

Total Pressure Gauges

Vacuum Gauges and Control Instruments
 10^{-12} - 2000 mbar (10^{-12} Torr)
Calibration Service

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Applications for Vacuum Gauges

Gauges	BOURDONVAC A	BOURDONVAC C	Capsule vacuum gauge	DIAVAC DV 1000	Handheld Measuring Instruments	Linear pressure transmitter CTR	THERMOVAC transmitter DI	PENNINGVAC transmitter TTR	IONIVAC transmitter PTR	IONIVAC IM 540	Pressure switch PS 113 A	Pressure switch PS 115	Diaphragm regulator MR
Mechanical engineering													
Car 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							■	■	■				
Particle accelerators									■				
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 Range

mbar	10 ⁻¹¹	10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	1	10	100	1000
Capacitance Diaphragm															
CERAVAC Transmitters (x = 2, 3, 4 or 5) ¹⁾															
CTR 91 / CTR 101											0.13			1330	→
CTR 91 / CTR 101										0.013				133	
CTR 91 / CTR 101									0.0013					13	
CTR 91 / CTR 101								0.00013			1.3				
CTR 91 / CTR 101							0.000013				0.13				
CTR 100											0.13			1330	→
CTR 100										0.013				133	
CTR 100									0.0013					13	
CTR 100								0.00013			1.3				
Thermal Conductivity (according to Pirani)															
THERMOVAC Transmitters ¹⁾															
TTR 100 (Pirani combined with capacitance diaphragm)									0.0005					1500	→
TTR 91									0.0005					1000	
TTR 96 S									0.0005					1000	
TTR 211 Profibus/DeviceNet									0.0005					1000	
TTR 216 Profibus/DeviceNet									0.0005					1000	
Handheld Measurement Instruments															
THERMOVAC Sensors TM 90 + 100															
Cold Cathode Ionization (according to Penning)															
PENNINGVAC Transmitters															
PTR 225, DN 25 KF				1 x 10 ⁻⁹						0.01					
PTR 237, DN 40 CF				1 x 10 ⁻⁹						0.01					
PTR 90, DN 40 CF				5 x 10 ⁻⁹										1000	
PTR 90, DN 40 KF				5 x 10 ⁻⁹										1000	
PTR 90, DN 25 CF				5 x 10 ⁻⁹										1000	
Hot Cathode Ionization															
IONIVAC Transmitters (Bayard-Alpert combined with Pirani) ¹⁾															
ITR 90 / ITR 200				5 x 10 ⁻¹⁰										1000	
ITR 90 / ITR 200 with Display				5 x 10 ⁻¹⁰										1000	
IONIVAC Sensors															
IE 414 (Bayard-Alpert)				2 x 10 ⁻¹¹						0.01					
IE 514 (Extractor)			1 x 10 ⁻¹²					0.0001							
Linear Diaphragm Sensors ²⁾															
DI 200											0.1			200	
DI 201											0.1			200	
DI 2000												1		2000	→
DI 2001												1		2000	→
DI 2001 rel.													-1000		+1000
mbar	10 ⁻¹¹	10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	1	10	100	1000

¹⁾ Different Part Numbers depend on the vacuum connection

²⁾ Differences of the sensors in the same operating range caused by the materials in contact with the medium

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 increa-

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

Capacitance Vacuum Gauge

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

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

Thermal Conductivity Gauge (Pirani)

This measurement principle utilizes the thermal conductivity of gases for the purpose of pressure measurements in the range from 10^{-4} mbar/Torr to atmospheric pressure. Today, only the principle of the controlled Pirani gauge is used by Oerlikon Leybold Vacuum 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.

Hot Cathode Ionization Vacuum Gauge

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 KF	DN 16 KF	DN 25 KF
Outer centering ring with O-ring Aluminum / FPM (FKM) ((Viton))	Part No. 183 53	Part No. 183 53	Part No. 183 54
Fine filter on centering ring with O-ring Stainless steel / FPM (FKM) ((Viton))	Part No. 883 95	Part No. 883 96	Part No. 883 97
Baffle with centering ring (FPM (FKM))	-	-	Part No. 230 078
Connection accessories for metal seals or bake out room up to 150 °C Ultra sealing ring, aluminum (Set of 3) Outer support ring Clamping ring	Part No. 883 73 Part No. 883 74 Part No. 882 75	Part No. 883 75 Part No. 883 76 Part No. 882 77	Part No. 883 75 Part No. 883 76 Part No. 882 77

Ordering Information	DN 40 KF	DN 16 CF	DN 40 CF
Outer centering ring with O-ring Aluminum / FPM (FKM) ((Viton))	Part No. 183 55	-	-
Fine filter on centering ring with O-ring Stainless steel / FPM (FKM) ((Viton))	Part No. 883 98	-	-
Baffle with centering ring (FPM (FKM))	Part No. 230 079	-	-
Connection accessories for metal seals or degassing room up to 150 °C Ultra sealing ring, aluminum (Set of 3) Outer support ring Clamping ring	Part No. 883 77 Part No. 883 78 Part No. 882 78	- - -	- - -
Connection accessories for CF connections Copper seals, (set of 10 pieces) Screw (set of 25 pieces)	- -	Part No. 839 41 Part No. 839 00	Part No. 839 43 Part No. 839 01
Replacement sinter filter with centering ring	Part No. 231 93 515	-	-

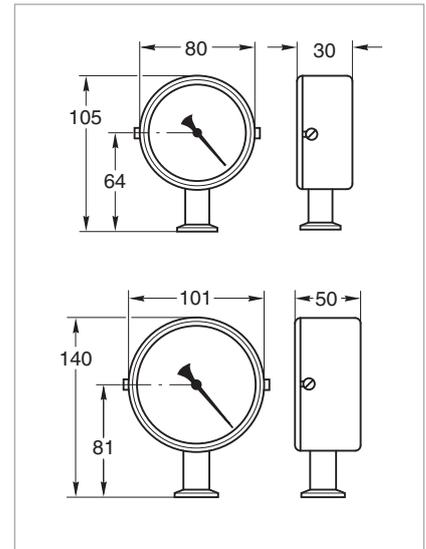
Products

Mechanical Gauges

Bourdon Vacuum Gauges



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



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

Advantages to the User

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

Typical Applications

- Vacuum distillation
- Drying processes
- For explosion hazard applications
- Vacuum conveying systems

Technical Data

BOURDONVAC A

BOURDONVAC C

		BOURDONVAC A	BOURDONVAC C
Measurement range	mbar	1 to 1020	1 to 1020
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 KF	16 KF
Length of scale	mm	207	188
Diameter	mm	80	101
Overall weight	mm	105	140
Weight	kg (lbs)	0.25 (0.55)	0.5 (1.10)
Leak tightness	mbar x l/s	1×10^{-8}	1×10^{-8}
Materials in contact with the medium		nickel plated standard steel, bronze, soft solder	stainless steel 1.4404

Ordering Information

BOURDONVAC A

BOURDONVAC C

Bourdon vacuum gauge	Part No. 160 40	Part No. 161 20
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Capsule Vacuum Gauges



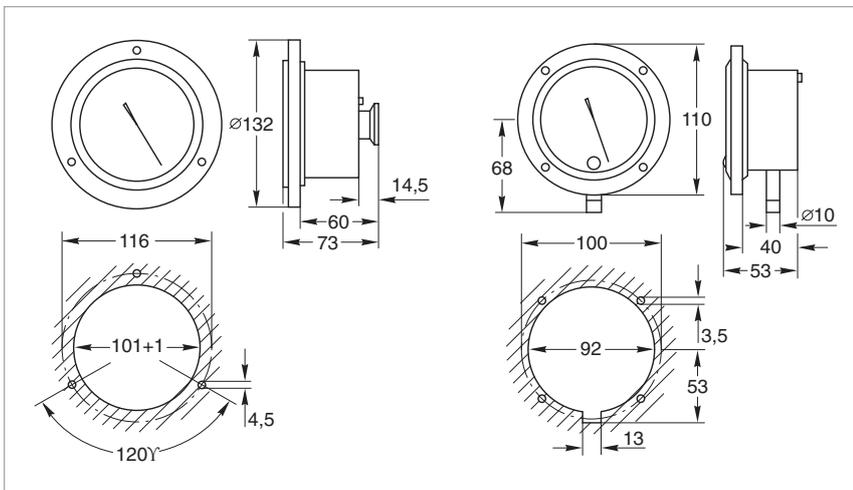
Rugged absolute pressure gauges for the pressure range from 1 to 1000 mbar (0.75 to 750 Torr).

Advantages to the User

- Rugged and insensitive to vibrations
- Models available for two measurement ranges (1 to 100 mbar and 1 to 1000 mbar)
- 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 and panel cut-outs for the capsule vacuum gauges
Part Nos. 160 63/64 (left) and Part No. 160 68 (right)

Technical Data

Capsule Vacuum Gauges

Measurement range	mbar	1 to 100	1 to 100	1 to 1000
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 KF	10 mm dia. hose nozzle with integrated isolation valve	16 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 Gauges

Capsule vacuum gauge	Part No. 160 63	Part No. 160 68	Part No. 160 64
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Diaphragm Vacuum Gauge DIAVAC DV 1000



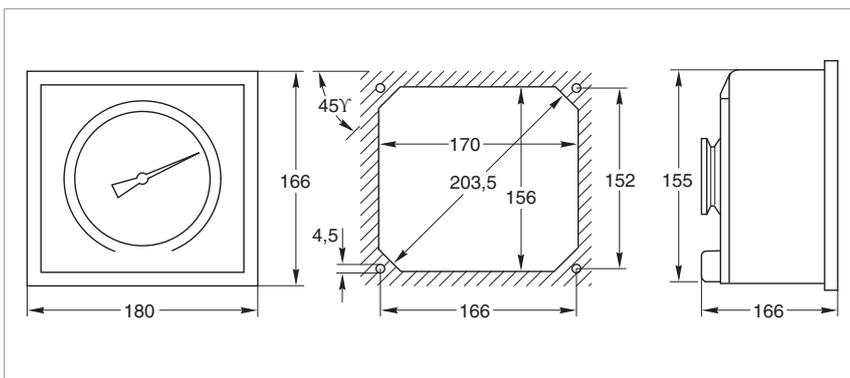
Rugged mechanical diaphragm vacuum gauge of high accuracy for the rough vacuum range from 1 to 1000 mbar (1 to 750 Torr).

Advantages to the User

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

Typical Applications

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



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

Technical Data**DIAVAC DV 1000**

Measurement range	mbar (Torr)	1 to 1000 (1 to 750)
Measurement uncertainty		
1 - 10 mbar (1.0 - 7.5 Torr)		± 1 mbar (Torr)
10 - 1000 mbar (7.5 - 750 Torr)		± 10% of meas. value
Storage temperature range	°C	-25 to +60
Nominal temperature range	°C	0 to 60
Permissible overload (abs.)	bar	3
Length of scale / dead volume	mm	270 / 130
Vacuum Connection	DN	40 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**

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

¹⁾ Complete with centering ring and sintered filter

Handheld Measuring Instruments

THERMOVAC Sensor TM 90



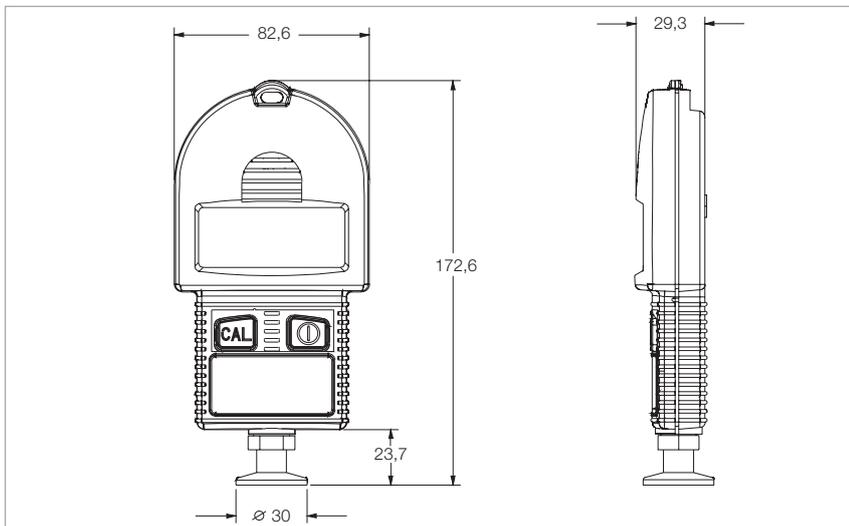
The THERMOVAC TM 90 is a simple handheld vacuum measuring instrument for occasional use. Its operation is based on the Pirani principle and covers a measurement range from 1×10^{-2} mbar to atmospheric pressure. It is delivered in a rugged plastic box.

Advantages to the User

- Cordless power supply through a standard 9 V battery
- Large 3 1/2 digit 7 segment display
- Pressure unit of measurement selectable between mbar, Torr and Pascal

Typical Applications

- Pressure measurements on refrigerating and air-conditioning systems before filling in the refrigerant
- Pressure measurements during servicing assignments



Dimensional drawings for the THERMOVAC sensor TM 90

Technical Data

THERMOVAC Sensor TM 90

Power source		9 Volt battery (type 6 LR61)
Battery life	h	< 5
Connection	DN	16 KF or 25 KF
Controls		On/Off/Unit selector
Indicated units of measurement		mbar, microns, Pa
Measurement range		atm. to 1×10^{-2} mbar (atm. to 1 Pa, atm. to 1 micron)
Automatic shutdown		after 15 minutes; last read out is displayed again after restarting
Reading accuracy	mbar microns	< $2 \pm 5\%$, > $2 \pm 10\%$, < $20.000 \pm 5\%$, > 20.000 microns $\pm 10\%$
Resolution		microns: in steps down to 1 micron Pascal: in steps down to 1 Pa mbar: in steps down to 0.01 mbar
Operating temperature	°C	0 to 50
Storage temperature	°C	-10 to +60
Weight (including battery)	kg (lbs)	0.22 (0.49)
Maximum overpressure	bar abs.	10

Ordering Information

THERMOVAC Sensor TM 90

TM 90, DN 16 KF	Part No. 230 076
TM 90, DN 25 KF	Part No. 230 077

THERMOVAC Sensor TM 100



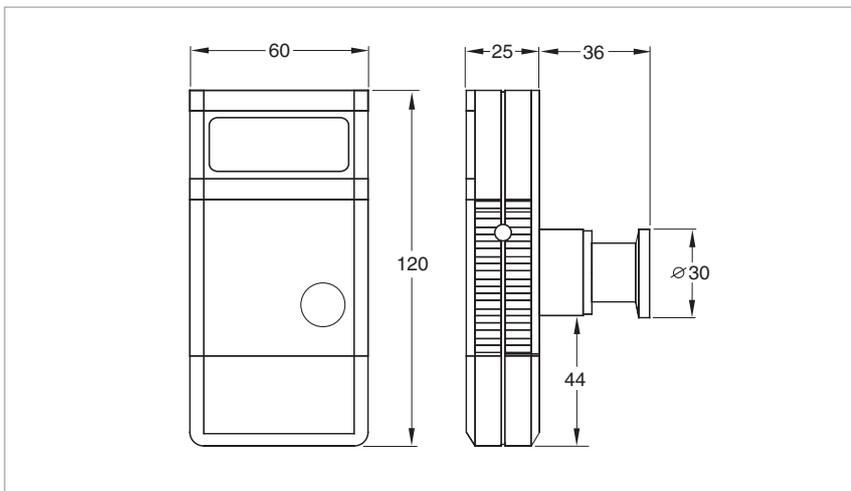
The handheld THERMOVAC TM 100 is capable of measuring pressures within the pressure range of 1200 to 5×10^{-4} mbar (900 to 3.75×10^{-4} Torr). By combining a piezo-resistive pressure sensor for the upper and a Pirani sensor for the lower pressure range, the measurements made by the THERMOVAC TM 100 are independent of the type of gas above pressures of 15 mbar. Especially noteworthy is the exceptionally long battery life.

