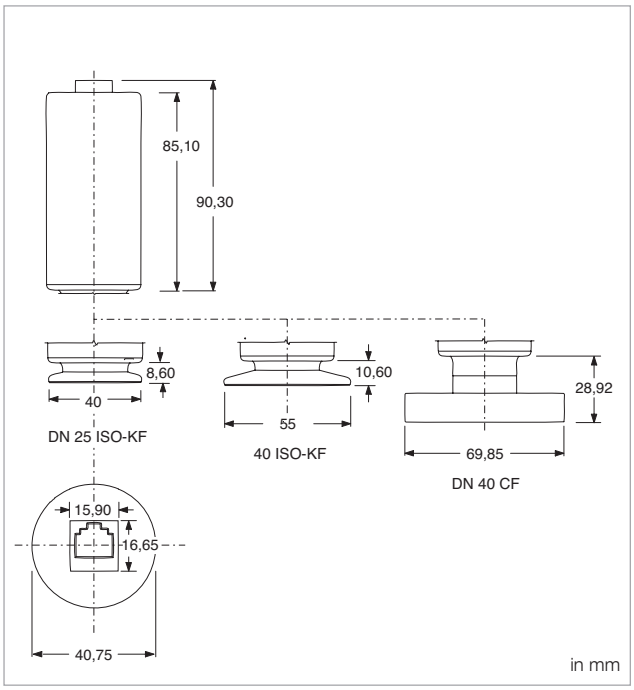
- General vacuum base pressure measurement
- Sputtering and coating technology
- Analytical technology (e. g. mass spectrometer control)
- Vacuum Furnaces
- Multipurpose pressure measurement and control up to the high vacuum range
- Metallurgy
- Scanning electron microscopes
- Process industry

Option

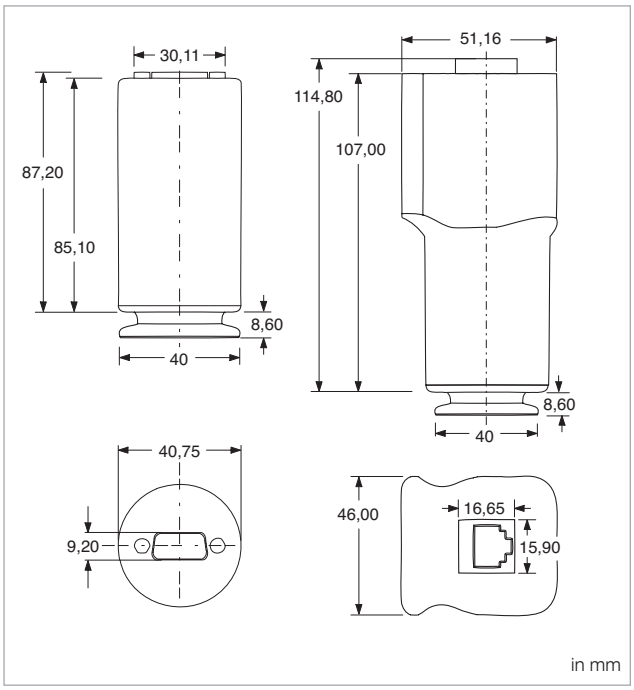
For protection of the sensor PTR 90 N against contamination, radiation and other disturbing factors the installation of a baffle is recommended.

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.

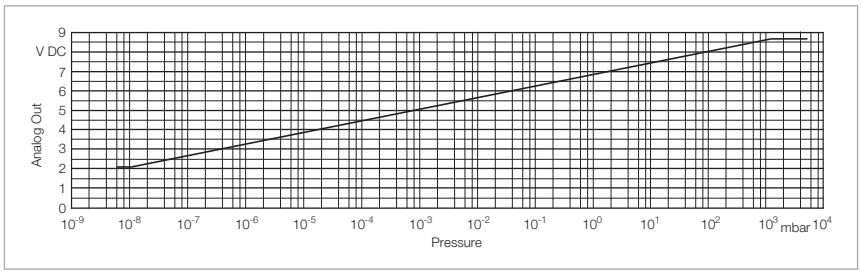
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Dimensional drawing for the PENNINGVAC transmitter PTR 90 N



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		Cold cathode and MEMS Pirani
Measurement principle		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 at 30 V AC / DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		
1.0 A at 30 V DC load		100 000
0.2 A at 30 V DC load		2 000 000
Status indicators		LED-ring (360°)
Max. cable lenght	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_2O_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

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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, EtherCAT	**230089V02**
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 (up to serial no. 17022777352)	**EK16291V02**
for PTR 90 N / PTR 225 N (from serial no. 17022777353)	**EK16292V02**
Replacement anode ring	
for PTR 90 N / PTR 225 N (up to serial no. 17022777352)	**20028711V02**
for PTR 90 N / PTR 225 N (from serial no. 17022777353)	**E20028712V02**
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**
RS232 / USB Converter for setpoint definition of RS232 gauges	**230399V02**

[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

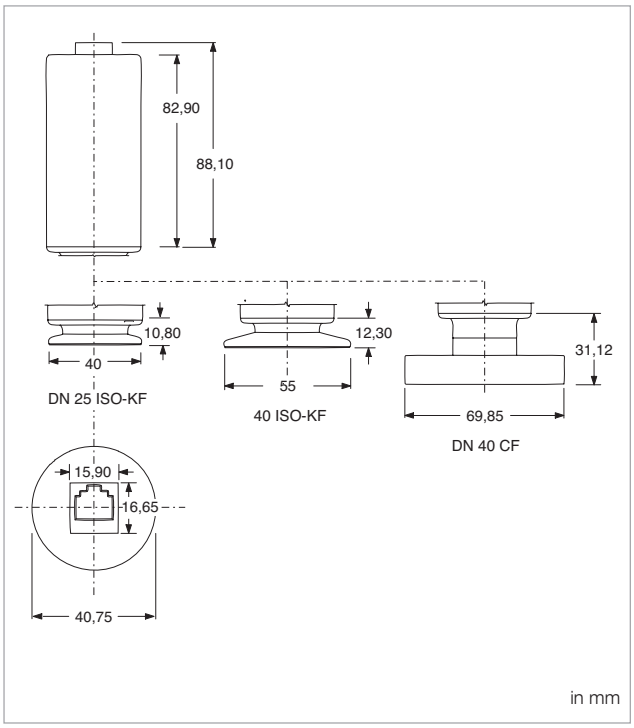
Option

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

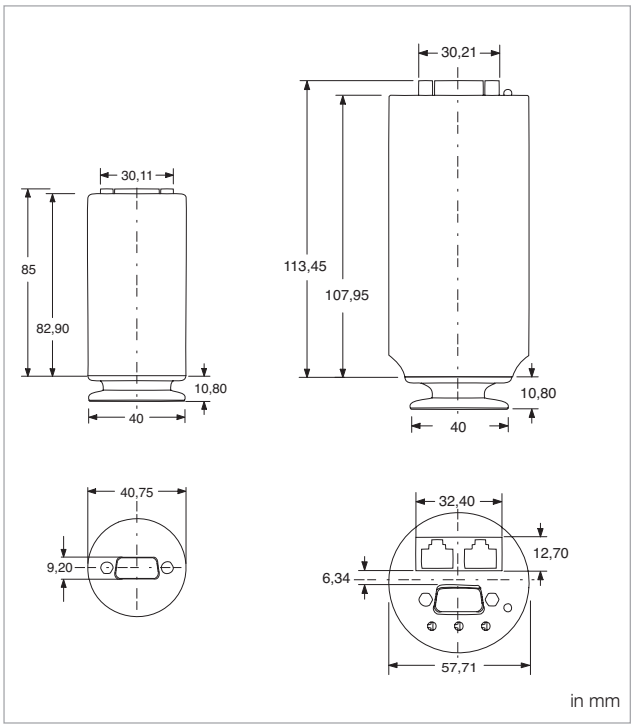


Baffle DN 25 ISO-KF, with centering ring,
Part No. 230 078

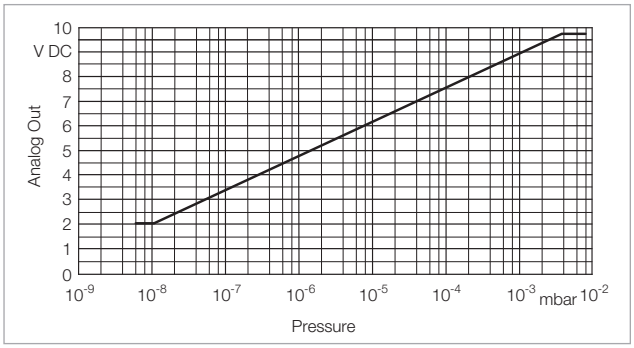
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Dimensional drawing for the PENNINGVAC transmitters
PTR 225 N and PTR 237 N



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 1×10^{-3} ±30 %
Repeatability of reading [1]	mbar	1×10^{-8} to 1×10^{-3} ±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 Resolution Impedance Update rate	 V DC bit Ω Hz	$V_{out} = 1.33 \times \log 10 (P_{mbar}) + 12.66$ 2.0 to 9.6 16 100 16
Interfaces		FCC 68 / RJ 45
Set point Relay range Relay Relay contact rating Relay contact resistance Relay contact endurance, min. 1.0 A at 30 V DC load 0.2 A at 30 V DC load	 mbar (Torr) mΩ 	 1×10^{-8} to 5×10^{-3} (0.75×10^{-8} to 3.75×10^{-3}) 2 [RS 232] 1 A at 30 V AC / DC, resistive load 100 100 000 2 000 000
Status indicators		LED-ring (360°)
Max. cable lenght	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_2O_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

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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 (up to serial no. 17022777352)	**EK16291V02**
for PTR 90 N / PTR 225 N (from serial no. 17022777353)	**EK16292V02**
Replacement anode ring	
for PTR 90 N / PTR 225 N (up to serial no. 17022777352)	**20028711V02**
for PTR 90 N / PTR 225 N (from serial no. 17022777353)	**E200287112V02**
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**
RS232 / USB Converter for setpoint definition of RS232 gauges	**230399V02**

[1] See chapter “Connection cables for Active Sensors”

Leybold Quality Instruments 2018 - Vacuum Measuring & Controlling

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

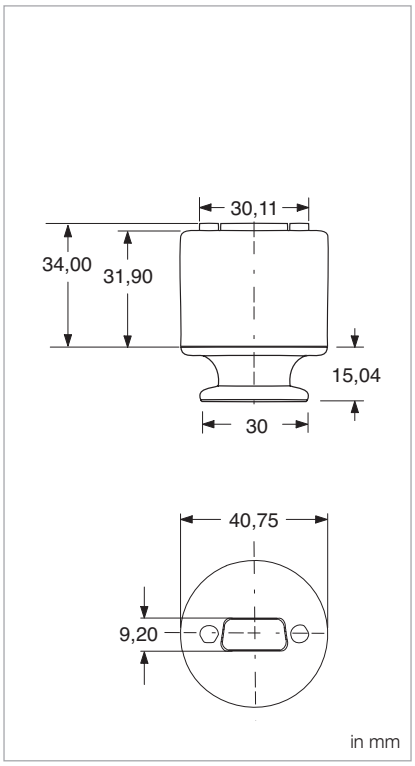
- Load lock applications
- Chamber over and under pressure control relative to ambient
- Coating Systems (e. g. UNIVEX)
- Vacuum chamber production
- Processes requiring both absolute pressure measurement and atmospheric switching capabilities
- Analytical equipment (e. g. mass spectrometer control)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

Option

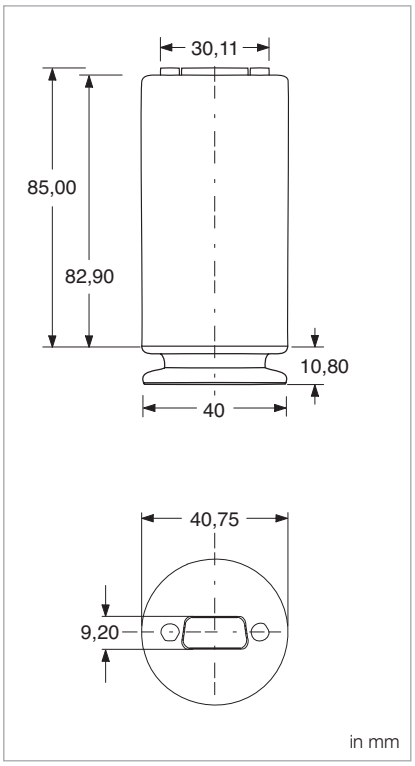
For protection of the sensor TTR 200 N and PTR 200 N against contamination, radiation and other disturbing factors the installation of a baffle is recommended.

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.

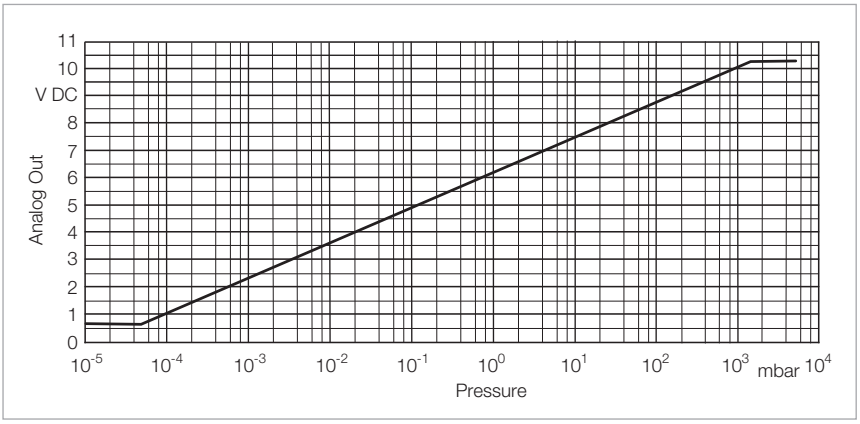
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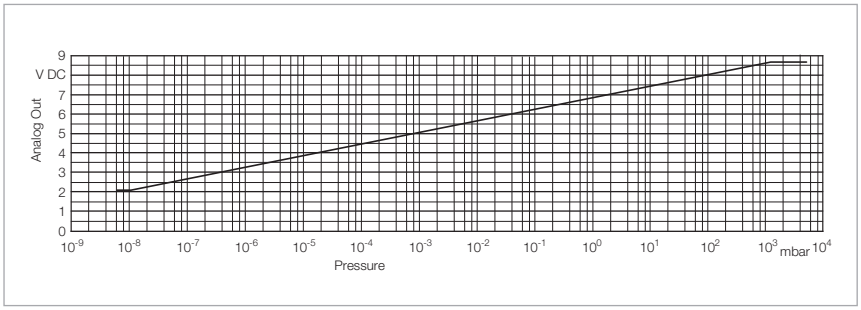
Dimensional drawing for the THERMOVAC transmitter TTR 200 N



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)	**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)
absolute	**mbar**	5 x 10^{-5} to 1500 [RS 232]	1 x 10^{-8} to atm. [RS 232]
	(Torr)	(3.75 x 10^{-5} to 1125) [RS 232]	(0.75 x 10^{-8} to atm.) [RS 232]
differential	**mbar**	-1013 to 1013 [RS 232]	-1013 to 1013 [RS 232]
	(Torr)	(-760 to 760) [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^{-4} to 1 x 10^{-3} ±10 %
		1 x 10^{-3} to 100 ±5 %	1 x 10^{-3} to 100 ±5 %
		100 to atm. ±25 %	100 to atm. ±25 %
Diff. Piezo	**mbar**	-10 to 10 ±10 % ±0.67 mbar	10 to 10 ±10 % ±0.67 mbar
		-100 to -10 ±8 %	-100 to -10 ±8 %
		-1013 to -100 ±1 %	-1013 to -100 ±1 %
		10 to 100 ±5 %	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} = log10 (P_{mbar}) x 1.286 + 6.143	V_{out} = log 0.6 (P_{mbar}) + 6.8
	V DC	0.61 to 10.23	2.0 to 8.667
Resolution	**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 at 30 V AC / DC, resistive load	1 A at 30 V AC / DC, resistive load
Relay contact resistance, max.	**mΩ**	100	100
Relay contact endurance, min.			
1.0 A at 30 V DC load		100 000	100 000
0.2 A at 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_2O_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		GRAPHIX ONE / TWO / THREE	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

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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 for PTR 90 N / PTR 225 N (up to serial no. 17022777352) for PTR 90 N / PTR 225 N (from serial no. 17022777353)	– –	EK16991V02 EK16992V02
Replacement anode ring for PTR 90 N / PTR 225 N (up to serial no. 17022777352) for PTR 90 N / PTR 225 N (from serial no. 17022777353)	– –	20028711V02 E20028712V02
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] 5 m 10 m 15 m 20 m RS232 / USB Converter for setpoint definition and parametrization of RS232 gauges	Type G 230550V01 230551V01 230552V01 230553V01 230399V02	Type G 230550V01 230551V01 230552V01 230553V01 230399V02