Advantages to the User

- Utilization is directly possible in a vacuum (we recommend batteries made by Panasonic: 6LR61PM, 9 V/ 500 mAh)
- Pressure measurements above 15 mbar are independent of the type of gas
- Pressure unit of measurement selectable between mbar, Torr and Pascal
- Large 4 digit 7 segment display
- Cordless power supply through a standard 9 V battery
- Protection category IP 40

Typical Applications

- Mobile pressure measurements of all kinds
- Pressure measurements on refrigerating and air-conditioning systems before filling in the refrigerant
- Pressure measurements during servicing of vacuum pumps
- Pressure measurements during the production of gas filled pressurised lamps, respectively refilling



Dimensional drawing for the THERMOVAC TM 100

THERMOVAC Sensor

TM 100

Technical Data

Measurement principle		Piezo-resistive (gas-type independent) and thermal conductance Pirani
Indicated units of measurement		mbar, Torr, microns, Pa
Measurement range	mbar (Torr)	1200 to 5×10^{-4} (900 to 3.75×10^{-4})
Maximum overload	bar abs.	2
Measurement uncertainty with reference to full-scale value (at 1200 - 10 mbar)	%	0.4 (full-scale)
measured value (at 10 to 0.01 mbar)	%	10 (full-scale)
Materials in contact with the vacuum		Stainless steel, gold, tungsten, nickel, glass, Viton
Measurement cycle	s	1.6
Settling time	ms	400
Operating temperature	°C	+5 to +50
Storage temperature	°C	-20 to +60
Supply voltage		Rechargeable 9 V battery (type 6LR61) or 12 V AC adaptor (miniature jack, + terminal at the tip)
Power consumption, approx.	mW	110 (pulse)
Operating duration		
Li battery	h	< 100
6LR61 alkaline	h	< 40
Display		LCD 12 mm
Connection	DN	16 KF
Dimensions (without flange)	mm	60 x 120 x 25
Protection class	IP	40
Weight (including battery)	kg (lbs)	0.23 (0.51)

THERMOVAC Sensor

TM 100

Ordering Information

TM 100, DN 16 KF	Part No. 230 080
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Active Sensors

CERAVAC Transmitters CTR 100 / CTR 91



The CERAVAC Transmitter with its diaphragm made of pure aluminium oxide ceramics offers excellent accuracy and reproducibility.

Advantages to the User

- Excellent accuracy
- Corrosion resistant
- High resolution
- Very good temperature stability
- Electrically and mechanically compatible with the conventional capacitance manometers with stainless steel diaphragm
- Heated and unheated types are available
- RS 232 C interface (only CTR 100)

Typical Applications

- General pressure measurements in the fine and rough vacuum range, also for corrosive process gases
- Chemical process engineering
- Semiconductor production processes
- Suited as a reference sensor for monitoring test instruments in accordance with DIN/ISO 9000

The Ceramics Diaphragm

The stiffness of aluminium oxide ceramics is greater than that of metal so that the ceramics material offer improved long term stability characteristics when exposed to frequent pressure changes or overpressures. The aluminium oxide ceramics diaphragm of the CERAVAC sensors is capable of returning precisely to its initial position with respect to a certain pressure so that the measurements will be highly reproducible.

Since the diaphragm is not impaired by overpressures or frequent pressure changes, no blocking valves will be required – a significant contribution towards reducing costs.

Moreover, aluminium oxide ceramics diaphragms return faster to their initial position compared to metal diaphragms; the time need between the processes for the measurement to stabilise is reduced. This is particularly important in the case of measurements close to Zero where metal

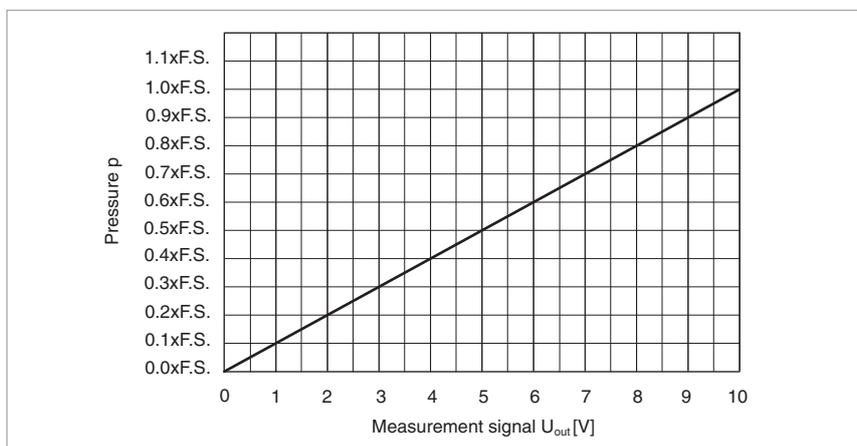
diaphragms take several minutes to return to their rest position.

Whereas metal diaphragms suffer from residual tensions and unavoidable irregularities due to their production process, diaphragms made of aluminium oxide ceramics are exceptionally homogeneous, and owing to the firing process at 2500 °C entirely free of tensions. This considerably reduces part to part variations in the sensors.

**CERAVAC Sensor
CTR 100
(Temperature Compensated)**

Technical Data

Full Scale (FS) / Measurement range	1 Torr / 1×10^{-4} - 1 Torr	10 Torr / 1×10^{-3} - 10 Torr 100 Torr / 0.01 - 100 Torr 1000 Torr / 0.1 - 1000 Torr Pressure Units: 1 Torr = 1.33 mbar = 133 Pascal
Materials exposed to gases	ceramic (Al ₂ O ₃), stainless steel 316, Vacon 70	ceramic (Al ₂ O ₃), stainless steel 316, Vacon 70
Max. overrange pressure	2000 Torr for 1/10/100 Torr sensors, 3000 Torr for 1000 Torr sensors	2000 Torr for 1/10/100 Torr sensors, 3000 Torr for 1000 Torr sensors
Measurement uncertainty	0.2% of reading ± temperature effect	0.2% of reading ± temperature effect
Resolution	0.003% of FS for 0.1/1 Torr sensors	0.003% of FS for 10/100/1000 Torr sensors
Temperature effects		
Zero coefficient	%/°C	0.015 of Full scale
Span coefficient	%/°C	0.01 of reading
Response time	ms	≤ 30
Nominal temperatur range	°C	+5 to +50
Supply voltage	V DC	+14 to +30
Power consumption	W	≤ 1
Signal Output	V	0 - 10; linear
Interface		0.26 (0.57)
Weight approx.	kg (lbs)	RS 232 C
Dead Volume	cm ³	6
Connection cable		see section "Connection Cable for active Sensors"
Calibration		see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"

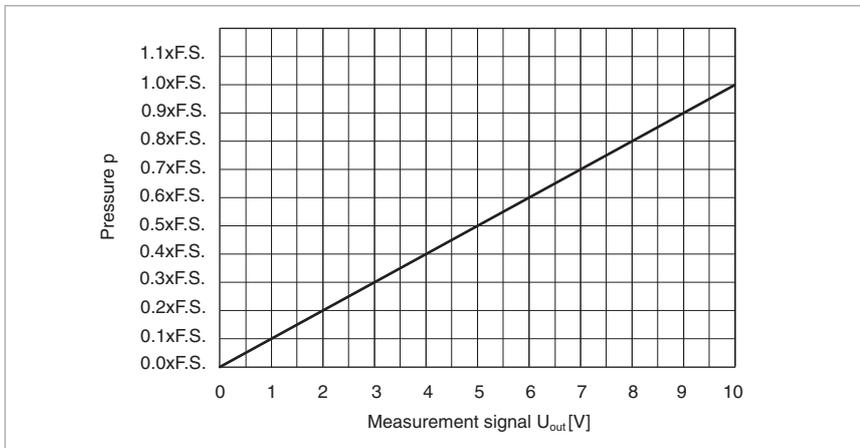


Characteristic of the CERAVAC Transmitter CTR 100

Technical Data

**CERAVAC Sensor
CTR 91
(45 °C heated)**

Full Scale (FS) / Measurement range	0.1 Torr / 1×10^{-5} - 0.1 Torr Pressure Units: 1 Torr = 1.33 mbar = 133 Pascal	1 Torr / 1×10^{-4} - 1 Torr 10 Torr / 1×10^{-3} - 10 Torr 100 Torr / 0.01 - 100 Torr 1000 Torr / 0.1 - 1000 Torr Pressure Units: 1 Torr = 1.33 mbar = 133 Pascal
Materials exposed to gases	ceramic (Al ₂ O ₃), stainless steel 316, Vacon 70	ceramic (Al ₂ O ₃), stainless steel 316, Vacon 70
Max. overrange pressure	1000 Torr for 0.1 Torr sensors	2000 Torr for 1/10/100 Torr sensors, 3000 Torr for 1000 Torr sensors
Measurement uncertainty	0.2% of reading ± temperature effect	0.15% of reading ± temperature effect
Resolution	0.0025% of FS for 0.1 Torr sensors	0.0025% of FS for 1 Torr sensors 0.0015% of FS for 10/100/1000 Torr sensors
Temperature effects		
Zero coefficient		1/10/100/1000 Torr sensor
Span coefficient	%/°C 0.005 of Full scale 0.01 of reading	0.0025 of Full scale 0.01 of reading
Reaction time	ms ≤ 30	≤ 30
Nominal temperatur range	°C +15 to +40	+15 to +40
Supply voltage	V DC either ± 15 or +24	either ± 15 or +24
Power consumption	W ≤ 19	≤ 19
Signal Output	V 0 - 10; linear	0 - 10; linear
Weight approx.	kg (lbs) 0.6 (1.32)	0.6 (1.32)
Dead Volume	cm ³ 6	7
Connection cable	see section "Connection Cable for active Sensors"	see section "Connection Cable for active Sensors"
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"



Characteristic of the CERAVAC Transmitter CTR 91

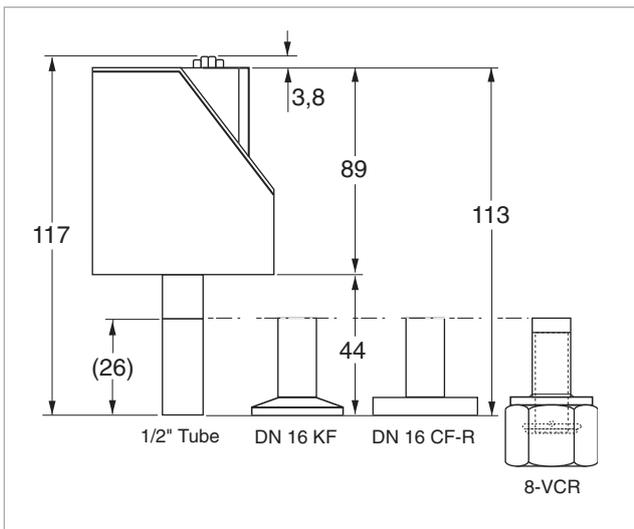
Ordering Information

CERAVAC Sensor

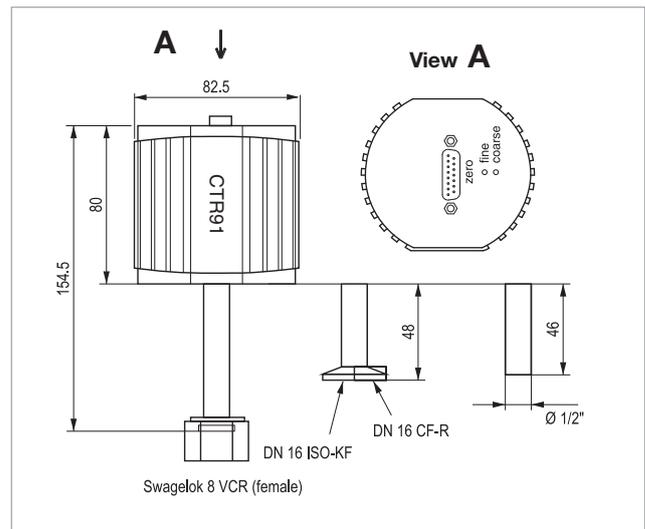
CTR 100

CTR 91

DN 16 ISO-KF 1000 Torr 100 Torr 10 Torr 1 Torr 0.1 Torr	Part No. 230 300 Part No. 230 301 Part No. 230 302 Part No. 230 303 -	Part No. 159 25 Part No. 159 26 Part No. 159 27 Part No. 159 28 Part No. 159 29
DN 16 CF-R 1000 Torr 100 Torr 10 Torr 1 Torr 0.1 Torr	Part No. 230 305 Part No. 230 306 Part No. 230 307 Part No. 230 308 -	Part No. 159 35 Part No. 159 36 Part No. 159 37 Part No. 159 37 Part No. 159 39
Cajon 8-VCR 1000 Torr 100 Torr 10 Torr 1 Torr 0.1 Torr	Part No. 230 310 Part No. 230 311 Part No. 230 312 Part No. 230 313 -	Part No. 159 45 Part No. 159 46 Part No. 159 47 Part No. 159 48 Part No. 159 49
1/2" tube 1000 Torr 100 Torr 10 Torr 1 Torr 0.1 Torr	Part No. 230 315 Part No. 230 316 Part No. 230 317 Part No. 230 318 -	Part No. 159 55 Part No. 159 56 Part No. 159 57 Part No. 159 58 Part No. 159 59
Accessories	The installation of a spiral tube is recommended in connection with applications involving contamination (oil vapors or dusts)	The installation of a spiral tube is recommended in connection with applications involving contamination (oil vapors or dusts)



Dimensional drawing for the CERAVAC Transmitter CTR 100



Dimensional drawing for the CERAVAC Transmitter CTR 91

THERMOVAC Transmitters

TTR 91 / TTR 91 S / TTR 96 S



THERMOVAC transmitters are active sensors (pressure to voltage converters) using thermal conductivity according to Pirani.

The further developed THERMOVAC transmitters have optimized price-to-performance ratio.

The value of the trigger point can be switched easily on the analog output and be shown on the display of the operating unit.

Advantages to the User

- Rugged sensing cells made of stainless steel
- Compact design
- Stable measurements within a wide temperature range
- Highly resistant to overpressures
- Exchangeable sensing cells
- Fast response
- Available with integrated switching relay (TTR 91 S, TTR 96 S)

Typical Applications

- Analytical engineering
- Safety circuits in vacuum systems
- Controlling ionization gauges
- General pressure measurement and control on systems in the fine and rough vacuum range

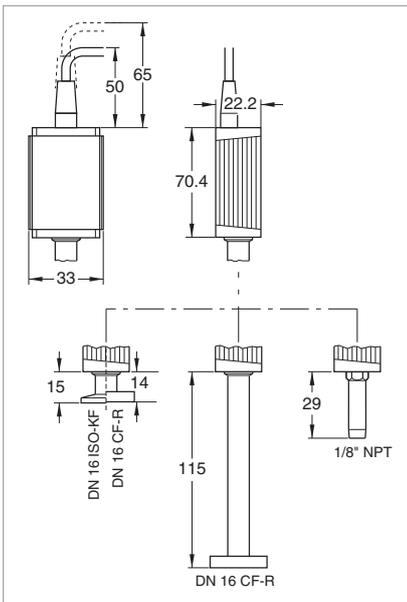
pressure value (atmospheric, "zero", reference pressure) by pressing a button.

Integration of the transmitters in programmable control systems is facilitated by the linear characteristic, which can be defined by entering a simple equation into the computer. The transmitters TTR 91 / TTR 91 S / TTR 96 S are compatible to older TTR models like TTR 211, TTR 216 S or TTR 90. Built-in relays allow switching functions to be performed directly by the transmitter, without the need of a programmable control.

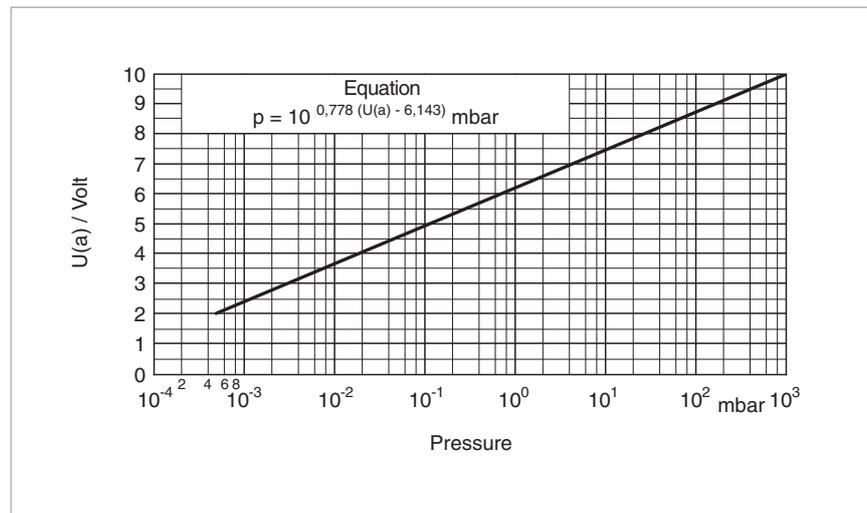
Sensor

The THERMOVAC transmitter has a Pirani sensing cell equipped with a tungsten (TTR 91/TTR 91 S) or nickel (TTR 96 S) filament.