[1] See chapter "Connection cables for Active Sensors"

IONIVAC Transmitter ITR 90



The ITR 90 is a 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 x 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

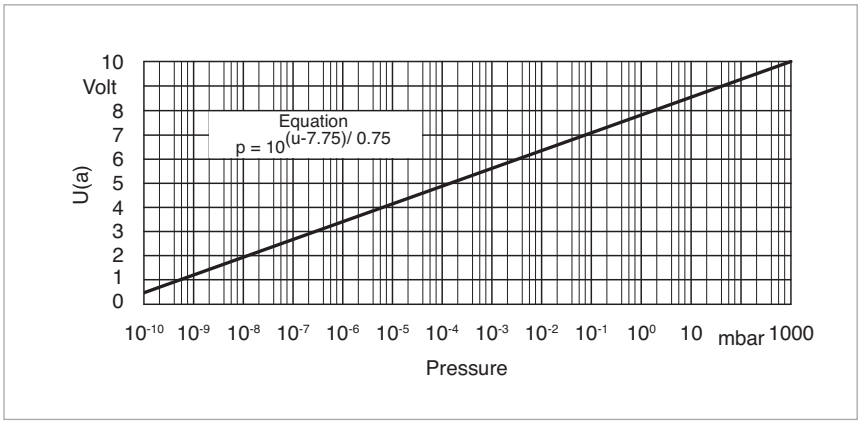
- Analytical
- Evaporation and coating
- Vacuum furnaces
- General purpose pressure measurements in the fine and high vacuum ranges

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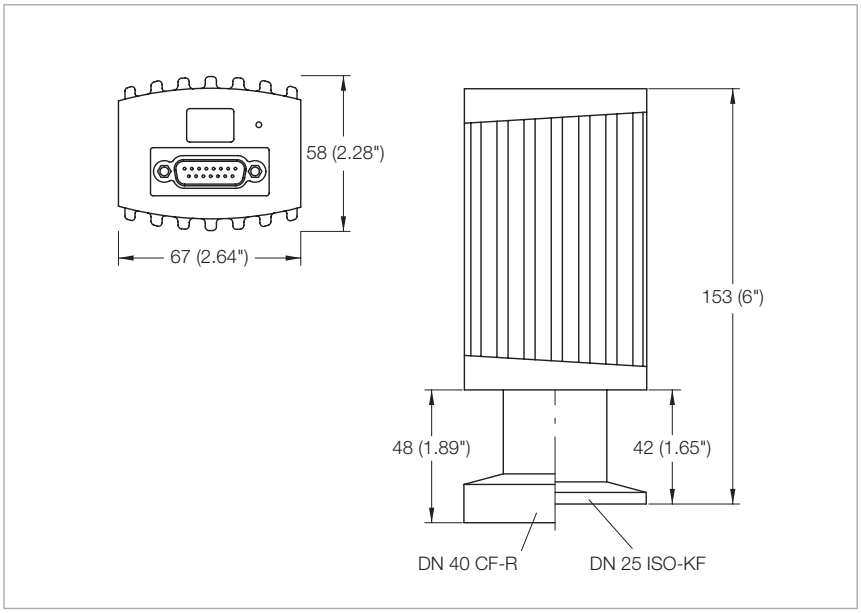
Sensor

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

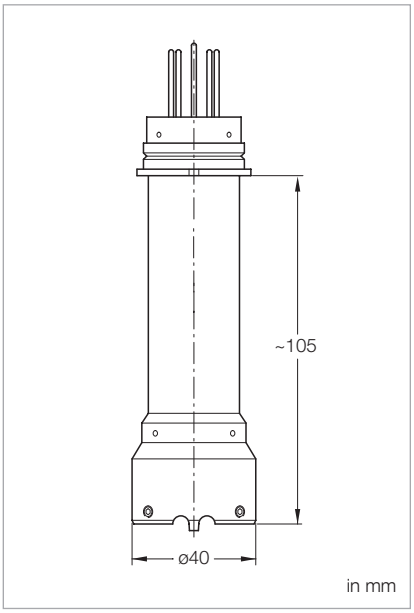
When using the bake out extension, measurements will be possible also at flange temperatures up to 150 °C.



Characteristic of the ITR 90



Dimensional drawing for the ITR 90; dimensions in mm, in brackets ( ) are in inch
(Image with integrated display; Profibus interface differing)



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 **Measurement uncertainty, 10^{-8} – 10^{-2} mbar** **Reproducibility, 10^{-8} – 10^{-2} mbar**	≥ 15% of the meas. value 15% of the meas. value 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)** **ITR 90, DN 40 CF kg (lbs)**	 0.285 (0.64) 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_a ≥ 10 kΩ) **Measurement signal** **Error signal**	 0 – 10 V, 0.774 – 10 V, 0.75 V pro decade < 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

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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

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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 x 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 x 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

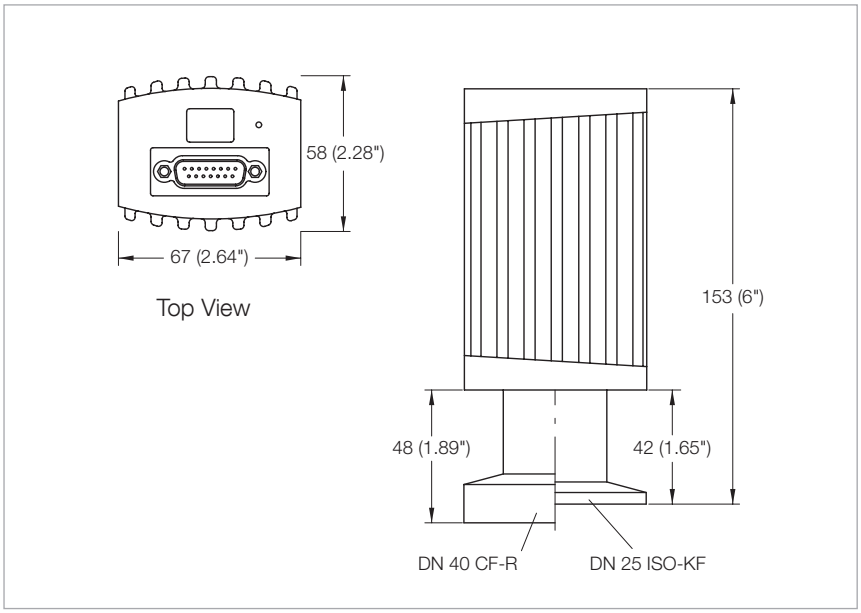
Options

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

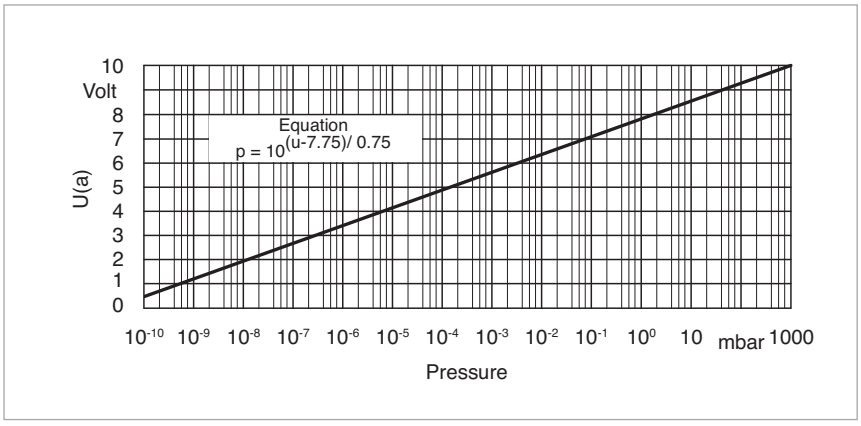
Sensor

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).

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Dimensional drawing for the ITR 200 S; dimensions in mm, in brackets ( ) are in inch
(Image with integrated display; Profibus interface differing)



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 **Measurement uncertainty, 10^{-8} – 10^{-2} mbar** **Reproducibility, 10^{-8} – 10^{-2} mbar**	≥ 15% of the meas. value 15% of the meas. value 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)** **ITR 200 S, DN 40 CF kg (lbs)**	 0.50 (1.10) 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** **Error signal**	 0 – 10 V, 0.774 – 10 V, 0.75 V pro decade < 0,5 V
Interface (standard / optional)	RS 232 C / Profibus
Switching function **Standard** **Profibus**	 1 normally open contact 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

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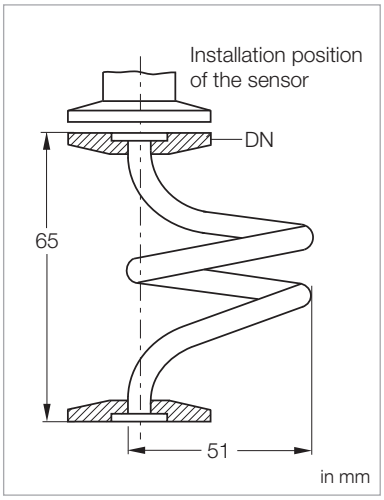
Ordering Information

IONIVAC-Transmitter ITR 200 S

	without Display Part No.	with Display 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 Baffle, DN 25 ISO-KF, with Installation baffle for CF/ISO-KF variant	**121 06** **121 07**	**121 06** **121 07**
Replacement sensor IE 200, DN 25 ISO-KF [2] IE 200, DN 40 CF-R [2] IE 200 SL [1], DN 40 CF-R [2]	**240 020** **240 021** **–**	**240 020** **240 021** **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

Spiral Tube

Materials	Stainless steel

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**

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Notes

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**
PENNINCVAC 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 TURBOVAC iX Extension Box
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**

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Technical Data

	Connection Cable	
	Sensor side	Controller-/Customer side
Cable		
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		
1.5 m	800103V0032	-
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

Ordering Information

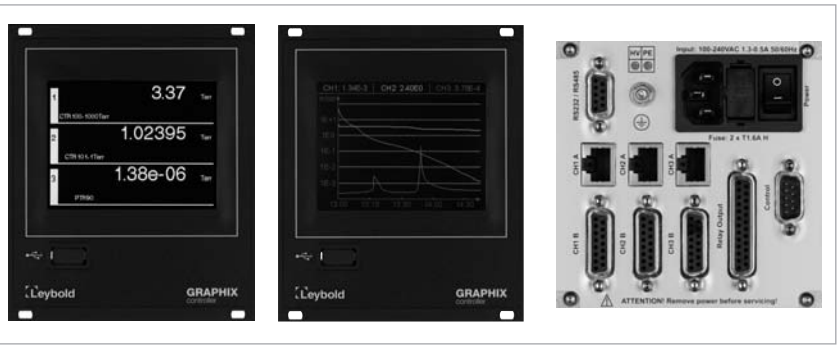
	Connection Cable	
	Type C	Type E
	Part No.	Part No.
Cable length		
5 m	124 55	124 63
10 m	230 022	163 69
15 m	124 56	124 64
20 m	124 57	124 65
30 m	124 58	–
50 m	230 345 V01	–

Ordering Information

	Connection Cable	
	Type F	Type G
	Part No.	Part No.
Cable length		
5 m	230 032 V01	230 550 V01
10 m	230 023 V01	230 551 V01
15 m	-	230 552 V01
20 m	-	230 553 V01

Controller and Operating Units for Active Sensors

GRAPHIX ONE, TWO, THREE



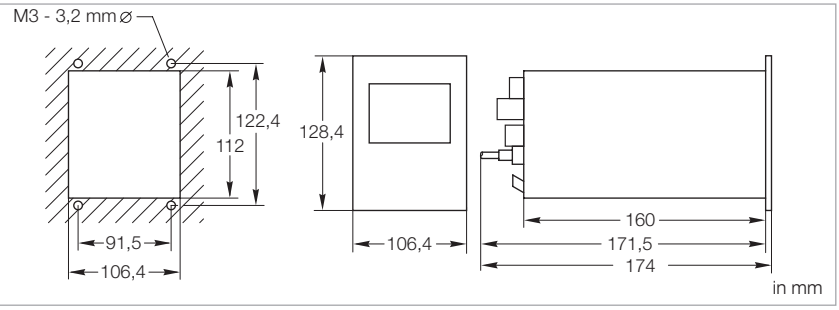
Controller GRAPHIX with different displays and rear panel (right)

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

Advantages to the User

- Display range from 1 x 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





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

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

CERAVAC

- 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 200 S
- ITR 200 SL

Other brands

- Active sensors with linear or logarithmic output

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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 Number Adjustment range Hysteresis Relay contact Load rating	freely assignable to the measurement channels 6 sensor dependent adjustable floating changeover contact 1 A / 30 V AC / 30 V DC		
Error message Relay contact Load rating	floating normally open contact 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 Part No.	GRAPHIX TWO Part No.	GRAPHIX THREE Part No.
GRAPHIX controller including 2 m EURO- and US mains cord	**230680V01**	**230681V01**	**230682V01**
THERMOVAC, PENNINGVAC, CERAVAC, 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), CERAVAC (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”
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

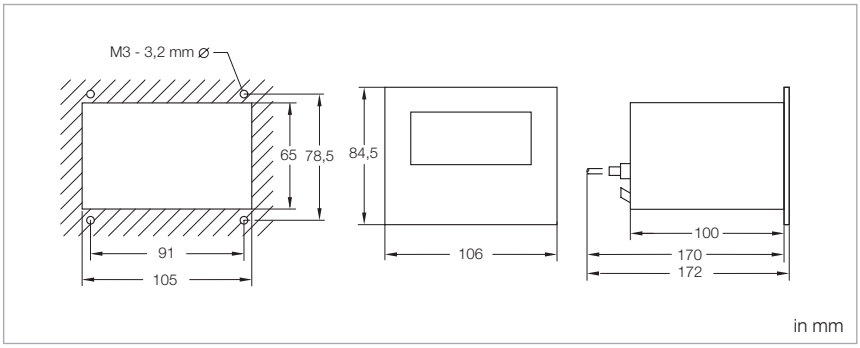
DISPLAY ONE



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 x 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



Dimensional drawing and panel cut-out for the DISPLAY ONE

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.

*) Connecting of older sensors possible

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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 3 HU, 19" rack	**230 005**

DISPLAY TWO, THREE

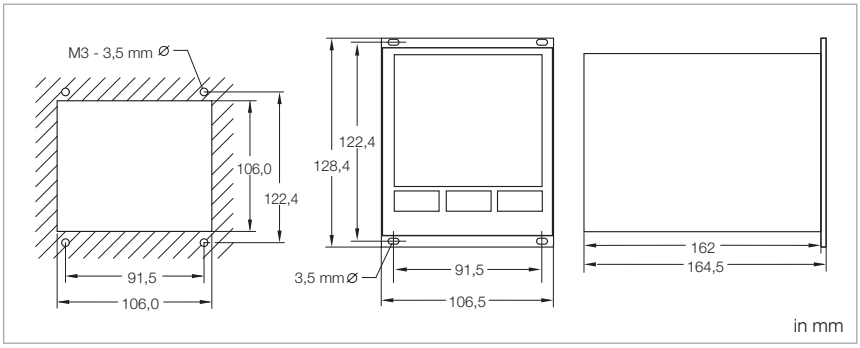


Cost-effective, operating and display units for the transmitters from the THERMOVAC and PENNINGVAC series.

All channels are displayed simultaneously.