If required, the sensing cells can easily be aligned to any precisely known



Dimensional drawing for the TTR 91 / TTR 91 S / TTR 96 S



Characteristic of the THERMOVAC Transmitters

Technical Data

THERMOVAC Transmitter TTR 91 / TTR 91 S / TTR 96 S

Measurement range	mbar (Torr)	5×10^{-4} to 1000 (3.75×10^{-4} to 750)
Measurement uncertainty		15% in the range 1×10^{-3} to 100 mbar (0.75×10^{-3} to 75 Torr)
Principle of measurement		Thermal conductivity according to Pirani
Supply voltage		14 to 30 V DC Hum voltage $\leq 1 V_{pp}$
Power consumption	VA	≤ 1
Storage temperature range	°C	-20 to +65
Nominal temperature range	°C	5 to 60
Max. rel. humidity	% n.c.	≤ 80
Protection class		IP 40
Weight, approx., for DN 16 KF	kg (lbs)	0.08 (0.18)
Sensor		Exchangeable sensing cell
Bake out temperature, max.	°C	80 (250 with long tube)
Dead volume, approx.	cm ³	2 (10 with long tube)
Materials in contact with the medium - filament		Stainless steel, Ni, glass, NiFe Tungsten (TTR 91, TTR 91 S) or nickel (TTR 96 S)
Over-pressure rating, abs.	bar	10
Signal output ($R_a \geq 10 \text{ k}\Omega$) Measurement signal		0 to 10.3 V DC 1.9 to 10 V DC, corresp. 5×10^{-4} to 1×10^3 mbar 1.286 V/decade, logarithmic
Status signal		Error: $\leq 0.5 \text{ V}$
Trigger (only TTR 91 S / TTR 96 S) Adjustment range	mbar (Torr)	Normally open relay contact 2×10^{-3} to 500 (1.5×10^{-3} to 375)
Hysteresis		10%
Rating		30 V, 0.5 A DC, floating
Error status		Relay contact open
Status indicators (only TTR 91 S / TTR 96 S)		Trigger (active): Green LED
Electrical connection		FCC-68/RJ45 socket, 8 way with shield
Cable length, max.	m	100

Ordering Information

THERMOVAC Transmitter TTR 91 / TTR 91 S / TTR 96 S

Without switching threshold TTR 91, DN 16 KF TTR 91, 1/8" NPT TTR 91, DN 16 CF TTR 91, 1/2" Tube, DN 16 CF bakeable	Part No. 230 035 Part No. 230 038 Part No. 230 036 Part No. 230 037
With switching threshold TTR 91 S, DN 16 KF TTR 91 S, 1/8" NPT TTR 91 S, DN 16 CF TTR 91 S, 1/2" Tube, DN 16 CF bakeable TTR 96 S, DN 16 KF TTR 96 S, 1/8" NPT TTR 96 S, DN 16 CF TTR 96 S, 1/2" Tube, DN 16 CF bakeable	Part No. 230 040 Part No. 230 043 Part No. 230 041 Part No. 230 042 Part No. 230 045 Part No. 230 048 Part No. 230 046 Part No. 230 047
Replacement sensing cell for TTR 91 / TTR 91 S DN 16 KF 1/8" NPT DN 16 CF 1/2" Tube, DN 16 CF bakeable for TTR 96 S DN 16 KF 1/8" NPT DN 16 CF 1/2" Tube, DN 16 CF bakeable	Part No. 230 050 Part No. 230 053 Part No. 230 051 Part No. 230 052 Part No. 230 055 Part No. 230 058 Part No. 230 056 Part No. 230 057
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Connection cable, FCC 68 on both ends, 8 way, shielded 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Type A Part No. 124 26 Part No. 230 012 Part No. 124 27 Part No. 124 28 Part No. 124 29 Part No. 124 30 Part No. 124 31 Part No. 124 32 Part No. 124 33
Accessories	The installation of a spiral tube is recommended in connection with applications involving contamination (oil vapors or dusts)

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

THERMOVAC Transmitter with Field Bus Interface Profibus or DeviceNet TTR 211 PB/D / TTR 216 PB/D



The THERMOVAC transmitters have been developed especially for integration into vacuum systems. Being active sensors (pressure to voltage converters) with a well-proven Pirani sensing cell and new operating and processing electronics these units offer a measurement range which spans 5×10^{-4} to 1000 mbar (3.75×10^{-4} to 750 Torr).

Advantages to the User

- Rugged Pirani sensing cells also for corrosive media
- Logarithmic signal output (algorithm supplied)
- High reproducibility
- Easily exchangeable sensing cells
- Switching threshold adjustable over a wide range (1×10^{-3} to 500 mbar (1×10^{-3} to 375 Torr)) and relay contact
- LED indicator for operation and trigger active
- Easily accessible monitoring connection to check the measurement signal and the trigger setting (voltmeter)
- High EMI compatibility through screened housing, FCC-68 connector and cables
- Computer interface
 - Field bus: Profibus DP/DeviceNet
- CE mark

Typical Applications

- Analytical engineering
- Safety circuits in vacuum systems
- Controlling ionization gauges
- Vacuum furnaces
- General pressure measurement and control on systems in the fine and rough vacuum range which have the following requirements:
 - Immediate data transfer to a programmable control/computer via analog interface
 - Coverage of greater distances between the point of the measurement and processing location
 - Several locations which are to be monitored continuously
 - Low voltage supply
 - Simple, cost and space saving installation
 - Increased reliability
 - Simple operation
 - Increased requirements concerning electromagnetic compatibility (EMI)

Sensor

The well-proven Pirani sensing cells with tungsten filament and a DN 16 KF flange are built into the TTR 211 PB/D THERMOVAC transmitters. The TTR 216 PB/D transmitter is equipped with a stainless steel sensing cell, with a platinum filament and an Al₂O₃ ceramics current feedthrough for use in connection with corrosive media or

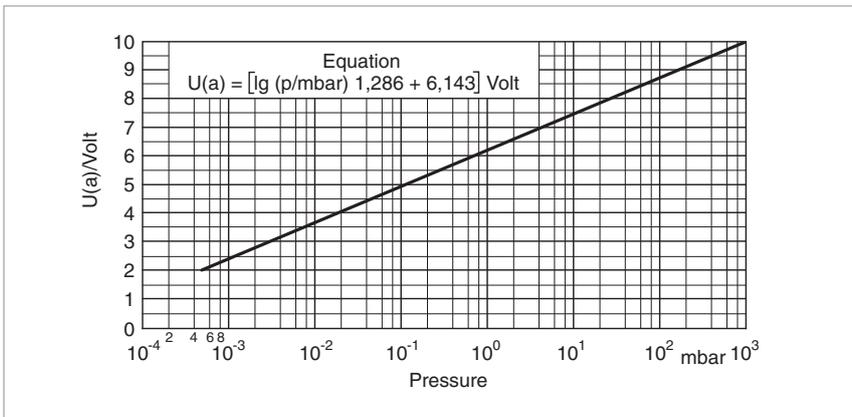
where much water vapor is present. The sensing cells can be easily exchanged on all transmitters.

If required, the sensing cell can easily be aligned at atmospheric pressure and "Zero" pressure through two potentiometers.

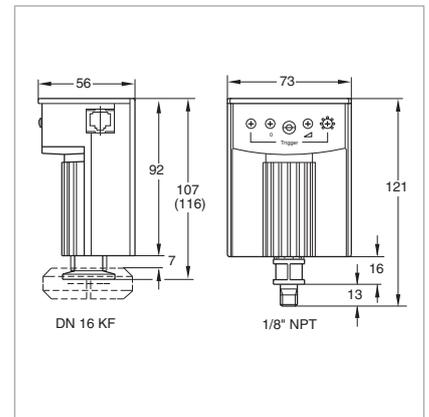
Integration of the transmitter in pro-

grammable control systems is facilitated by the straight characteristic which may be defined by entering a simple equation into the computer.

Through the built-in relays it is possible to perform important switching functions directly through the transmitter without the need of a programmable control.



Characteristic of the TTR 211 PB/D and TTR 216 PB/D



Dimensional drawing for the TTR 211 PB/D and TTR 216 PB/D

Technical Data

THERMOVAC Transmitter TTR 211 PB/D / TTR 216 PB/D

Display range	mbar (Torr)	5×10^{-4} to 1000 (3.75×10^{-4} to 750)
Measurement uncertainty		20% in the range 1×10^{-3} to 1×10^{-2} mbar (0.75×10^{-3} to 0.75×10^{-2} Torr) 15% in the range 1×10^{-2} to 30 mbar (0.75×10^{-2} to 22.5 Torr)
Principle of measurement		Thermal conductivity acc. to Pirani
Supply voltage		14.5 to 36 V DC, typ. 24 V DC Ripple voltage $< 2 V_{pp}$
Power consumption	VA	< 2
Storage / nominal temperature range	°C	-20 to +70 / +10 to +50
Max. rel. humidity (climatic class F)	% n.c.	95
Protection class		IP 40
Dimensions (H x W x D)	mm	106 x 73 x 56
Weight, approx.	kg (lbs)	0.29 (0.64)
Inflammability		UL 94 - V 2
Sensor		Exchangeable sensing cell
Filament		Tungsten (TTR 211)/platinum (TTR 216)
Vacuum connection	DN	16 KF
Bake out temperature, max	°C	80 at the flange
Dead volume, max.	cm ³	11
Materials in contact with the medium		TTR 211: Aluminum, nickel-plated steel, Vacon, tungsten, CrNi8020, glass, epoxy cement; TTR 216 S: Stainless steel, CrNi, Al ₂ O ₃ ceramics, NiFe, Mo, Ni, platinum
Over-pressure rating, abs.		TTR 211: 3 bar, TTR 216: 10 bar
Signal output ($R_a \geq 10 \text{ k}\Omega$)		0 to 10.6 V
Measurement signal		1.9 to 10 V, corresp. 5×10^{-4} to 1×10^3 mbar logarithmic divisions 1.286 V/decade
Status signal		broken filament 10.5 V
Trigger		n.o./changeover relay contact
Adjustment range	mbar (Torr)	1×10^{-3} to 500 (0.75 to 375)
Hysteresis		about 30% of the adjusted pressure
Reaction time	ms	< 50
Rating		60 V, 0.5 A DC
Error status		contact open in case of broken filament or supply off
Status indicators		Operation (Power): Orange LED Trigger (active): Green LED
Monitor output ($R_a \geq 100 \text{ k}\Omega$)		Jack socket (3.5 mm) at which the measurement signal and the trigger setting is available
Electrical connection		FCC-68 socket, 8 way with shield
Cable length, max.	m	100
Interface		
TTR 211 D / 216 D		DeviceNet
TTR 211 PB / 216 PB		Profibus DP

Ordering Information

THERMOVAC Transmitter TTR 211 PB/D / TTR 216 PB/D

TTR 211 D, DN 16 KF Tungsten filament (1 trigger) DeviceNet interface Replacement sensing cell	Part No. 896 51 Part No. E 157 75
TTR 211 PB, DN 16 KF Tungsten filament (1 trigger) Profibus DP interface Replacement sensing cell	Part No. 896 50 Part No. E 157 75
TTR 216 D, DN 16 KF Platinum filament (1 trigger) DeviceNet interface Replacement sensing cell	Part No. 896 53 Part No. E 157 77
TTR 216 PB, DN 16 KF Platinum filament (1 trigger) Profibus PB interface Replacement sensing cell	Part No. 896 52 Part No. E 157 77
Calibration	see section "Miscellaneous", para. "LEYBOLD Calibration Service"
Connecting cable, FCC 68 on both ends, 8 way with shield 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Type A Part No. 124 26 Part No. 230 012 Part No. 124 27 Part No. 124 28 Part No. 124 29 Part No. 124 30 Part No. 124 31 Part No. 124 32 Part No. 124 33
Accessories	The installation of a spiral tube is recommended in connection with applications involving contamination (oil vapors or dusts)

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

THERMOVAC Transmitters

TTR 100 / TTR 100 S2



The Pirani Capacitance Diaphragm Gauge is the first vacuum gauge which combines ceramic capacitance diaphragm and thermal conductivity technologies. Unlike standard heat transfer technology, the Oerlikon Leybold Vacuum TTR 100 offers superior accuracy and gas-type-independent readings between 100 mbar and 1500 mbar.

Advantages to the User

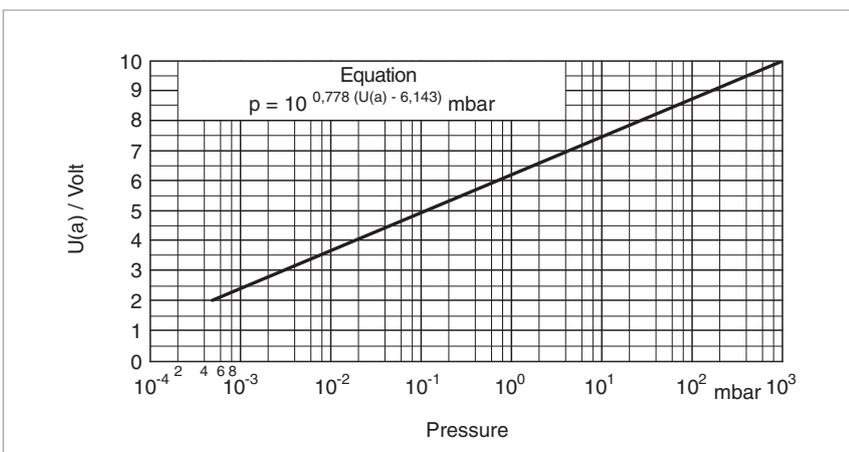
- Wide measurement range from 5×10^{-4} to 1500 mbar
- Gas-type-independent pressure measurement between 100 mbar and 1500 mbar
- Available with up to two integrated relays (TTR 100 S2)
- Mounts in any orientation
- 0 to 10.3 V analog output for easy system integration
- Compact design
- Flow independent
- Rapid cycling
- Follows true pressure in pump and vent

Typical Applications

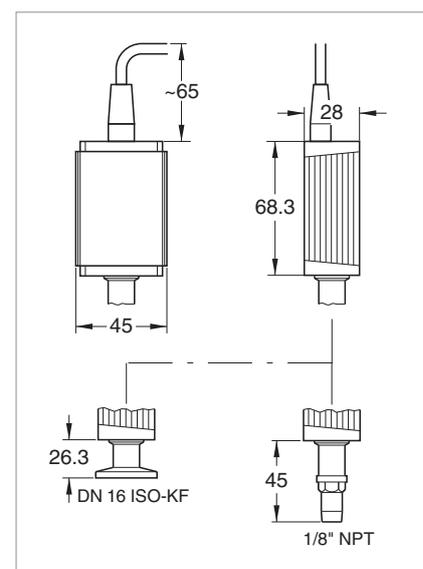
- Loadlock control
- Forevacuum pressure monitoring
- Safety circuits in vacuum systems
- General measurement and control in the medium and rough vacuum range
- Control of high vacuum ionization gauges

Option

Dust and other particles may cause increasing measurement errors and reduced lifetime. Therefore we recommend the installation of a fine filter in critical applications. Fine filters are listed in section "General", para. "Connection Accessories for Small Flanges".



Characteristic of the THERMOVAC Transmitters



Dimensional drawing for the TTR 100

Technical Data

THERMOVAC Transmitter

TTR 100 / TTR 100 S2

Measurement principle	Thermal conductance according to Pirani combined with capacitance diaphragm	
Measurement range (air, O ₂ , CO, N ₂)	mbar (Torr)	5 x 10 ⁻⁴ to 1500 (3.8 x 10 ⁻⁴ to 1125)
Accuracy		
1 x 10 ⁻³ to 50 mbar		± 15% of reading
50 to 950 mbar		± 5% of reading
ATM (atmospheric pressure)		± 2.5% of reading
Repeatability		± 2% of reading
Trigger (only TTR 100 S2)		2
Setting range with potentiometer		1.5 x 10 ⁻³ to 1400 mbar
Relay contacts		N.O. / potential free
closed		at low pressure (lamp lit)
open		at high pressure or no supply (lamp off)
Hysteresis		10% of threshold
Contact rating		30 V DC / 1 A
Relay status		active: LED, green
Output signal analog		0 to 10.3 V
Measurement range		+1.9 to +10.23 V
Voltage vs. pressure		1.286 V / decade, logarithmic
Output impedance		2 x 4.7 Ohm, short circuit-proof
Minimum load impedance		10 kOhm
Response time		10 ms
Power supply		
Voltage (ripple ≤ 1 V _{pp})		+15 to +30 V DC
Consumption, max.		2.5 W
Fuse to be connected		1 AT (time delay)
Electrical connection		FCC-68, 8 way with shield
Cable length, max.	m	100
Materials exposed to vacuum (process media)		
Vacuum connection		stainless steel
Pirani filament		tungsten
Capacitance sensor cell		Al ₂ O ₃
Feedthrough		glass
Other materials		Ni, Cu, NiFe, SnAg, AgPd
Internal volume		
DN 16 ISO-KF	cm ³	6
1/8" NPT	cm ³	8
Over-pressure rating, abs.	bar	5
Temperature		
Operation (ambient)	°C	+10 to +50
Storage	°C	-20 to +65
Bakeout at flange, max.	°C	+80
Filament temperature	°C	< 160
Relative humidity		< 80% at temperatures < +31 °C, decreasing to 50% at +40 °C
Mounting orientation any		any
Use		Indoors only, altitudes up to 2000 m NN
Protection class	IP	40
Weight		
DN 16 ISO-KF	kg (lbs)	0.09 (0.20)
1/8" NPT	kg (lbs)	0.09 (0.20)

Ordering Information

THERMOVAC Transmitter TTR 100 / TTR 100 S2

Without switching threshold TTR 100, DN 16 KF TTR 100, 1/8" NPT	Part No. 230 026 Part No. 230 028
With switching threshold TTR 100 S2, DN 16 KF TTR 100 S2, 1/8" NPT	Part No. 230 027 Part No. 230 029
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Connection cable, FCC 68 on both ends, 8 way, shielded 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Type A Part No. 124 26 Part No. 230 012 Part No. 124 27 Part No. 124 28 Part No. 124 29 Part No. 124 30 Part No. 124 31 Part No. 124 32 Part No. 124 33
Accessories	The installation of a spiral tube is recommended in connection with applications involving contamination (oil vapors or dusts)

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

PENNINGVAC Transmitters

PTR 225 / PTR 225 S / PTR 237



The PENNINGVAC transmitters have been developed especially for integration in programmable control systems. As active sensors (pressure to voltage converters) - equipped with a rugged cold cathode sensing cell and with matched operating and processing electronics - these transmitters offer a wide measurement range of 1×10^{-9} to 1×10^{-2} mbar (0.75×10^{-9} to 0.75×10^{-2} Torr). The measurement signal may be transmitted over long distances without problems.