Advantages to the User

- Power supply voltage for the transmitters
- Display range from 1 x 10^{-9} to 2000 mbar (0.75 x 10^{-9} to 1500 Torr)
- Readout selectable between mbar, Torr or Pascal
- Adjustable switching thresholds with variable hysteresis, floating changeover 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



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

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

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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 x 10^{-10} to 2000	1 x 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_a > 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 Part No.	DISPLAY THREE 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”

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 x 10^{-4} to 1000 mbar (3.75 x 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

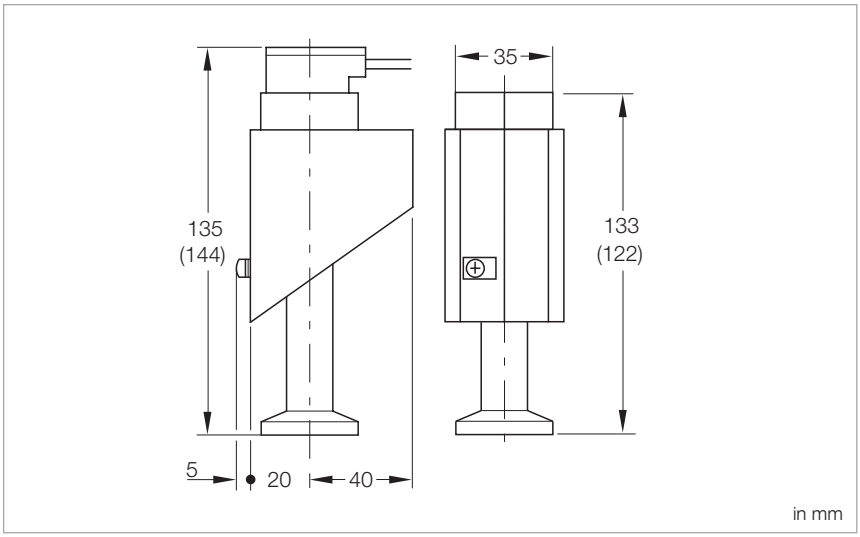
- Aluminum sensing cell with tungsten filament
- Improved temperature compensation

TR 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

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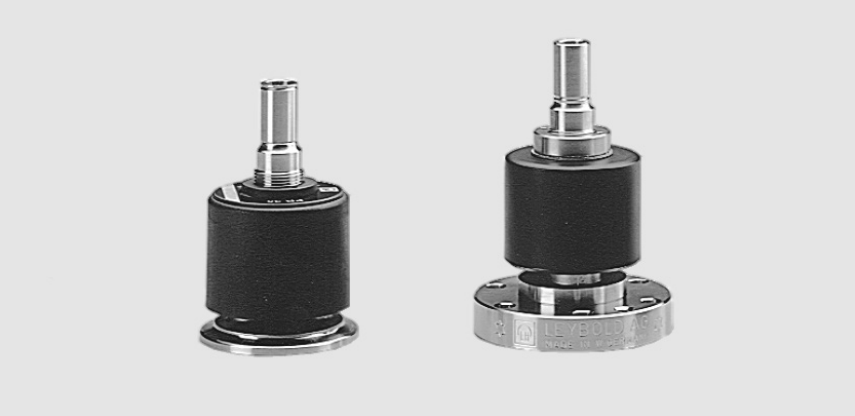
Technical Data

		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, epoxy cement	Aluminium Vacon, Glass, Tungsten CrNi 8020 epoxy cement	Stainless steel, Vacon, Glass, Tungsten CrNi 8020	Stainless steel 1.4301 (SS 304), Al_2O_3[2], 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



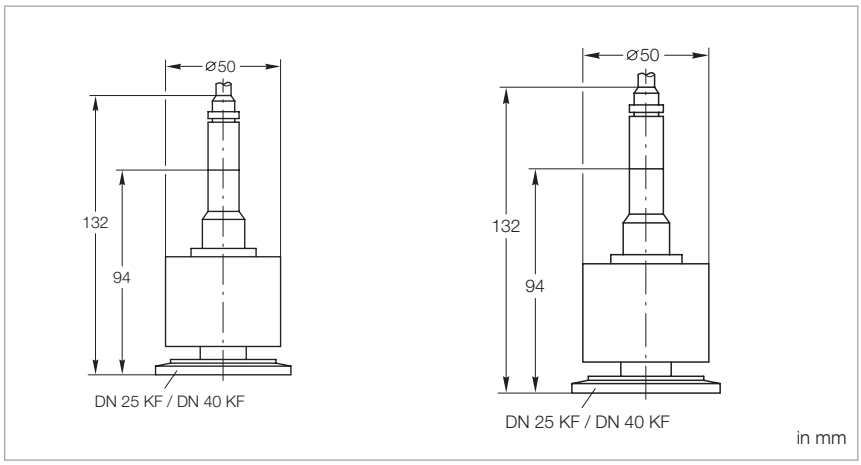
These passive sensors use cold cathode ionization technology according to Penning.

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

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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 Sensors IE 414 and IE 514



These passive sensors use hot cathode ionization technology.

IE 414

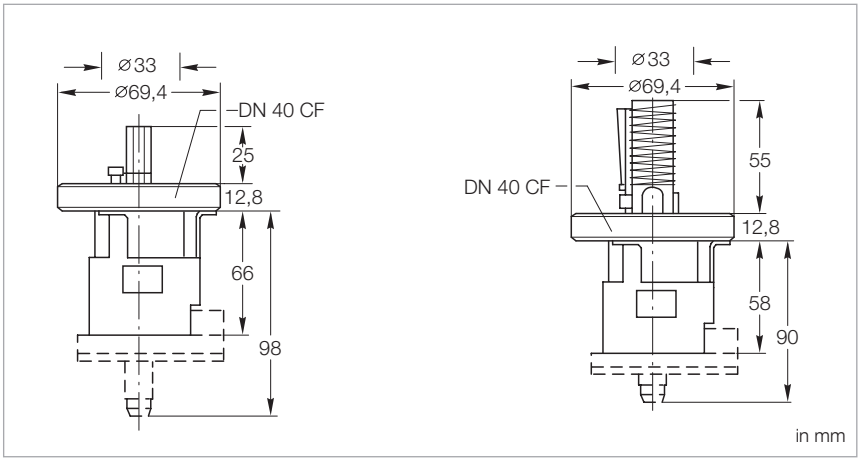
- Bayard-Alpert sensing system
- Measurement range to 2 x 10^{-11} mbar (1.5 x 10^{-11} Torr)
- Protection shield welded in place

IE 514

- Extractor sensing system
- Reliable to 1 x 10^{-12} mbar (0.75 x 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)

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Technical Data

		IE 414	IE 514
Measurement range	mbar (Torr)	2 x 10^{-11} to 10^{-2} (1.5 x 10^{-11} to 10^{-2})	10^{-12} to 1 x 10^{-4} (10^{-12} to 7.5 x 10^{-5})
X-ray limit	mbar (Torr)	≤ 10^{-11} (≤ 10^{-11})	≤ 10^{-12} (≤ 10^{-12})
Operating temperature range	°C	0 to +80	0 to +80
Degassing temperature at the flange, max.	°C	250 [1] / 400 [2]	250 [1] / 400 [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
Hot cathode current	A	1.4	1.4
Hot cathode voltage	V	2.7	3.7
Sensitivity for Nitrogen	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

Operating Unit for Passive Sensors

COMBIVAC CM 51/CM 52





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

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.

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

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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

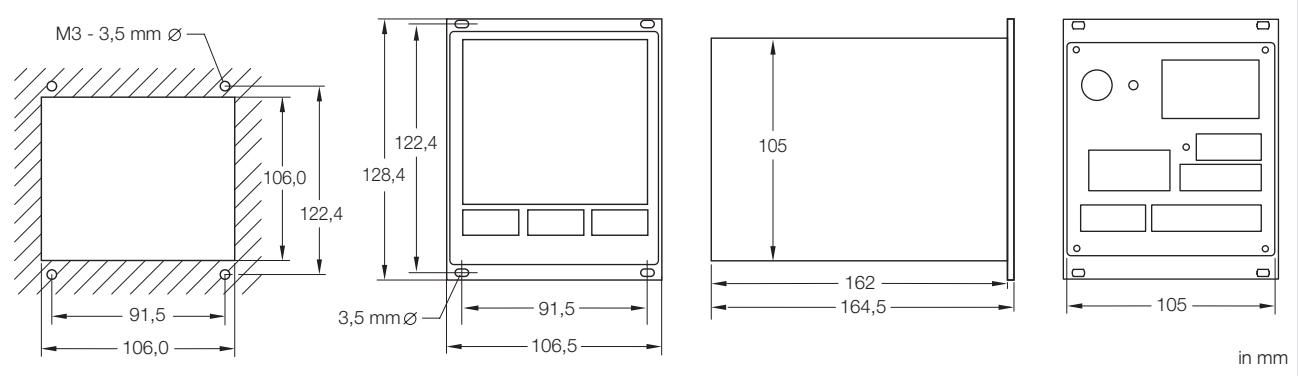
- TR 211
- TR 211 NPT
- TR 212
- TR 216

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

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Technical Data

COMBIVAC

		CM 51	CM 52
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)		0 to 10 V, log. divisions	0 to 10 V, log. divisions
THERMOVAC		linear: 3 decades, approximately 10.5 V in case of a failure, logarithmic: (1 x 10^{-3} mbar), 1.67 V/decade	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

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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	230 110	230 115
with Profibus DB	230 111	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
30 m	–	245 011 V01
50 m	–	245 010 V01
up to 100 m (application dependent)	–	upon request

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 x 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”)