Advantages to the User

- All-metal cold cathode sensors (inverted Penning)
- High reproducibility
- Good ignition characteristics through the optimized design for the electrodes
- Low tendency for contamination (also during argon operation) due to high voltage reduction after ignition of the plasma and due to the titanium cathodes
- Switching threshold adjustable over a wide range (1×10^{-9} to 1×10^{-2} mbar (0.75×10^{-9} to 0.75×10^{-2} Torr)) and with a load-bearing relay contact (PTR 225 S)
- Low stray magnetic field
- High EMI compatibility through screened housing, FCC-68 connector and cables
- LED indicator for operation
- Logarithmic signal output (algorithm supplied)
- Intelligent interface
- CE mark
- High resistance against sputtering due to titanium cathode plates

Typical Applications

- Evaporation and sputtering systems
- Analytical engineering
- Vacuum furnaces
- High vacuum systems
- General pressure measurement and control on systems in the fine and rough vacuum range which have the following requirements:
 - Immediate data transfer to a programmable control/computer via analog interface
 - Coverage of greater distances between the point of the measurement and processing location
 - Several locations which are to be monitored continuously
 - Low voltage supply
 - Simple, cost and space saving installation
 - Increased reliability, also in argon processes (sputtering)
 - Simple operation
 - Increased requirements concerning electromagnetic compatibility (EMI)

Option

For protection of the sensors PTR 225 against contamination, radiation and other disturbing factors the installation of a baffle is recommended.



Baffle DN 25 KF, Part No. 230 078

Sensor

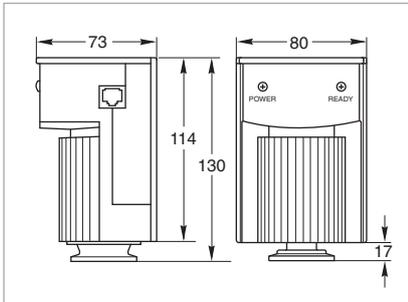
Cold cathode sensors - based on the well-proven principle of the inverted Penning - are built into the PENNINGVAC transmitters PTR 225/225 S/237 which have a DN 25 KF or DN 40 CF flange. The housing of the transmitter, including its electronics, as well as the magnet can easily be removed for degassing of the all-metal sensor with Al_2O_3 current feed-through. The design of the Penning

sensors with its closed magnetic field causes a negligible stray field. Thus the PTR 225/225 S/237 may also be installed close to sensitive parts within a system.

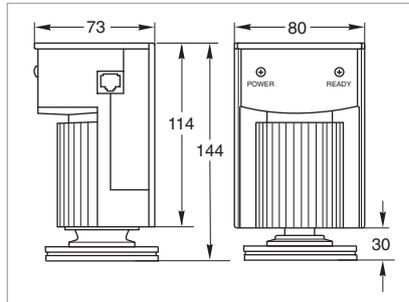
The anode ring and the titanium cathode plates can be exchanged easily for quick maintenance of the sensors in case of contamination. The shape of the cathode plates is such that they also act as a baffle for the sensors.

Integration of the transmitter in programmable control systems is facilitated by the linear characteristic which can be defined by entering a simple equation into the computer.

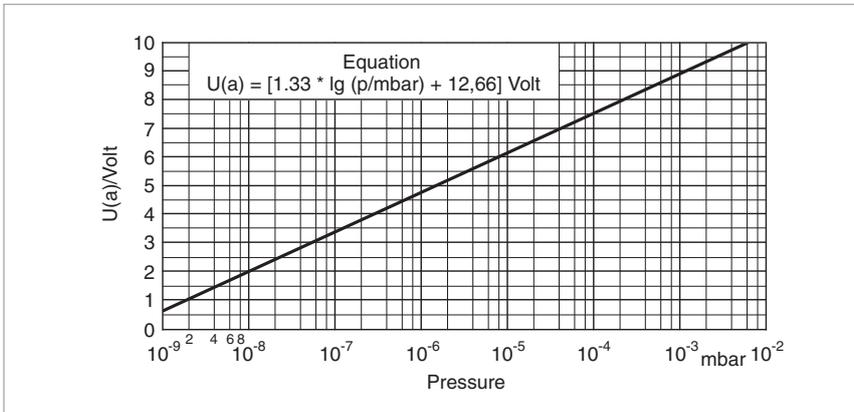
Built-in relays (PTR 225 S) allow switching functions to be performed directly by the transmitter, without the need of a programmable control.



Dimensional drawing for the PTR 225



Dimensional drawing for the PTR 237



Characteristic of the PTR 225/225 S/237

Technical Data

PENNINGVAC Transmitter

PTR 225 / PTR 225 S / PTR 237

Display range	mbar (Torr)	1×10^{-9} to 1×10^{-2} (0.75×10^{-9} to 0.75×10^{-2})
Measurement uncertainty		30% in the range 1×10^{-8} to 1×10^{-4} mbar (0.75×10^{-8} to 0.75×10^{-4} Torr)
Principle of measurement		Cold cathode ionization according to Penning
Supply voltage		14.5 to 36 V DC typ. 24 V DC hum voltage < 2 Vpp
Power consumption	VA	< 2
Storage temperature range	°C	-20 to +70
Nominal temperature range	°C	+10 to +50
Max. rel. humidity (climatic class F)	% n.c.	95
Protection class	IP	40
Dimensions (H x W x D)	mm	125 x 80 x 73
Weight, approx.	kg (lbs)	0.5 (1.1)
Inflammability		UL 94 - V 2
Sensor		Detachable for cleaning
Vacuum connection	DN	25 KF or 40 CF
Degassing temperature, max.	°C	250 with electronics detached
Dead volume, max.	cm ³	21
Materials in contact with the medium		Stainless steel, CrNi, Al ₂ O ₃ ceramics, NiFe, Mo, Cu, Ni, titanium
Over-pressure rating (abs.)	bar	10
Signal output ($R_a \geq 10 \text{ k}\Omega$) Measurement signal		0 to 10.6 V 0.66 to 10 V, corresponds to 1×10^{-9} to 1×10^{-2} mbar logarithm. divisions 1.333 V/decade
Trigger (PTR 225 S) Adjustment range Hysteresis Rating Error status	mbar (Torr)	Changeover relay contact 1×10^{-9} to 1×10^{-3} (0.75×10^{-9} to 0.75×10^{-3}) About 30% of the adjusted pressure 60 V, 0.5 A DC Contact in its rest position when "no ignition" / "HT off"
High voltage control input		ON: At $U < 2.9 \text{ V}$, or $U > 12 \text{ V}$ OFF: At $U > 3 \text{ V}$, or $U < 7 \text{ V}$
Status output Ready to measure Error (no ignition)		Voltage level HIGH (typ. 24 V DC) LOW (0 V)
Status indicators		Operation: Orange LED Ready to measure (ignited): Green LED Trigger (active): Green LED
Monitor output ($R_a \geq 100 \text{ k}\Omega$)		Jack socket (3.5 mm) at which the trigger setting is available
Electrical connection		FCC-68 socket, 8 way with shield
Cable length, max.	m	100
Interface PTR 225 PB PTR 237 D		Profibus DP DeviceNet

Ordering Information

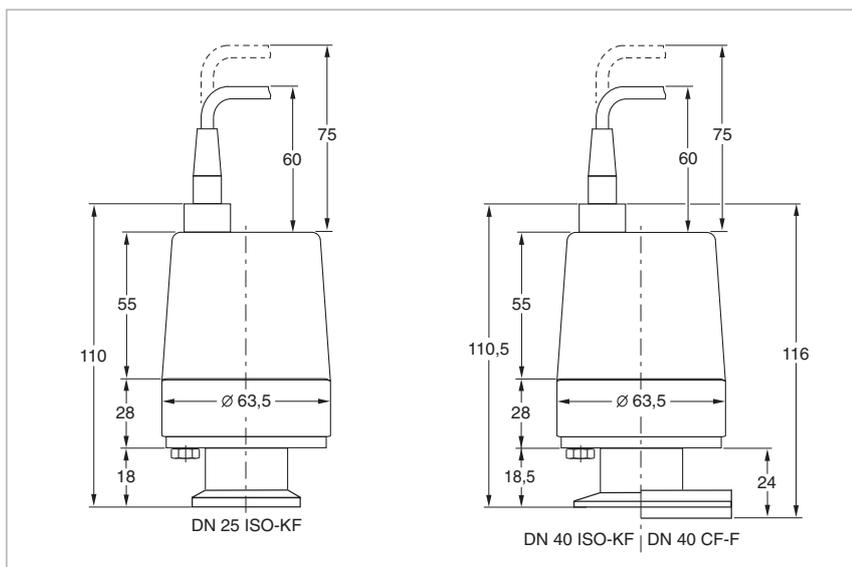
PENNINGVAC Transmitter PTR 225 / PTR 225 S / PTR 237

PTR 225, DN 25 KF	Part No. 157 34
PTR 225 S, DN 25 KF	Part No. 164 34
PTR 225 PB, DN 25 KF Profibus interface	Part No. 896 41
PTR 237, DN 40 CF	Part No. 157 36
PTR 237 D, DN 40 CF DeviceNet interface	Part No. 896 42
Baffle, DN 25 KF, with centering ring	Part No. 230 078
Replacement cathode plates, titanium (set of 5 pieces) Replacement anode ring	Part No. EK 162 91 Part No. 200 28 711
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Connection cable, FCC 68 on both ends, 8 way, shielded 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Type A Part No. 124 26 Part No. 230 012 Part No. 124 27 Part No. 124 28 Part No. 124 29 Part No. 124 30 Part No. 124 31 Part No. 124 32 Part No. 124 33

PENNINGVAC Transmitter PTR 90



The PENNINGVAC transmitter combines the cold cathode ionization principle with the Pirani principle. This allows for complete coverage of the pressure range from 5×10^{-9} mbar to atmospheric pressure by a single transmitter. The cold cathode system is ignited directly through switching on the internal high-voltage at the optimum ignition pressure.



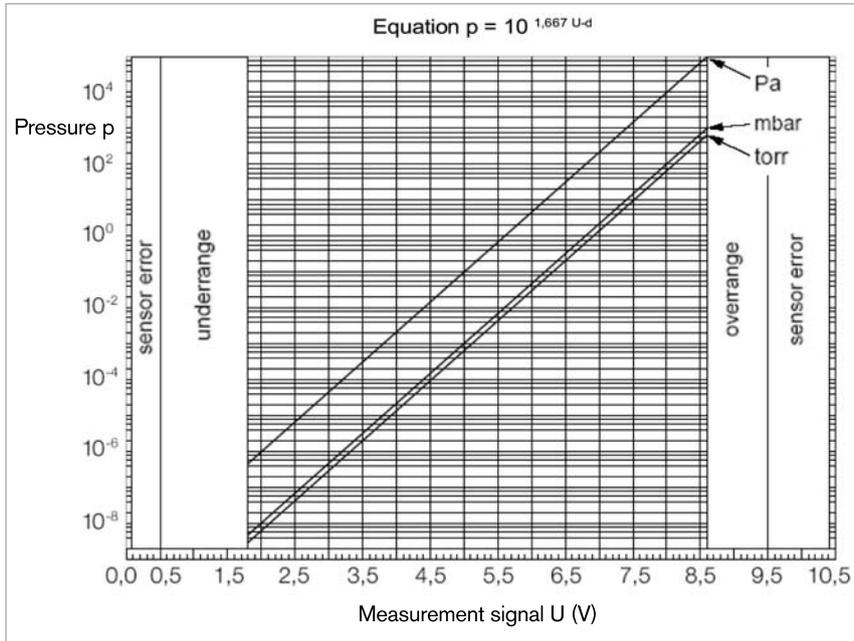
Dimensional drawing for the PENNINGVAC transmitters PTR 90

Advantages to the User

- High operational reliability through automatic ignition of the cold cathode
- Low complexity for installation and wiring due to the integration of two principles of measurement in a single casing
- Compact design
- Good serviceability
- Extra low voltage power supply
- Simple, cost and space saving installation
- Increased reliability also in connection with argon processes (sputtering)
- Simple to operate
- CE mark

Typical Applications

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



Characteristic of the PTR 90

Option

For protection of the sensor ITR 90 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 KF connections is integrated in a centering ring.



Baffle DN 25 KF, Part No. 121 07

Technical Data

PENNINGVAC Transmitter

PTR 90

Display range	mbar (Torr)	5 x 10 ⁻⁹ ... 1000 (3.75 x 10 ⁻⁹ ... 750)
Measurement uncertainty	%	30 in the range 1 x 10 ⁻⁸ ... 100 mbar (in the range 0.75 x 10 ⁻⁸ ... 75 Torr)
Principle of measurement		Cold cathode measurement system based on the principle of the inverted magnetron and Pirani measurement system
Reproducibility	%	5 in the range 1 x 10 ⁻⁸ ... 100 mbar (in the range 0.75 x 10 ⁻⁸ ... 75 Torr)
Output signal (measurement signal)		
Voltage range		0 - 10.5
Measurement range		1.82...8.6
Relationship voltage-pressure		Logarithmic, 0.6 V/decade
Error signal		< 0.5 V no power supply > 9.5 V Pirani sensor is defective (broken filament)
Power supply	V DC	15 - 30
Electrical connection		FCC 68 socket, 8 way
Operating temperature	°C	+5 to +55
Storage temperature	°C	-40 to +65
Materials in contact with the medium		Stainless steel, ceramics, Mo, Ni, Au, W
Overpressure resistance (absolute)	bar	10
Protection class	IP	40

Ordering Information

PENNINGVAC Transmitter

PTR 90 DN 25 KF DN 40 KF DN 40 CF	Part No. 230 070 Part No. 230 071 Part No. 230 072
Baffle DN 25 KF DN 40 KF	Part No. 230 078 Part No. 230 079
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Connection cable, FCC 68 on both ends, 8 way, shielded 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Type A Part No. 124 26 Part No. 230 012 Part No. 124 27 Part No. 124 28 Part No. 124 29 Part No. 124 30 Part No. 124 31 Part No. 124 32 Part No. 124 33

IONIVAC Transmitter ITR 90



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

If needed, the pressure can be displayed via the integrated display.

Advantages to the User

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

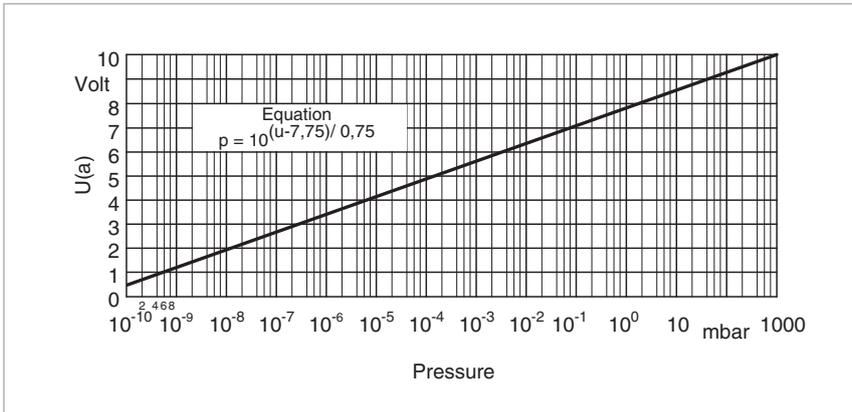
Typical Applications

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

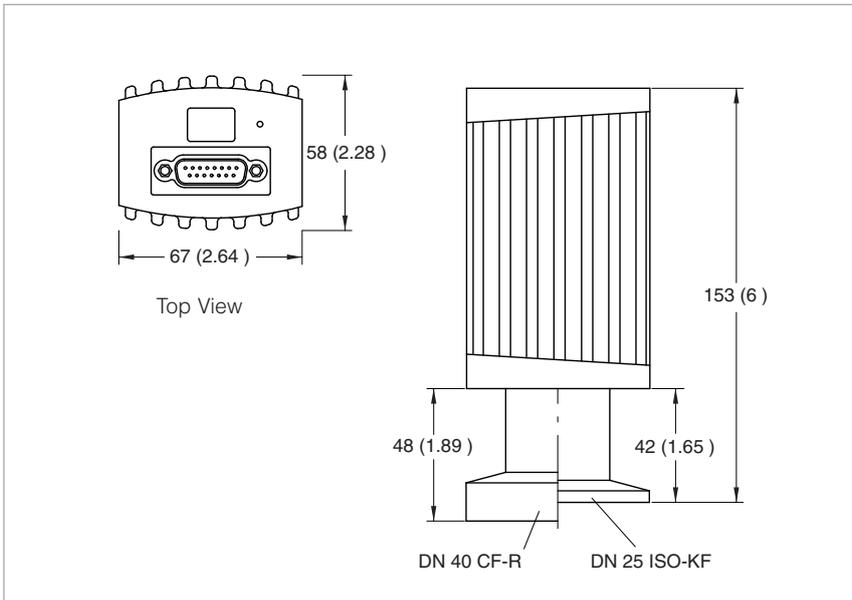
Sensor

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

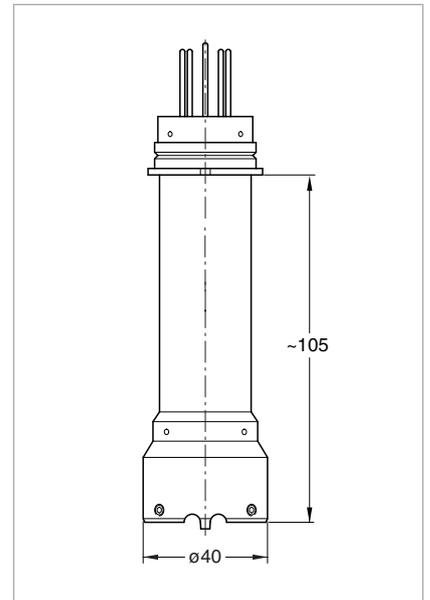
When using the bake out extension, measurements will be possible also at flange temperatures up to 150 °C.



Characteristic of the ITR 90



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



Dimensional drawing for the bake out extension

Technical Data

IONIVAC Transmitter

ITR 90

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

¹⁾ Flange temperature when using the bake out extension

Ordering Information

IONIVAC Transmitter ITR 90

Without Display

With Display

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

¹⁾ including hex. socket screw key

IONIVAC Transmitter ITR 200 S



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

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

Advantages to the User

- Service life increase and increased operational reliability through integration of a second hot cathode
- Full coverage of the pressure range from 5×10^{-10} mbar to atmospheric pressure
- High repeatability within the typical process pressure range of 10^{-2} to 10^{-8} mbar
- Controlled switching on and switching off through the integrated dual Pirani optimized the service life of the yttrium-coated iridium cathodes
- Compact design
- Enclosed, stable electrode geometry in rugged metal casing
- Efficient degassing through electron bombardment
- Simple to install
- Extension for higher bake out temperatures in the measurement mode
- 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

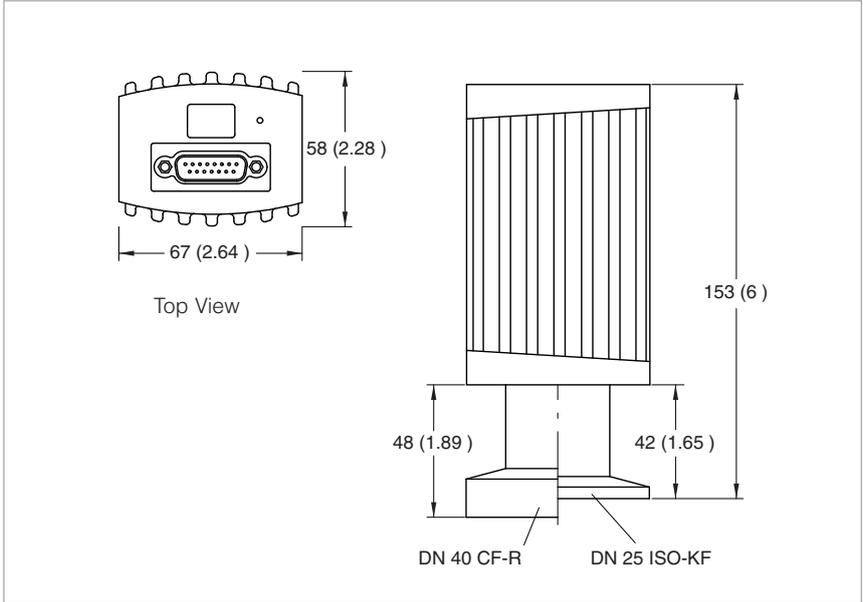
- Analytical engineering
- Sputtering and coating technology
- Vacuum furnaces
- Multipurpose pressure measurement in the medium and high vacuum range

Options

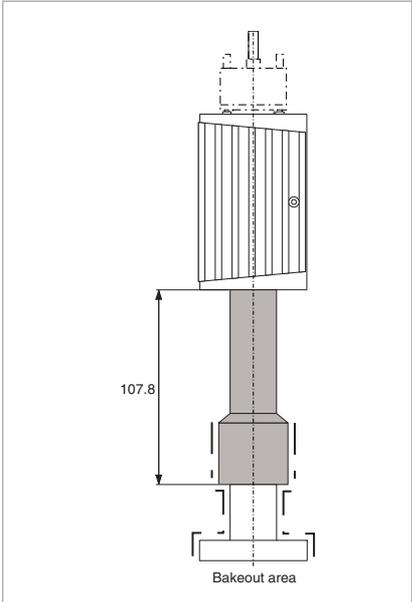
Upon request, the ITR 200 S can be supplied with an integrated display, a Profibus or a DeviceNet interface.

Sensor

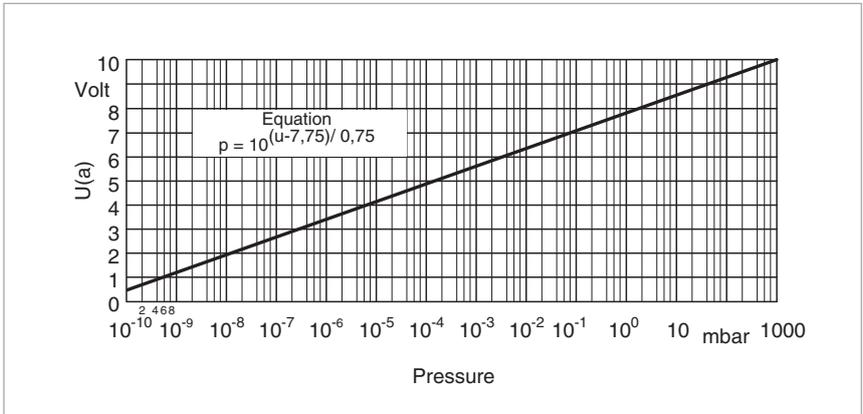
The sensor of the ITR 200 S includes besides the Pirani system a dual cathode measurement system according to Bayard-Alpert. If one of the hot cathodes should burn out during operation, then the second cathode is automatically switched on. Moreover, each sensor contains a memory chip with the relevant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



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



Dimensional drawing for the bake out version



Characteristic of the ITR 200

Technical Data

IONIVAC Transmitter ITR 200 S

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

¹⁾ Flange temperature when using the bake out extension

Ordering Information

IONIVAC Transmitter ITR 200 S

Without Display

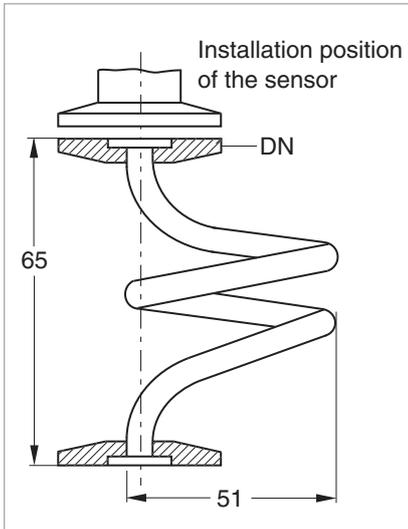
With Display

ITR 200 S, DN 25 KF 1 switching function	Part No. 230 250	Part No. 230 251
ITR 200 SP, DN 25 KF Profibus interface, 2 switching functions	Part No. 230 252	-
ITR 200 SD, DN 25 KF DeviceNet interface, 2 switching functions	Part No. 230 253	-
ITR 200 S, DN 40 CF-R, rotatable CF flange 1 switching function	Part No. 230 254	Part No. 230 255
ITR 200 SP, DN 40 CF-R, rotatable CF flange Profibus interface, 2 switching functions	Part No. 230 256	-
ITR 200 SD, DN 40 CF DeviceNet interface, 2 switching functions	Part No. 230 257	-
ITR 200 SL ¹⁾ , DN 40 CF-R, rotatable CF flange, 1 switching function, 150 °C bakeable	-	Part No. 230 258
Options		
Power supply for IONIVAC transmitter 100 V - 240 V AC / 24 V DC incl. 5 m connection cable and 5 m RS 232 C cable	Part No. 121 06	Part No. 121 06
Baffle, DN 25 KF, with Installation baffle for CF/KF variant	Part No. 121 07	Part No. 121 07
Replacement sensor		
IE 200, DN 25 KF ²⁾	Part No. 240 020	Part No. 240 020
IE 200, DN 40 CF-R ²⁾	Part No. 240 021	Part No. 240 021
IE 200 SL ¹⁾ , DN 40 CF-R ²⁾	-	Part No. 240 022
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Connection cable	see section "Connection Cable for active Sensors"	see section "Connection Cable for active Sensors"

¹⁾ SL = long version (bake out extension)

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 vapours and dusts. Thus measurement accuracy is improved and a longer service life of the pressure sensors is attained.

Installation is recommended in connection with

- measurement system TTR (preferred)
- CERAVAC CTR

Operating Principle

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

Maintenance

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

Note

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

Technical Data

Materials

Spiral Tube

Stainless steel

Ordering Information

Spiral Tube

DN 16 ISO-KF
DN 25 ISO-KF
DN 40 ISO-KF

Spiral Tube

Part No. 230 082
Part No. 230 083
Part No. 230 084

Connection Cables for Active Sensors

Active Sensors

Operating Units for Active Sensors

DISPLAY ONE

DISPLAY TWO DISPLAY THREE

CENTER ONE CENTER TWO CENTER THREE

THERMOVAC Transmitter TTR 91, TTR 91 S, TTR 96 S a. o. TTR 211 PB/D, TTR 216 PB/D	Type A	Type A	Type A
PENNINGVAC Transmitter PTR 90, PTR 225, PTR 225 S, PTR 237	Type A (only PTR 90)	Type A	Type A
CERAVAC Transmitter CTR 100, CTR 101 (digital signal)	-	-	Type C
IONIVAC Transmitter ITR 90, ITR 200 S	-	-	Type C

Operating Units for Active Sensors

Active Sensors

IONIVAC IM 540 (Channel 3 and 4)

CMove

Bare wire ends

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

Technical Data

Connection Cable

Cables Type A Type B Type C Type E	FCC 68 (RJ45) on both ends, 8 way, shielded Sub-D 15 way female to FCC 68 (RJ45), 8 way, shielded Sub-D 15 way female to Sub-D 15 way male, shielded Sub-D 15 way female to bare wire ends, shielded
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Ordering Information

Connection Cable

	Type A	Type B
Cable length		
5 m	Part No. 124 26	Part No. 230 013
10 m	Part No. 230 012	Part No. 230 014
15 m	Part No. 124 27	Part No. 230 015
20 m	Part No. 124 28	Part No. 230 016
30 m	Part No. 124 29	Part No. 230 017
40 m	Part No. 124 30	Part No. 230 018
50 m	Part No. 124 31	Part No. 230 019
75 m	Part No. 124 32	Part No. 230 020
100 m	Part No. 124 33	Part No. 230 021

Ordering Information

Connection Cable

	Type C	Type E
Cable length		
5 m	Part No. 124 55	Part No. 124 63
10 m	Part No. 230 022	Part No. 163 69
15 m	Part No. 124 56	Part No. 124 64
20 m	Part No. 124 57	Part No. 124 65
30 m	Part No. 124 58	Part No. 124 66
40 m	1)	Part No. 124 67

¹⁾ Longer cable runs are not specified because of the RS 232 C connection

Operating Units for Active Sensors

DISPLAY ONE



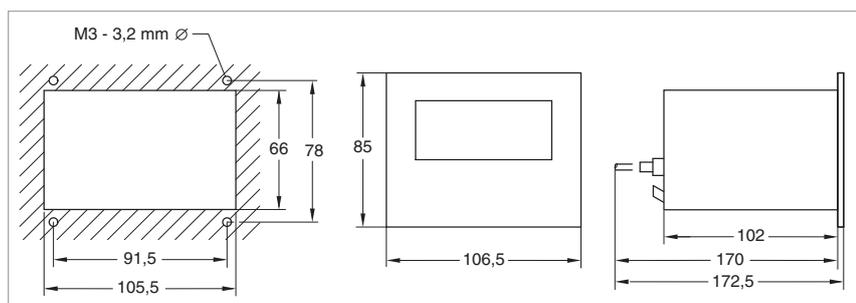
Cost-effective, compact single channel display unit for the transmitters from the THERMOVAC series and for PTR 90.

Advantages to the User

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

Connectable Sensors

- THERMOVAC
- TTR 100
 - TTR 211
 - TTR 216 S
 - TTR 90
 - TTR 90 S
 - TTR 91
 - TTR 91 S
 - TTR 96 S
- PENNINGVAC
- PTR 90



Dimensional drawing and panel cut-out for the DISPLAY ONE

Technical Data**DISPLAY ONE**

Number of measurement channels	1		
Display for measured values	digital, 7 segment LED		
Display range	mbar (Torr)	5 x 10 ⁻⁹ to 2000 (3.8 x 10 ⁻⁹ to 1500)	
Unit of measurement (selectable)	mbar, Torr, Pascal		
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		
Main connection			
EURO version	V / Hz	100 - 240 / 50/60	
US version	V / Hz	100 - 240 / 50/60	

Ordering Information**DISPLAY ONE**

EURO version, including mains cord	Part No. 230 001		
US version, including mains cord	Part No. 235 001		
THERMOVAC transmitter			
PENNINGVAC transmitter PTR 90	see section "Active Sensors"		
Connection cable, FCC 68 on both ends, 8 way, shielded			
5 m	Type A		
10 m	Part No. 124 26		
15 m	Part No. 230 012		
20 m	Part No. 124 27		
30 m	Part No. 124 28		
40 m	Part No. 124 29		
50 m	Part No. 124 30		
75 m	Part No. 124 31		
100 m	Part No. 124 32		
Adapter panel for installation in a 3 HU, 19 in. rack	Part No. 230 005		

DISPLAY TWO / THREE



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

All channels are displayed simultaneously.

Advantages to the User

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

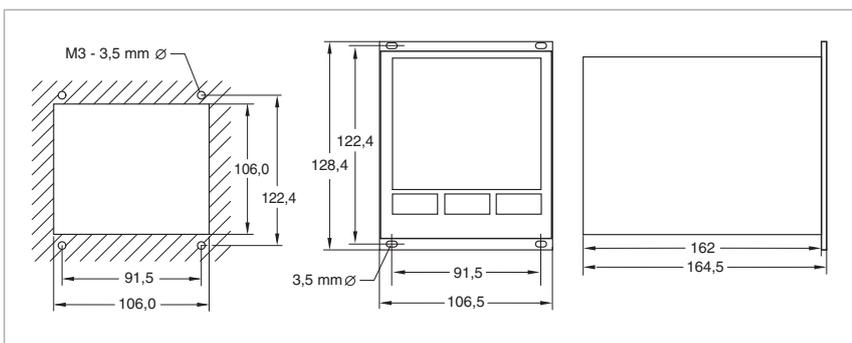
Connectable Sensors

THERMOVAC

- TTR 211
- TTR 216 S
- TTR 90
- TTR 91
- TTR 96 S
- TTR 100
- TTR 100 S2

PENNINGVAC

- PTR 90
- PTR 225
- PTR 225 S
- PTR 237



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

Technical Data

DISPLAY TWO

DISPLAY THREE

Number of measurement channels	2	3
Display for measured values	digital, 7 segment LED, 4 digits	digital, 7 segment LED, 4 digits
Display range mbar (Torr)	1×10^{-10} to 2000 (0.75×10^{-10} - 1500)	1×10^{-10} to 2000 (0.75×10^{-10} - 1500)
Unit of measurement (selectable)	mbar, Torr, Pascal	mbar, Torr, Pascal
Gas type correction (for PTR)	factor adjustable	factor adjustable
Sensor connection	FCC68 (RJ45)	FCC68 (RJ45)
Sensor power supply V DC	24	24
Electrical outputs	screw terminal	screw terminal
Switching threshold Number Adjustment range Hysteresis Relay contact Load rating	2 (1 per channel) sensor dependent adjustable floating changeover contact 60 V, 1 A DC / 30 V, 1 A AC	3 (1 per channel) sensor dependent adjustable floating changeover contact 60 V, 1 A DC / 30 V, 1 A AC
Ready relay 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 ($R_a \geq 10 \text{ k}\Omega$)	0 - 10 V per measurement channel, output characteristic corresponds to the connected transmitter	0 - 10 V per measurement channel, output characteristic corresponds to the connected transmitter
Control input	PENNINGVAC PTR: high voltage on	PENNINGVAC PTR: high voltage on
Mains connection V AC / Hz	85 - 240 / 50 - 60	85 - 240 / 50 - 60
Power consumption W	< 10	< 15
Nominal temperature range °C	+5 to +50	+5 to +50
Weight kg (lbs)	1.3 (2.87)	1.4 (3.09)
Protection class IP	40	40

Ordering Information

DISPLAY TWO

DISPLAY THREE

EURO version, including mains cord US version, including mains cord	Part No. 230 024 Part No. 235 024	Part No. 230 025 Part No. 235 025
THERMOVAC transmitter	see section "Active Sensors"	see section "Active Sensors"
PENNINGVAC transmitter	see section "Active Sensors"	see section "Active Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A)	see section "Connection Cables for Active Sensors"	see section "Connection Cables for Active Sensors"

CENTER ONE



Universal compact display and operating unit for the active sensors from the CERAVAC, THERMOVAC, PENNINGVAC and IONIVAC series.