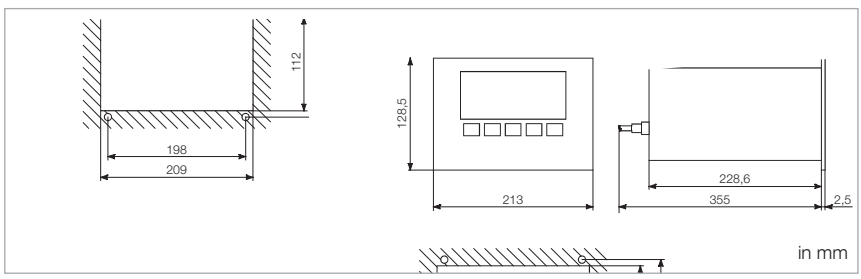
combined with

- 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

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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) Measurement range Extractor mbar (Torr) Measurement range Bayard-Alpert mbar (Torr)	1 x 10^{-12} to 1100 (0.75 x 10^{-12} to 825) 1 x 10^{-12} to 1 x 10^{-4} (0.75 x 10^{-12} to 0.75 x 10^{-4}) 1 x 10^{-11} to 1 x 10^{-2} (0.75 x 10^{-11} to 0.75 x 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 x 10^{-10} to 1 x 10^{-2} mbar, 5 s^{-1} 1 x 10^{-12} to 1 x 10^{-10} mbar, 0.5 s^{-1}
Emission current Extraktor sensor mA Bayard-Alpert sensor mA	 1.6 0.1 to 10; automatic control
Emission current shutdown at	p > 1 x 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 Extractor / Bayard-Alpert (R_a = 2,5 kΩ)	logarithmic 0 to 10 V (1 V / dec.) or linear 0 to 10 Volt error indication U > 10.5 V
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

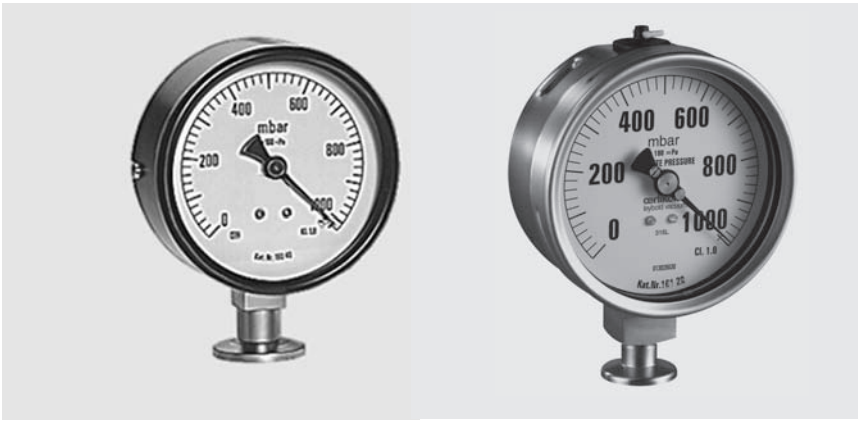
IONIVAC IM 540

	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 Replacement cathode IE 414 IE 514, DN 40 CF Replacement cathode IE 514	 **158 66** **158 63** **158 67** **158 61**
Gauge head cables for IE 414/514 5 m 10 m 15 m 5 m, bakeable to 200 °C 10 m, bakeable to 200 °C	 **158 68** **150 88** **230 670 V01** **158 44** **230 671 V01**
Extension cables for IE 414/514 10 m 20 m	 **245 002** **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”

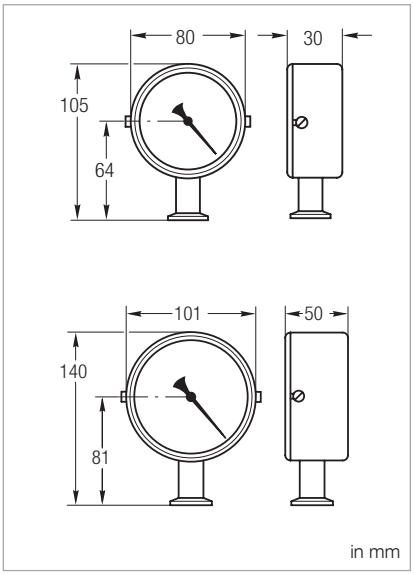
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Mechanical Gauges

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 x 10^{-8}	1 x 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



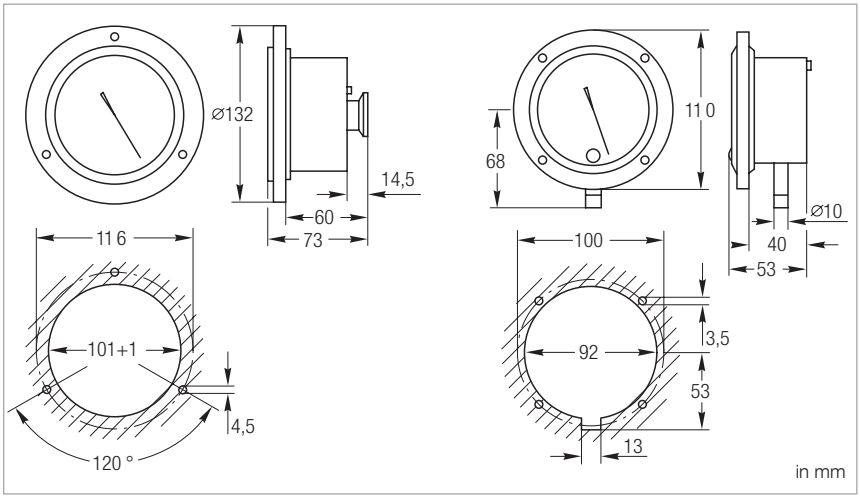
Rugged absolute pressure gauges for the pressure range from 1 to 1000 mbar (0.75 to 750 Torr).

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)

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Leybold Quality Standard 2018 - Vacuum Measuring Technology
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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

Ordering Information

Capsule Vacuum Gauge

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

Leybold Quality Statement 2018 – Vacuum Measuring Technology

Diaphragm Vacuum Gauge DIAVAC DV 1000



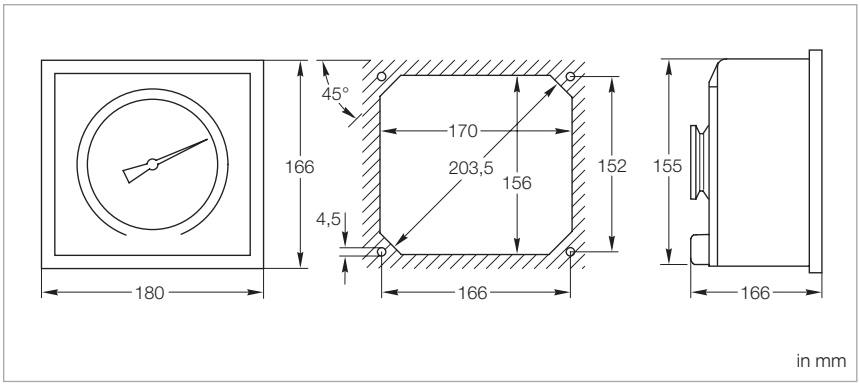
Rugged mechanical diaphragm vacuum gauge of high accuracy for the rough vacuum range from 1 to 1000 mbar (1 to 750 Torr).

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 destillation
- 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

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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) 10 – 600 mbar (7.5 - 450 Torr)		 ±1 mbar (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 display Torr display	 **160 67** [1] **896 06** [1]
Factory calibration	**154 22**
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

Additional Sensors

Older Sensors / Replacement Sensors



Linear pressure sensor



Replacement sensor TTR 211



Replacement sensor TTR 216

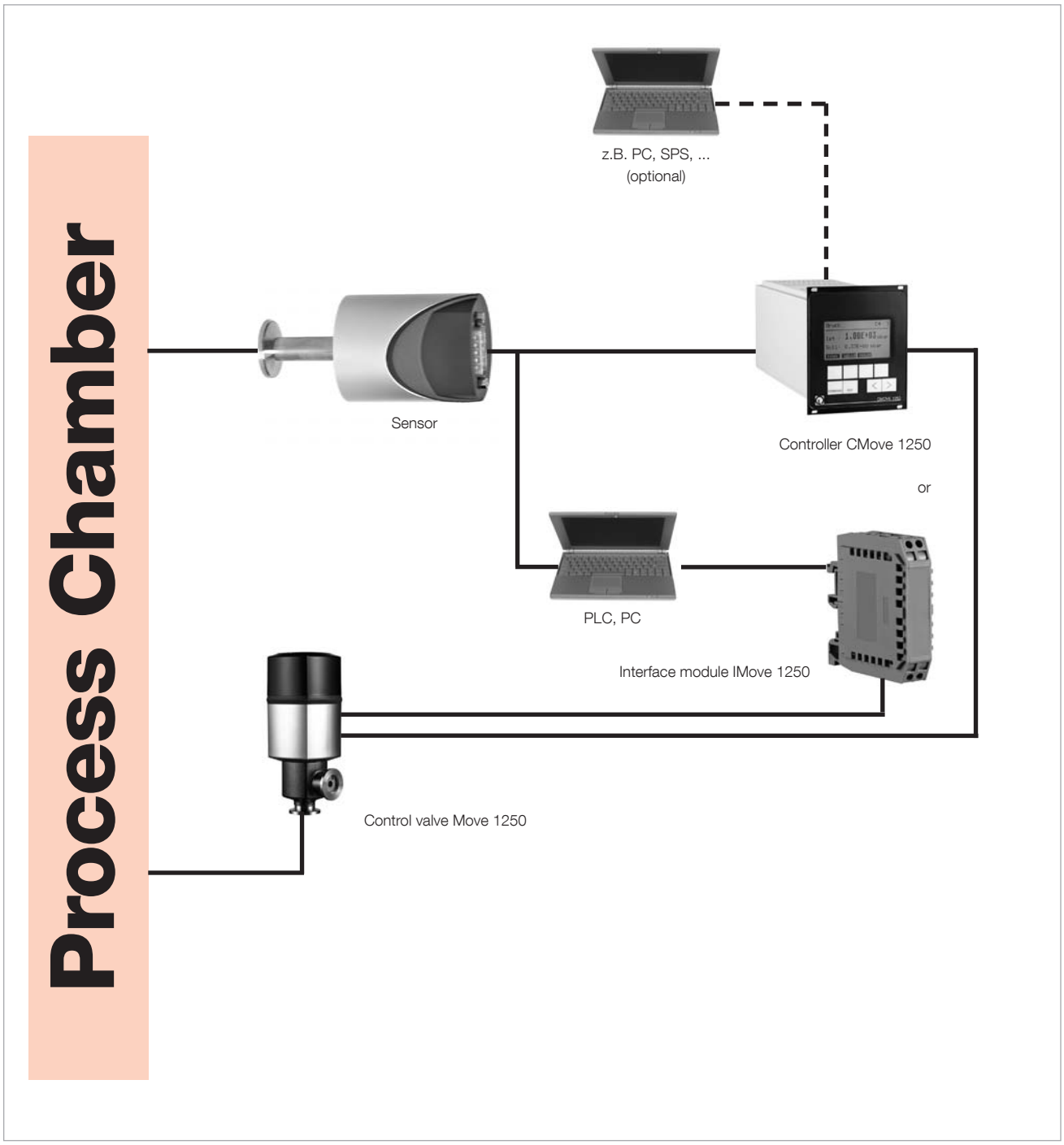
Type	Corresponding Sensors/ Operating Units	Ordering Information
		Part No.
Replacement sensor TTR 211	TTR 211 PB / D	**E 157 75**
Replacement sensor TTR 216	TTR 216 PB / D	**E 157 77**
Replacement spare sensor IE 100 **DN 25 ISO-KF** **DN 40 CF**	 ITR 100 ITR 100	 **E 163 61** **E 163 67**
Replacement spare cathode IE 413	IM 510	**158 63**
Linear pressure sensor **(Previous version)**	DI 200 DI 201 DI 2000 DI 2000 Adaptor	**158 12** **158 14** **158 13** **245022V01**

[1] For all DI-Sensors

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Notes

Pressure Control System Move



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Control Valve Move 1250



Control valve Move 1250

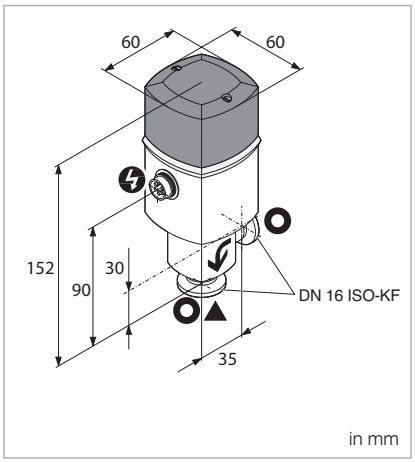
Control Valve Move 1250

Advantages to the User

- Extended control range from 1 x 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)

Technical Data

		Control Valve Move 1250
Vacuum connection		DN 16 ISO-KF
Mounting orientation		Any
Leak tightness	**mbar x l/s**	1 x 10^{-9}
Pressure range		1 x 10^{-8} mbar to 2.5 bar (absolute)
Gas flow [1]		
with filter, on the inlet side		5 x 10^{-6} to 1250 mbar x l/s
with filter, on the inlet and the vacuum side	**mbar x l/s**	5 x 10^{-6} to 1000
Power supply		
Operation voltage	**V DC**	24 (± 10%)
Power consumption	**VA**	12
Current consumption	**mA**	500, 20 to 30 (closed circuit current)
Actuation		Step motor
Digital		CMove or IMove 1250
Analog	**V DC**	0 to 10
Type of protection	**IP**	40
Closing time / opening time	**s**	3 / 4
Ambient temperature	**°C**	+5 to +40
Bake out temperature		
Valve body	**°C**	80
Actuator	**°C**	60
Material		
Valve body		Stainless steel 1.4435
Valve needle, valve disc		Stainless steel 1.4301
Filter		Stainless steel 1.4404
Seals		FPM
Dosing sleeve		Fluorplastomer
Weight	**kg (lbs)**	0.5 (1.1)

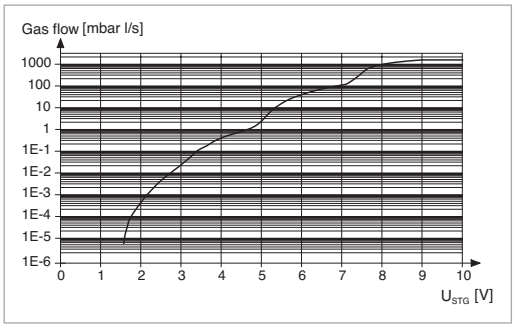


Dimensional drawing for the Move 1250

[1] For air at a differential pressure of Δp = 1 bar

[2] 1 sccm = 1.69 x 10^{-2} $\frac{\text{mbar x l}}{\text{s}}$

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



Gas flow curve of the Move 1250

Ordering Information

Control Valve Move 1250

	Part No.
Control Valve	
Move 1250	**230 219**
Filter for the inlet or vacuum side consisting of filtering candle, O-ring and two securing rings	**109 63**
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**

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Notes

Controller CMove 1250



Controller CMove 1250

Technical Applications

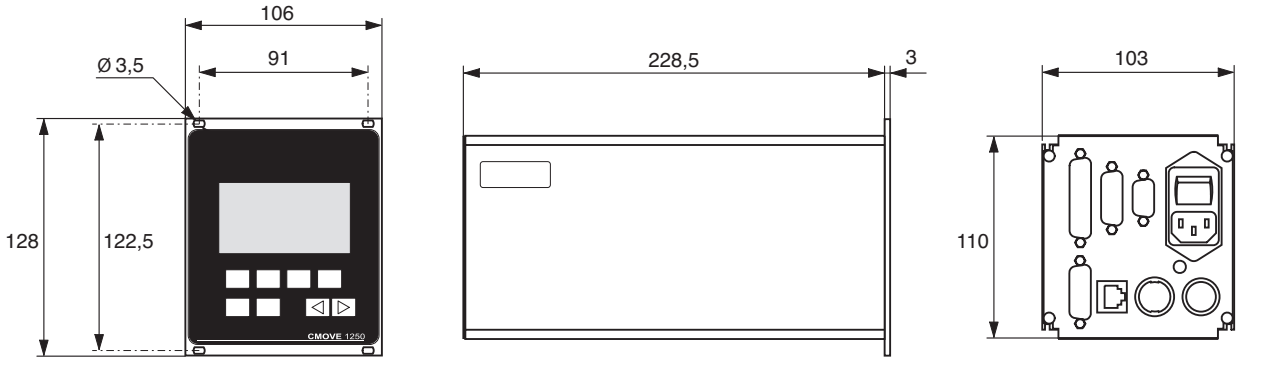
- Simple to operate
  - Self-explanatory LCD display and function keys
- Analog/digital inputs/outputs and interfaces
  - Digital input valve control, switch-over
    Pressure and gas flow adjustment
    Digital output valve control, error message
- Adjustable PID control algorithms
- 99 pre-programmed 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