Advantages to the User

- Power supply voltage for the transmitters
- Display range from 1×10^{-10} to 2000 mbar
- Automatic switchover to exponential readout of the measured data depending on the pressure range
- Readout selectable between mbar, Torr or Pascal
- Adjustable switching threshold with variable hysteresis, floating change-over contact and visual indication of the switching status on the display
- Zero correction for both display and chart recorder output through a key when using CERAVAC transmitters
- Option of entering gas correction factors for PENNINGVACs
- Chart recorder output 0 - 10 Volt
- RS 232 C interface with adjustable baud rate
- Relay output for error signalling
- Compact bench top enclosure (1/4 19 in., 2 HU)
- For fitting into 19 in., 3 HU racks

Connectable Sensors

THERMOVAC

- TTR 211
- TTR 216 S
- TTR 90
- TTR 91
- TTR 96 S
- TTR 100
- TTR 100 S2

PENNINGVAC

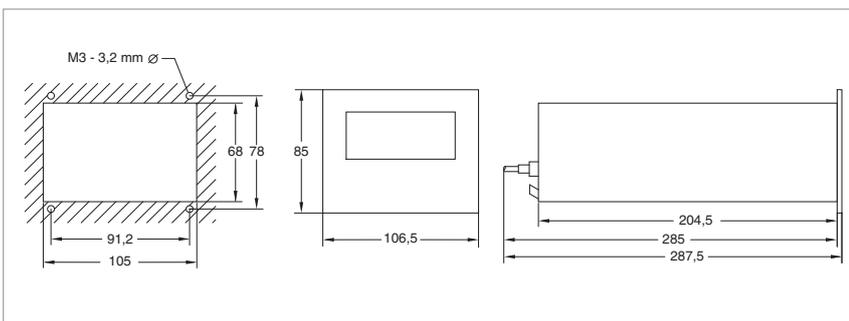
- PTR 90
- PTR 225
- PTR 225 S
- PTR 237

CERAVAC

- CTR 90
- CTR 91
- CTR 100

IONIVAC

- ITR 90
- ITR 100
- ITR 200 S
- ITR 200 SL



Dimensional drawing and panel cut-out for the CENTER ONE

Technical Data

CENTER ONE

Number of measurement channels		1
Display for measured values		digital, 7 segment LED, 5 digits
Display range	mbar (Torr)	1×10^{-10} to 2000 (0.75×10^{-10} to 1500)
Unit of measurement (selectable)		mbar, Torr, Pascal, Micron
Gas type correction		factor adjustable
Sensor connection		15 way Sub-D socket FCC68 (RJ45)
Sensor power supply	V DC	24
Electrical inputs and outputs		9 way Sub-D plug
Switching threshold		
Number		1
Adjustment range		sensor dependent
Hysteresis		adjustable
Relay contact		floating changeover contact
Load rating		60 V, 0.5 A DC / 30 V, 0.5 A AC
Error message		
Relay contact		floating normally open contact
Load rating		60 V, 0.5 A DC / 30 V, 0.5 A AC
Chart recorder output ($R_a \geq 10 \text{ k}\Omega$)		0 - 10 Volt, characteristic corresponds to the connected transmitter
Control input		PTR: high voltage on ITR 100: emission on
Interface RS 232 C		9 way Sub-D socket
Mains connection	V AC / Hz	85 V - 264 / 50-60
Power consumption	W	< 30
Weight	kg (lbs)	0.85 (1.9)
Protection class	IP	30

Ordering Information

CENTER ONE

EURO version with 2 m EURO mains cord US version with 2 m US mains cord		Part No. 230 002 Part No. 235 002
THERMOVAC, PENNINGVAC, CERA VAC and IONIVAC transmitters		see section "Active Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A), CERA VAC (Type B analog, Type C digital) and IONIVAC (Type C)		see section "Connection Cables for Active Sensors"
Adapter panel for installation in a 3 HU, 19 in. rack		Part No. 230 005
Screw terminal for the 9 way output socket		Part No. 230 006

CENTER TWO / THREE



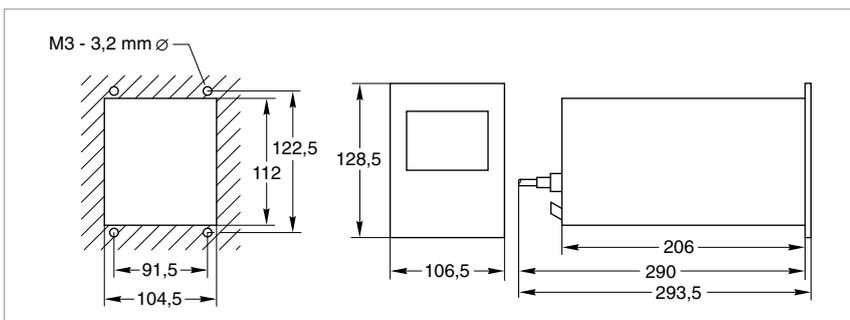
Universal display and operating units for the active sensors from the CERAVAC, THERMOVAC, PENNINGVAC and IONIVAC series. All channels are displayed simultaneously.

Advantages to the User

- Power supply voltage for the transmitters
- Display range from 1×10^{-10} to 2000 mbar (0.75×10^{-10} to 1500 Torr)
- Automatic switchover to exponential presentation of the measured data dependent on the pressure range
- Readout selectable between mbar, Torr, Micron or Pascal
- Adjustable switching thresholds with variable hysteresis, floating change-over contacts and visual indication of the switching status in the display, freely assignable to the individual measurement channels
- Zero correction for both display and chart recorder output through a key when using CERAVAC transmitters
- Option of entering gas correction factors for PENNINGVACs
- Separate chart recorder outputs 0 - 10 V for each measurement channel
- Additional chart recorder output 0 - 10 V programmable to several measurement channels
- RS 232 C interface with adjustable baud rate
- Relay output for error signalling
- Compact bench top enclosure (1/4 19 in., 3 HU)
- For fitting into 19 in., 3 HU racks

Connectable Sensors

- THERMOVAC
- TTR 211
 - TTR 216 S
 - TTR 90
 - TTR 91
 - TTR 96 S
 - TTR 100
 - TTR 100 S2
- PENNINGVAC
- PTR 90
 - PTR 225
 - PTR 225 S
 - PTR 237
- CERAVAC
- CTR 90
 - CTR 91
 - CTR 100
- IONIVAC
- ITR 90
 - ITR 200 S
 - ITR 200 SL



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

Technical Data

CENTER TWO

CENTER THREE

Number of measurement channels	2	3
Display for measured values	digital, 7 segment LED, 5 digits	digital, 7 segment LED, 5 digits
Display range	mbar (Torr)	1 x 10 ⁻¹⁰ to 2000 (0.75 x 10 ⁻¹⁰ to 1500)
Unit of measurement (selectable)	mbar, Torr, Pascal, Micron	mbar, Torr, Pascal, Micron
Gas type correction	factor adjustable	factor adjustable
Sensor connection	15 way Sub-D socket FCC68 (RJ45)	15 way Sub-D socket FCC68 (RJ45)
Sensor power supply	V DC	24
Electrical outputs	25 way Sub-D socket	25 way Sub-D socket
Switching threshold	independently assignable	independently assignable
Number	4	6
Adjustment range	sensor dependent	sensor dependent
Hysteresis	adjustable	adjustable
Relay contact	floating changeover contact	floating changeover contact
Load rating	60 V, 0.5 A DC / 30 V, 0.5 A AC	60 V, 0.5 A DC / 30 V, 0.5 A AC
Error message		
Relay contact	floating normally open contact	floating normally open contact
Load rating	60 V, 0.5 A DC / 30 V, 0.5 A AC	60 V, 0.5 A DC / 30 V, 0.5 A AC
Chart recorder output (R _a ≥ 10 kΩ)	0 - 10 V per measurement channel, output characteristic corresponds to the connected sensor, in addition one chart recorder output can be programmed	0 - 10 V per measurement channel, output characteristic corresponds to the connected sensor, in addition one chart recorder output can be programmed
Control input	PENNINGVAC PTR: high voltage on	PENNINGVAC PTR: high voltage on
Interface RS 232 C	9 way Sub-D socket	9 way Sub-D socket
Mains connection	V AC / Hz	90 - 250 / 50 - 60
Power consumption	W	45
Nominal temperature range	°C	+5 to +50
Weight	kg (lbs)	1.1 (2.43)
Protection class	IP	20

Ordering Information

CENTER TWO

CENTER THREE

EURO version with 2 m EURO mains cord US version with 2 m US mains cord	Part No. 230 004 Part No. 235 004	Part No. 230 003 Part No. 235 003
THERMOVAC, PENNINGVAC, CERAVAC and IONIVAC transmitters	see section "Active Sensors"	see section "Active Sensors"
Connection cables for THERMOVAC and PENNINGVAC (Type A), CERAVAC (Type B) and IONIVAC (Type C)	see section "Connection Cables for Active Sensors"	see section "Connection Cables for Active Sensors"
Screwed connection for 9 way Sub-D socket	Part No. 230 006	Part No. 230 006

PIEZOVAC PV 20



This complete vacuum gauge offers accurate and cost-effective measurements in the range between 1 and 2000 mbar (0.75 and 1500 Torr), or 0.1 and 200 mbar (0.075 and 150 Torr).

Advantages to the User

- Complete instrument: Sensor and cable included
- Dual LCD display – combines the advantages of analog and digital readouts
- Clear display of pressure and operating status with analog trend indication, can also be read from a great distance
- Logarithmic/linear 0 to 10 V chart recorder output
- Compact bench-top unit (1/4 19 in., 3 HU), which may also be installed in panel cut-outs and 19 in. racks
- Ceramic absolute pressure sensor which is highly corrosion resistant
- THERMOVAC sensors TR 211, TR 212 and TR 216 may be alternatively connected
- CE mark

Typical Applications

- General pressure measurements in the fine and rough vacuum range, in connection with vacuum furnaces and analytical instruments
- Monitoring the operation of backing pumps and vacuum systems
- Replacement of mercury manometers in the lab and in production lines

Sensors

The PIEZOVAC PV 20 is delivered complete with a DI 2000 or DI 200 sensor. The sensor is supplied fully aligned for operation.

For information on the THERMOVAC sensors, see chapter “Activ Sensors”.

Technical Data

PIEZOVAC PV 20

Display range	mbar (Torr)	0.1 to 2000 (0.075 to 1500)
Display		digital: 7 segment LCD, analog: LCD bar
Measurement uncertainty with DI 200/201/2000 Sensor	% FS	0.2
Unit of measurement (selectable)		mbar, Torr, Pa, Micron
Chart recorder output ($R_a \geq 2,5 \text{ k}\Omega$)		0 to 10 V, linear divisions for absolute pressure sensors, about 10.5 V during faults 0 to 10 V, logarithmic divisions for THERMOVAC sensors (1.67 V/decade)
Main connection 50/60 Hz (selectable)	V	90 to 130 / 180 to 250
Power consumption	VA	9
Storage temperature range	°C	-40 to +60
Nominal temperature range	°C	0 to 40
Max. rel. humidity	% n.c.	80
Weight, approx.	kg (lbs)	2 (4.4)
Dimensions (W x H x D)	mm	106.5 x 128.5 x 172
Cable length, max.	m	100
Connectable sensors		TR 211/212/216, DI 200/201/2000/2001

Ordering Information

PIEZOVAC PV 20

Complete with 2 m long main cord and DI 2000 sensor, with 5 m long cable, 230 V AC, Measurement range 1 - 2000 mbar (0.75 - 1500 Torr)	Part No. 157 96
Complete with 2 m long main cord and DI 200 sensor, with 5 m long cable, 230 V AC, Measurement range 0.1 - 200 mbar (0.075 - 150 Torr)	Part No. 157 97
Calibration	see section "Miscellaneous", para. "Oerlikon Leybold Vacuum Calibration Service"
Options 19" installation frame 1/4 19" blank panel	Part No. 161 00 Part No. 161 02

Ultra High Vacuum Gauges

IONIVAC IM 540



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

Advantages to the User

- Precise UHV pressure measurements with the Bayard-Alpert sensor IE 414 (offering excellent longterm stability) or the Extractor sensor IE 514 (offering an extremely low X-ray limit of $< 1 \times 10^{-12}$ mbar)
- 1 measurement channel for IONIVAC sensor (Bayard-Alpert or Extractor)
- Possibility of simultaneously connecting a second IONIVAC sensor
- Degassing of the anode through electron bombardment with time-limit
- Continuous UHV measurement also during the degassing phase (up to $+250$ °C with bakeable gauge head cable)
- 2 measurement channels for direct connection of transmitters from the series THERMOVAC TTR and CERA VAC 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 in., 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

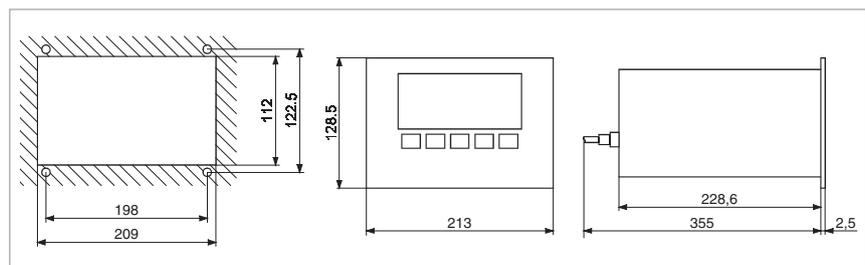
- Pressure measurement and control in the UHV range
- Measurement of ultimate pressure in UHV systems
- Checking of ultimate pressure in semiconductor production
- Total pressure measurements in the area of cryo technology
- Total pressure measurements in calibration systems

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
 - CERA VAC 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 CERA VAC CTR 100/CTR 91 of suitable range overlap is connected.