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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
Control accuracy [1]		0,5% F.S. sensor
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 x 10^{-6} to 1.25 x 10^{+3} mbar x l/s
with MOVE X		CLOSED, 1.0 x 10^{-5} to 1.0 x 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
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
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

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Interface Module IMove 1250 for Move 1250



Advantages to the User

- Status query and valve position

Typical Applications

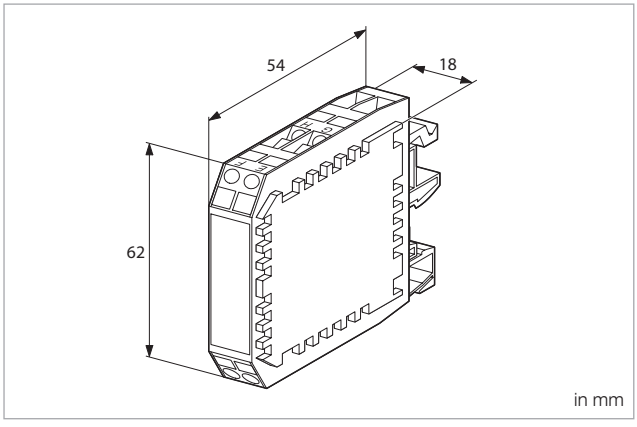
The interface module IMove 1250 connects a RS 232C interface (for example from a computer or a PLC) to the digital interface of the Move 1250 control valve.

Technical Data — Interface Module IMove 1250

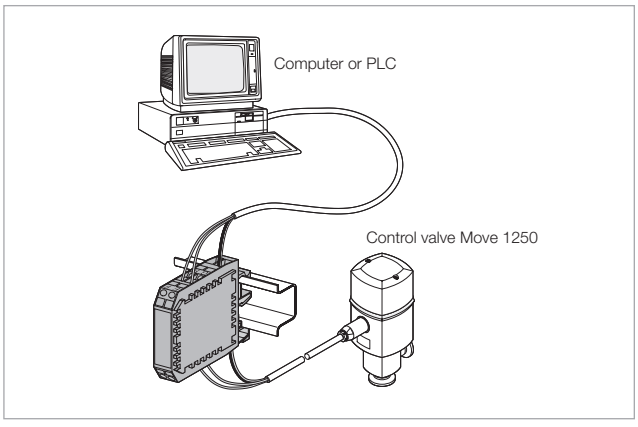
Temperature		
Operation	°C	+5 to +50
Storage	°C	-10 to +65
Protection class	IP	30
Operation voltage	V DC	24 ± 10%
Current consumption		
IMove 1250	mA	< 50 (own consumption)
Move 1250	mA	< 500
Provide upfront fusing		1 AT
Interface		RS 232 C
Mounting		
Support rails		EN 50022-35 (symmetrical EN 50035-G32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

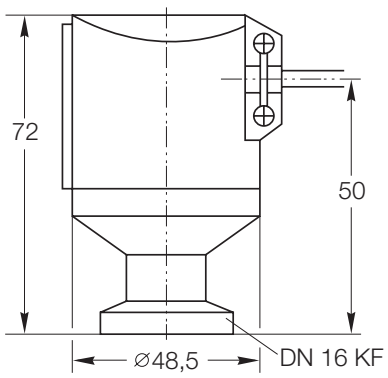
- Rugged design
- High switching capacity
- Corrosion protected
- Easy to use
- IP 44 protection
- Can be connected to a programmable control

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 ≤ 1 x 10^{-4} mbar x l/s.



Dimensional drawing for the low pressure safety switch PS 113 A

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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

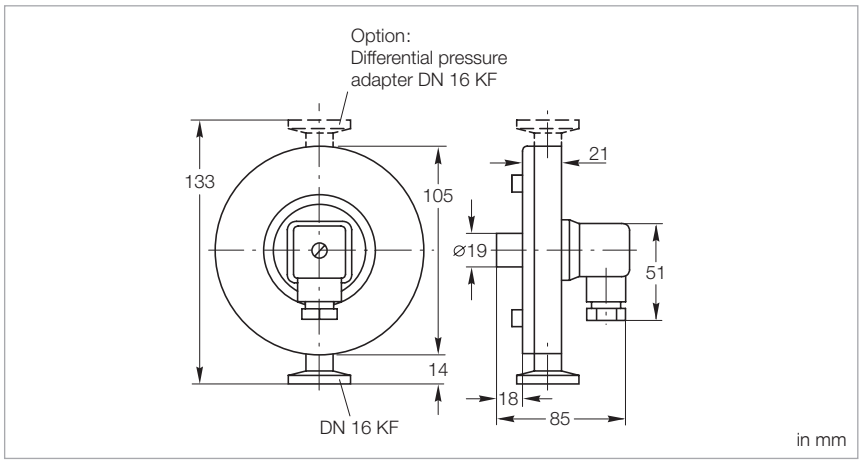


Rugged absolute pressure switch with electrical switching contact and a adjustable switching pressure between 0.5 and 2000 mbar (0.4 and 1500 Torr).

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

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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**

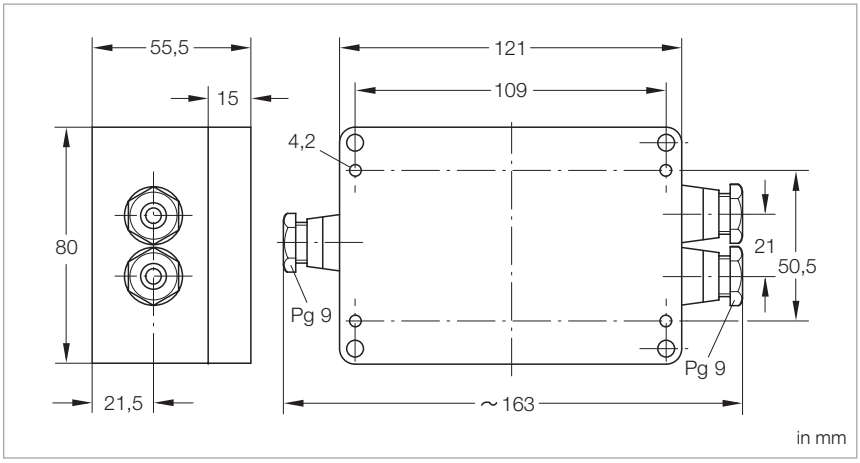
Switching Amplifier SV 110

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

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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



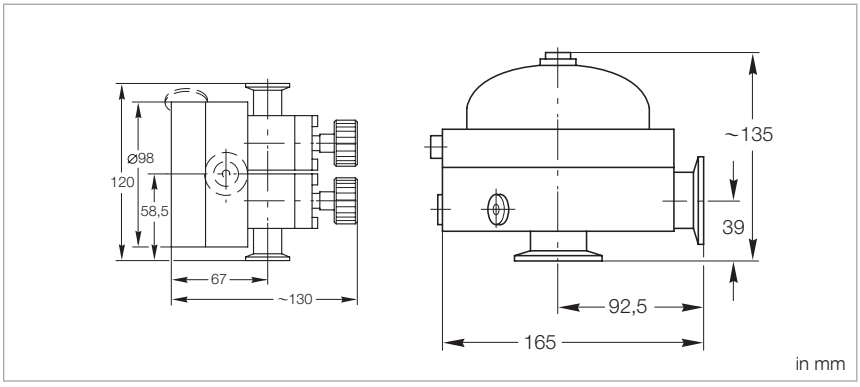
The MR 16/50 diaphragm regulators are absolute pressure regulators which automatically adapt the pumping speed of a vacuum pump depending on the amount of gas, without the need for an external power supply.

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)

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Technical Data

Diaphragm Pressure Regulator

		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
	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	**160 26**	**160 26**
KALREZ diaphragm	**–**	**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	**240 001**	**240 001**

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.

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Technical Data

DAkkS Calibration

Calibration range	mbar (Torr)	to 10^{-3}	to 10^{-5}	to 10^{-8}

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}

Ordering Information

Factory Calibration

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

For PENNINGVAC transmitters only Factory Calibration is available.

Calibration Systems are described in the Catalog Part “Vacuum Pump Systems”.

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