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

Technical Data

IONIVAC IM 540

Number of measurement channels		3
Bayard-Alpert / Extractor		Channel 1 or 2
THERMOVAC / CERA VAC		Channel 3 and 4
Display range	mbar (Torr)	1×10^{-12} to 1100 (0.75×10^{-12} to 825)
Display range Extractor	mbar (Torr)	1×10^{-12} to 1×10^{-4} (0.75×10^{-12} to 0.75×10^{-4})
Display range Bayard-Alpert	mbar (Torr)	1×10^{-11} to 1×10^{-2} (0.75×10^{-11} to 0.75×10^{-2})
Measurement range switching		automatic or decade pre-select
Units of measurement (selectable)		mbar, Torr, Pa, Micron
Measurement uncertainty	%	± 10 of the value displayed
Trend indication		bargraph
Measurement value display rate		1×10^{-10} to 1×10^{-2} mbar, 5 s^{-1} 1×10^{-12} to 1×10^{-10} mbar, 0.5 s^{-1}
Emission current		
Extractor sensor	mA	1.6
Bayard-Alpert sensor	mA	0.1 to 10; automatic control
Emission current shutdown at		$p > 1 \times 10^{-2}$ mbar, broken cathode, short-circuit, interruption of the electric circuit
Bake out power		
Extractor / Bayard-Alpert	W	20 / 40
Sensor 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 for Extractor/Bayard-Alpert ($R_a \geq 2.5 \text{ k}\Omega$)		logarithmic 0 to 10 V (1 V / dec.) or linear 0 to 10 Volt, error indication $U > 10.5 \text{ V}$
Interface (standard / optional)		RS 232 C / Profibus
Switching thresholds (single operation or interval)		2 with floating changeover contact
Mains connection	V / 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

IONIVAC IM 540 with 2 m long mains cord (EURO and US)	Part No. 230 100
Options Profibus DP interface	Part No. 230 101
DKD calibration	see section "Miscellaneous"
IONIVAC sensors IE 414, DN 40 CF Replacement cathode IE 414 IE 514, DN 40 CF Replacement cathode IE 514	Part No. 158 66 Part No. 158 63 Part No. 158 67 Part No. 158 61
Gauge head cables for IE 414/514 5 m 10 m 5 m, bakeable up to 200 °C	Part No. 158 68 Part No. 150 88 Part No. 158 44
Extension cables for IE 414/514 10 m 20 m	Part No. 245 002 Part No. 200 02 937
THERMOVAC Transmitter TTR	see section "Active Sensors"
Connection cable for THERMOVAC (Type A)	see section "Connection Cables for Active Sensors"
CERAVAC Transmitter CTR	see section "Active Sensors"
Connection cable for CERAVAC (Type B)	see section "Connection cables for active sensors"

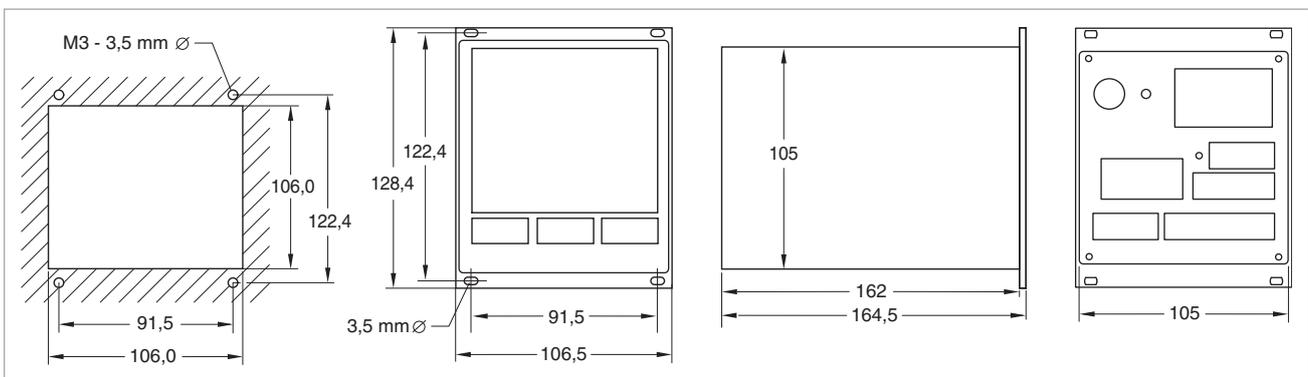
COMBIVAC CM 51



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.

Advantages to the User

- Compact three channel operating unit for a pressure range from 10^{-9} to 1000 mbar for passive sensors
- Automatic switchover from THERMOVAC operation to Penning (cold cathode) operation
- Easy to operate
- Keyboard locking through SOFTLOCK
- 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 Section "Sensors")
- Aligned and temperature compensated THERMOVAC sensors (see Section "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 in., 3 HU) made of metal for installation in front panel cut outs and 19 in. racks
- Fully remotely controllable through RS 232 C and Profibus interface
- CE mark
- RoHS-compliant



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

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
- PR 25
 - PR 26
 - PR 27
 - PR 28

Technical Data

COMBIVAC CM 51

Number of measurement channels		3
Display range		
Channels 1, 2 (THERMOVAC)	mbar	5×10^{-4} to 1000
Channel 3 (PENNINGVAC)	mbar	10^{-9} to 10^{-2}
Unit of measurement (selectable)		mbar, Torr, Pa
Measurement uncertainty		
THERMOVAC		$\leq 20\%$ of the measured value in the range 10^{-3} to 10^{-2} mbar / $\leq 15\%$ of the measured value in the range 10^{-2} to 10^2 mbar
PENNINGVAC		$\pm 30\%$ of the measured value in the range 10^{-8} to 10^{-4} mbar
Measured value display		digital, 7 segment LCD, 4 digits
Type of gas (selectable)		factor adjustable
Switching thresholds		2 per channel
Operating mode		single, interval-trigger
Adjustable switching thresholds		
THERMOVAC	mbar	5×10^{-3} to 500
PENNINGVAC	mbar	1×10^{-8} to 9.9×10^{-3}
Switching relay hysteresis		10% of the trigger value (default), freely adjustable for THERMOVAC and PENNINGVAC
Relay contact load rating		AC/DC, max. 30 V / 1 A
Chart recorder output (default)		0 to 10 V, log. divisions
THERMOVAC		linear: 3 decades, approximately 10.5 V in case of a failure, logarithmic: (1×10^{-3} mbar), 1.67 V/decade
PENNINGVAC		logarithmic: (1×10^{-9} mbar), 1.43 V/ decade
Interface		RS 232 C, RS 485 and Profibus
Mains connection 50/60 Hz	V	100 - 240
Power consumption	W	< 10
Storage temperature range	°C	-20 to +60
Nominal temperature range	°C	+5 to +50
Max. rel. atmospheric humidity	% n.c.	80
Weight	kg	1.4
Dimensions (W x H x D)	mm	106.4 x 128.5 x 164.5
Installation depth	mm	approx. 220
Protection class	IP	40

Ordering Information

COMBIVAC CM 51

Operating unit COMBIVAC CM 51 including EURO and US mains cord, 2 m with RS 232 C/ 485 with Profibus DB	Part No. 230 110 Part No. 230 111
Cable adapter CM 31 - CM 51	upon request
DKD calibration	see chapter Oerlikon Leybold Calibration Service
Options 19 in. installation frame 1/4 19 in. blank panel	Part No. 161 00 Part No. 161 02
THERMOVAC sensors for CM 51 TR 211, DN 16 KF TR 211, 1/8" NPT TR 212, DN 16 KF TR 212, DN 16 CF TR 216, DN 16 KF	Part No. 157 85 Part No. 896 33 Part No. 158 52 Part No. 157 86 Part No. 157 87
Gauge head cables for TR sensors 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Part No. 162 26 Part No. 162 27 Part No. 124 34 Part No. 162 28 Part No. 124 35 Part No. 124 36 Part No. 124 37 Part No. 124 38 Part No. 124 39
PENNINGVAC sensors for CM 51 PR 25, DN 25 KF PR 26, DN 40 KF PR 27, DN 40 CF PR 37, DN 40 CF, degassable	Part No. 157 52 Part No. 136 46 Part No. 136 47 Part No. 136 48
Gauge cables for PR sensors 5 m 10 m 15 m 20 m 30 m 40 m 50 m 75 m 100 m	Part No. 162 88 Part No. 162 89 Part No. 124 49 Part No. 157 56 Part No. 124 50 Part No. 124 51 Part No. 124 52 Part No. 124 53 Part No. 124 54

Additional Sensors

IONIVAC Sensors IE 414/IE 514



These passive sensors use hot cathode ionization technology.

IE 414

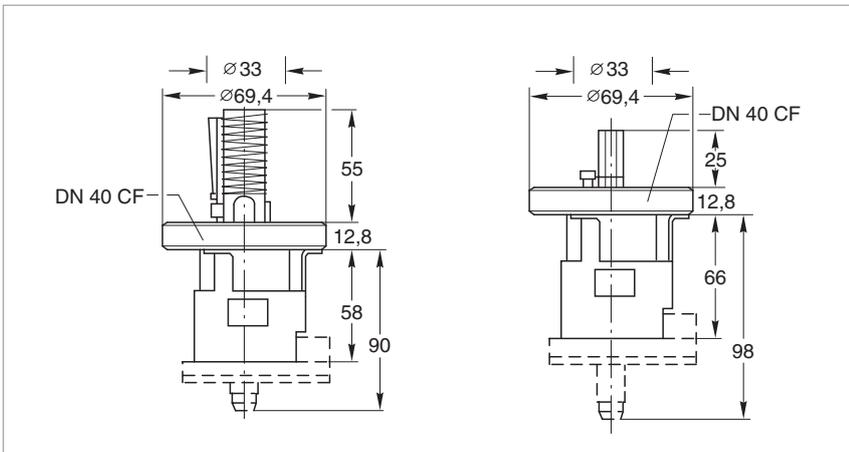
- Bayard-Alpert sensing system
- Measurement range to 2×10^{-11} mbar (1.5×10^{-11} Torr)
- Protection shield welded in place

IE 514

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

Advantages to the User

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



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

Technical Data**IE 414****IE 514**

Measurement range	mbar (Torr)	2×10^{-11} to 10^{-2} (1.5×10^{-11} to 10^{-2})	10^{-12} to 1×10^{-4} (10^{-12} to 7.5×10^{-5})
X-ray limit	mbar (Torr)	$\leq 10^{-11}$ ($\leq 10^{-11}$)	$\leq 10^{-12}$ ($\leq 10^{-12}$)
Operating temperature range	°C	0 to +80	0 to +80
Degassing temperature at the flange, max.	°C	200 ¹⁾ / 350 ²⁾	200 ¹⁾ / 350 ²⁾
Material			
Cathode		Iridium with yttric oxid coating	Iridium with yttric oxid coating
Feedthrough pins		NiFe 42	NiFe 42
Anode		Pt/Ir 90/10/pt wire	Mo and CoNiCr
Vacuum connection	DN	40 CF	40 CF
Adjustment data			
Ion detector potential	V	0	0
Cathode potential	V	80	100
Anode potential	V	220	220
Emission current	mA	0.06 to 0.6	1.6
Heating current for the hot cathode	A	1.4	1.4
Heating voltage for the hot cathode	V	2.7	3.7
Sensitivity for nitrogen	mbar ⁻¹	17	6.6
Bake out operation	V	700	700
Electron bombardment	mA	30	30
Operating units		IM 520, 510, 540	IM 520, 510, 540

Ordering Information**IE 414****IE 514**

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

¹⁾ With bakeable gauge head cable

²⁾ With gauge head cable detached

THERMOVAC Sensors

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



These passive sensors use thermal conductivity technology according to Pirani.

Advantages to the User

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

TR 211

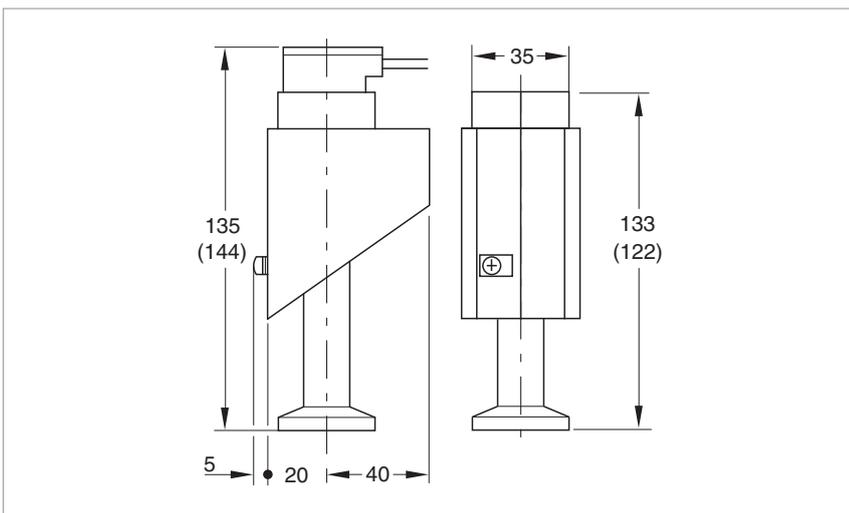
- Aluminum sensing cell with tungsten filament
- Improved temperature compensation

TR 211 NPT/TR 212

- Stainless steel sensing cell with tungsten filament
- Over-pressure resistant

TR 216

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



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

Technical Data

TR 211

TR 211 NPT

TR 212

TR 216

Measurement range	mbar (Torr)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)	5 x 10 ⁻⁴ to 1000 (3.8 x 10 ⁻⁴ to 7.5 x 10 ²)
Operating temperature range (compensated)	°C	0 to +40	0 to +40	0 to +40	0 to +40
Storage temperature range, max.	°C	80	80	80	80
Filament		tungsten	tungsten	tungsten	platinum
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 KF	1/8" NPT	16 KF/16 CF	16 KF
Materials in contact with the medium		aluminum, Vacon, glass, tungsten CrNi 8020,	stainless steel, Vacon, glass, tungsten CrNi 8020 epoxy cement	stainless steel, Vacon, glass, tungsten CrNi 8020	stainless steel 1.4301 (SS 304), Al ₂ O ₃ ceramics, CrNi 8020,
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

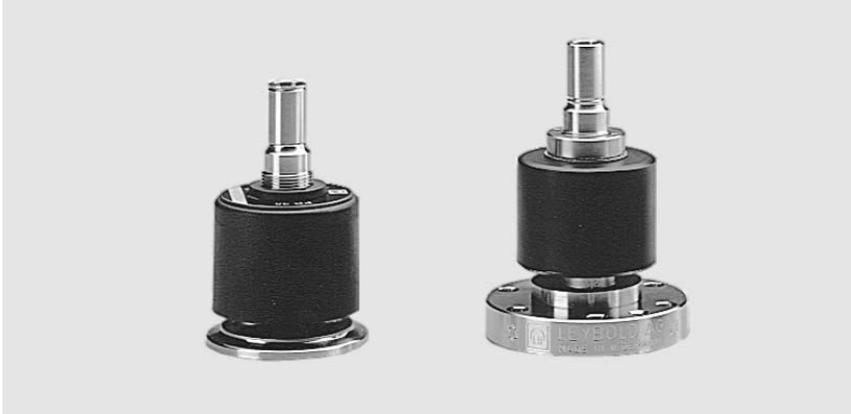
TR 212

TR 216

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

PENNINGVAC Sensors

PR 25/PR 26/PR 27/PR 28



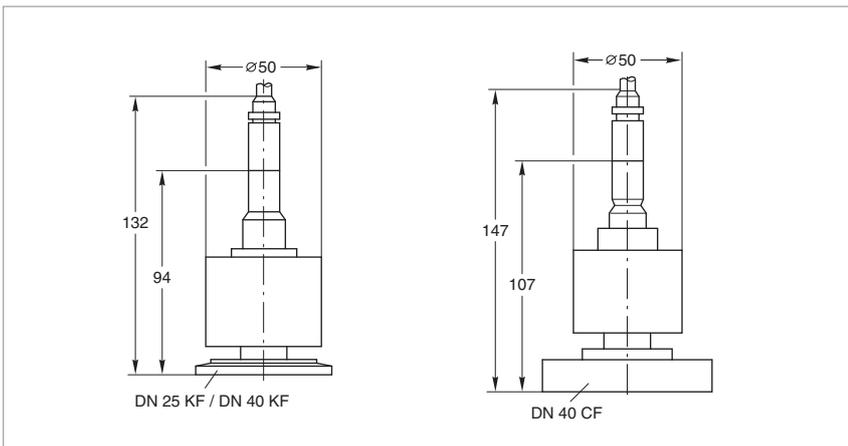
These passive sensors use cold cathode ionization technology according to Penning.

Advantages to the User

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

Option

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



Dimensional drawing for the PENNINGVAC PR sensors

Technical Data**PR 25****PR 26****PR 27****PR 28**

Measurement range	mbar (Torr)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)	1 x 10 ⁻⁹ to 10 ⁻² (0.75 x 10 ⁻⁹ to 10 ⁻²)
High voltage supply (anode potential)	kV	+3.3/+1.6	+3.3/+1.6	+3.3/+1.6	+3.3/+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	-	-	-	350
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 KF	40 KF	40 CF	40 CF
Operating units		COMBIVAC CM 31, 32, 33 / PENNINGVAC PM 31			

Ordering Information**PR 25****PR 26****PR 27****PR 28**

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

Linear Pressure Sensors

DI 200/DI 201/DI 2000/DI 2001/DI 2001 rel



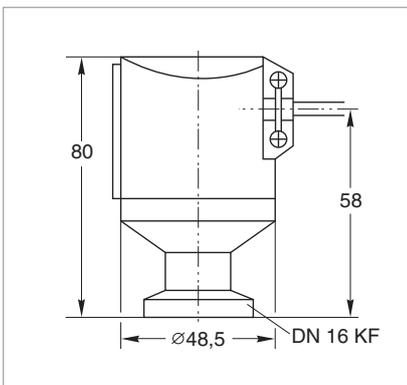
Capacitive pressure sensor based on ceramics technology. Available as absolute or relative pressure sensor.

Advantages to the User

- Pressure sensor of the two-wire type
- 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
- Supply voltage range of 12 to 30 V DC
- Linear output signal of 4 to 20 mA
- Compact design

Typical Applications

- Pressure measurements in the rough vacuum range, and for corrosive media
- Chemical process engineering
- Vacuum packaging
- Drying processes
- 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 2001 rel)



Dimensional drawing for the sensors
DI 200/DI 201/DI 2000/DI 2001/DI 2001 rel

Technical Data

DI 200

DI 201

DI 2000

DI 2001

DI 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.	bar	5	5	10	10	10
Nominal temperature range	°C	0 to +60	0 to +60	0 to +60	0 to +60	0 to +60
Measurement uncertainty ¹⁾ (± temperature error)	% FS	0.2	0.2	0.2	0.2	0.2
Resolution	% FS	0.05	0.05	0.05	0.05	0.05
Reproducibility	% FS	0.1	0.1	0.1	0.1	0.1
Linearity	% FS	0.2	0.2	0.2	0.2	0.2
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
Principle of measurement		Capacitive	Capacitive	Capacitive	Capacitive	Capacitive
Sensing head supply		Two-wire system	Two-wire system	Two-wire system	Two-wire system	Two-wire system
Output signal	mA	4 to 20	4 to 20	4 to 20	4 to 20	4 to 20
Supply voltage	V DC	+24 typ.	+24 typ.	+24 typ.	+24 typ.	+24 typ.
Operating range	V	12 to 30, ripple 1 V _{pp}	12 to 30, ripple 1 V _{pp}	12 to 30, ripple 1 V _{pp}	12 to 30, ripple 1 V _{pp}	12 to 30, ripple 1 V _{pp}
Dead volume	cm ³	3	3	3	3	3
Vacuum connection	DN	16 KF	16 KF	16 KF	16 KF	16 KF
Weight, approx.	kg (lbs)	0.55 (1.2)	0.55 (1.2)	0.55 (1.2)	0.55 (1.2)	0.55 (1.2)
Protection class	IP	44	44	44	44	44
Materials in contact with the medium		Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics FPM (FKM)	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics EPDM	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics FPM (FKM)	Stainless Steel, 1.4305 Al ₂ O ₃ (96 %) Ceramics, EPDM	Stainless Steel 1.4305 Al ₂ O ₃ (96 %) Ceramics EPDM
Operating units		MEMBRANOVAC DM 11, DM 12 / PIEZOVAC PV 20 / COMBIVAC CM 32, 2T	MEMBRANOVAC DM 11, DM 12 / PIEZOVAC PV 20 / COMBIVAC CM 32, 2T	MEMBRANOVAC DM 11, DM 12 / PIEZOVAC PV 20 / COMBIVAC CM 32, 2T	MEMBRANOVAC DM 11, DM 12 / COMBIVAC CM 32, 2T	MEMBRANOVAC DM 11, DM 12 / COMBIVAC CM 32

Ordering Information

DI 200

DI 201

DI 2000

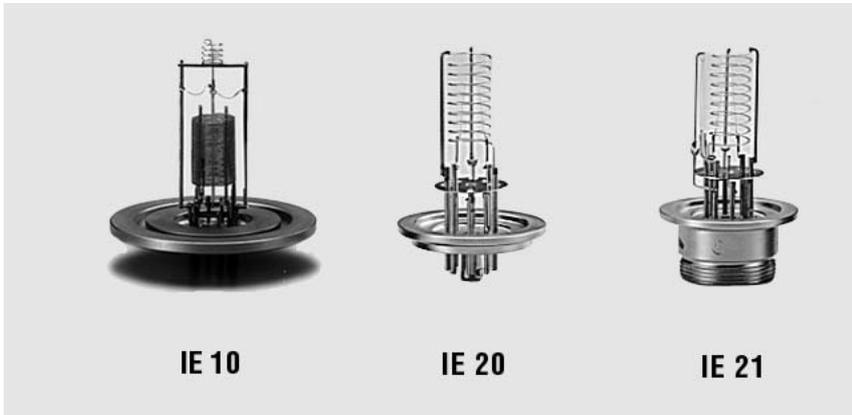
DI 2001

DI 2001 rel

Linear absolute pressure sensor, complete with 5 m long connection cable and connecting plug	Part No. 158 12	Part No. 158 14	Part No. 158 13	Part No. 158 15	Part No. 245 000
Extension cable	Part No.				
10 m	200 04 112				
20 m	200 02 645				

¹⁾ Sum of linearity, hysteresis and reproducibility

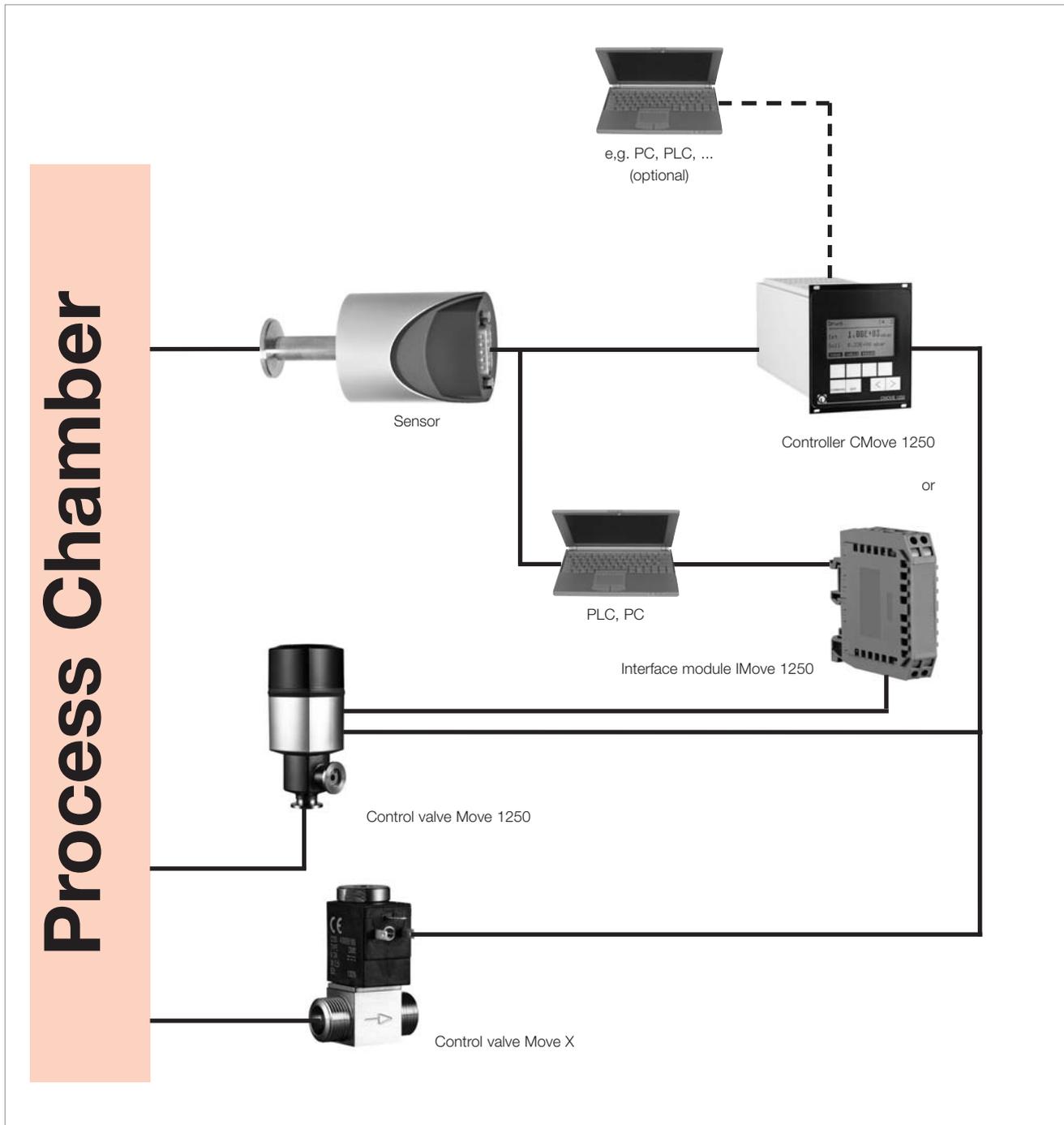
Spare Sensors for Older Operating Units



Type	Corresponding Sensors/ Operating Units	Ordering Information
Replacement spare sensor IE 10	IM 110, IM 110 D	Part No. 163 43
Replacement spare sensor IE 20	IM 210, IM 210 D, IT 230	Part No. 163 14
Replacement spare sensor IE 21	IM 210, IM 221	Part No. 158 17
Replacement spare sensor IE 100 DN 25 KF DN 40 CF	ITR 100 ITR 100	Part No. E 163 61 Part No. E 163 67
Replacement spare cathode	IE 220	Part No. 158 58 ¹⁾
Replacement spare sensor TR 301	TM 320, CM 350, IM 520, DM 11, DM 12, CM 32	Part No. 157 40
Replacement sensing cell	TR 201/901 DN 16 KF	Part No. 162 09 ¹⁾
Replacement sensing cell	TR 201/901 NPT	Part No. 896 76 ¹⁾
Replacement sensing cell	TR 301	Part No. 157 43

¹⁾ to be discontinued

Pressure Control System Move



Control Valves Move 1250 and Move X

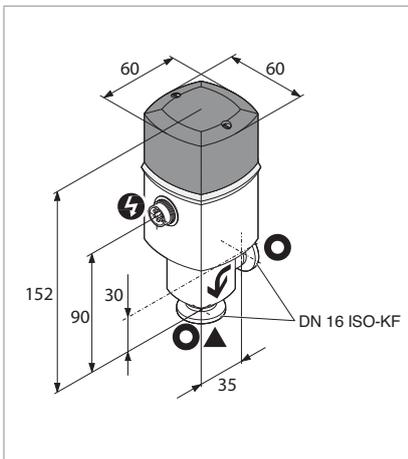


Control valve Move 1250

Control Valve Move 1250

Advantages to the User

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



Dimensional drawing for the Move 1250

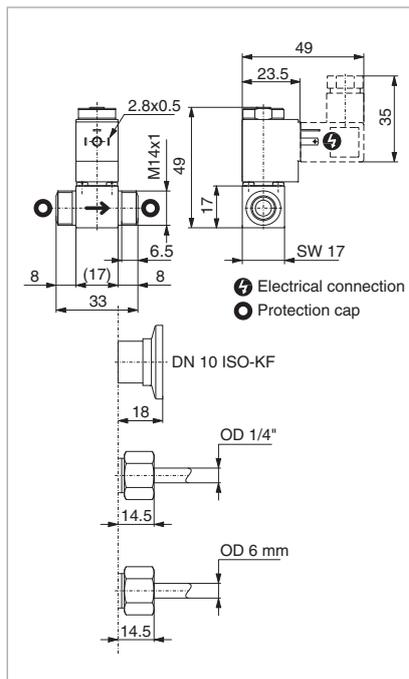


Control valve Move X

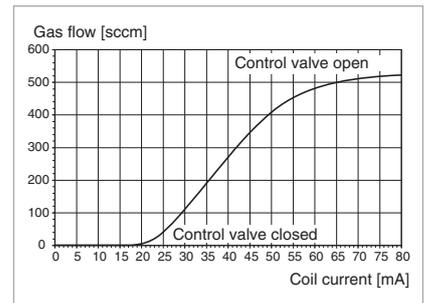
Control Valve Move X

Advantages to the User

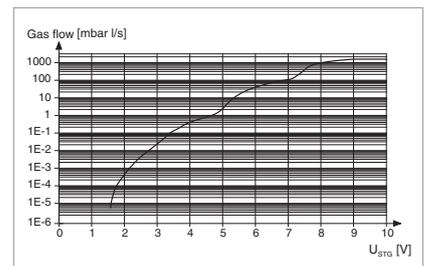
- 6 different valves for the gas flows ranging from 10 sccm FS to 5000 sccm FS
- Fast response
- Electromagnetic pressure regulation with variable gas flow (upstream regulation)
- Normally closed
- Many adapters are available



Dimensional drawing for the Move X with connection adapter



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



Gas flow curve of the Move 1250

Control Valve

Technical Data

Move 1250

Move X

Vacuum connection		DN 16 ISO-KF	Threaded connection M 14 x 1 for accepting of: Flange connection DN 10 ISO-KF Pipe connection \varnothing 1/4" Pipe connection \varnothing 6 mm
Installation orientation		Any	Any, preferably vertical
Leak tightness	mbar x l/s	1×10^{-9}	1×10^{-9}
Pressure range		1×10^{-8} mbar to 2.5 bar (absolute)	1×10^{-8} mbar to 1000 mbar (max. pressure in closing direction 2 bar)
Gas flow ¹⁾ with filter, on the inlet side		5×10^{-6} to 1250 mbar x l/s	10 sccm FS ^{2), 3)} 50 sccm FS ^{2), 3)} 100 sccm FS ^{2), 3)} 500 sccm FS ^{2), 3)} 1000 sccm FS ^{2), 3)} 5000 sccm FS ^{2), 3)}
with filter, on the inlet and the vacuum side	mbar x l/s	5×10^{-6} to 1000	–
Power supply			
Supply voltage	V DC	24 (\pm 10%)	0 to 24
Power consumption	VA	12	2.5 max.
Current consumption	mA	500, 20 to 30 (closed circuit current)	–
Actuation		Step motor	Coil
Digital		CMove or IMove 1250	CMove 1250
Analog	V DC	0 to 10	–
Type of protection	IP	40	51
Closing time / opening time	s	3 / 4	–
Response time	ms	–	< 30
Ambient temperature	°C	+5 to +40	+5 to +50
Bake out temperature			
Valve body	°C	80	+5 to +50 (during operation)
Actuator	°C	60	80 (without power supply)
Material			
Valve body		Stainless steel 1.4435	Stainless steel 1.4301
Valve needle, valve disc		Stainless steel 1.4301	–
Filter		Stainless steel 1.4404	–
Seals		FPM (FKM)	FPM (FKM)
Dosing sleeve		Fluorplastomer	–
Armature disc		–	Stainless steel 1.4510
Guide tube		–	Stainless steel 1.4105
Weight	kg (lbs)	0.5 (1.1)	0.08 (0.18)

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

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

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

Ordering Information

Control Valve

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

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

Controller CMove 1250



Controller CMove 1250

Technical Applications

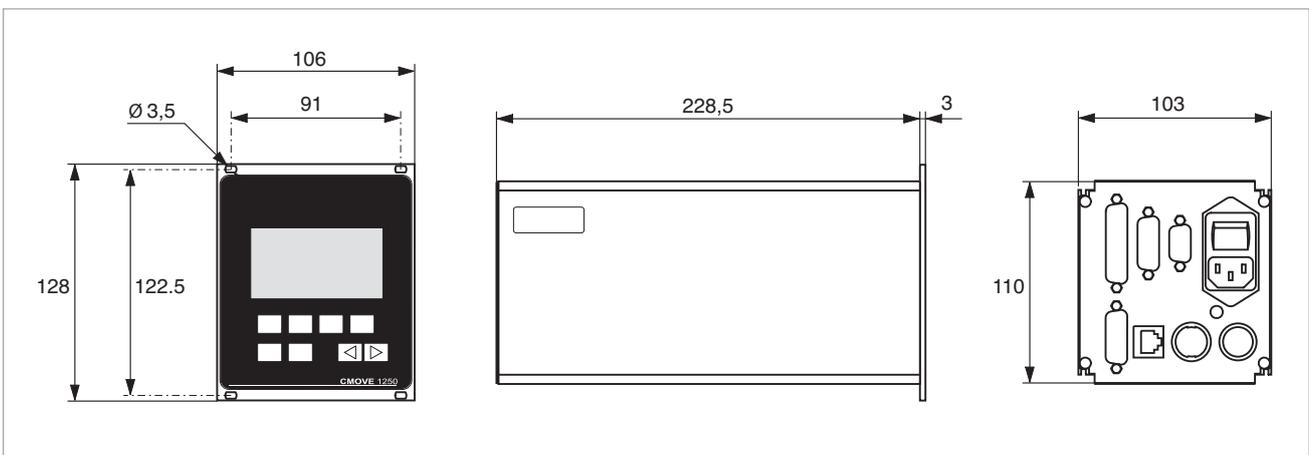
- Simple to operate
- Self-explanatory LCD display and function keys
- Analog/digital inputs/outputs and interfaces
- Digital input valve control, switch-over
- Pressure and gas flow adjustment
- Digital output valve control, error message
- Adjustable PID control algorithms
- 99 pre-programmed PI control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

Typical Applications

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

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

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



Dimensional drawing for the CMove 1250

Technical Data

Controller CMove 1250

Power supply		
Mains voltage, 50/60 Hz	V AC	90 - 250
Power consumption	VA	50
Control types		Auto = (PI) adjustable in 1 to 99 selectable steps PID = PID is user adjustable 5% F.S. sensor
Control inaccuracy		
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
Display range		
Pressure control		
CERAVAC		
THERMOVAC		
PENNINGVAC		
IONIVAC		
with 0 bis 10 V linear	mV	0 to 10.000
Flow control		
with MOVE 1250		CLOSED, 5.0×10^{-6} to $1.25 \times 10^{+3}$ mbar x l/s
with MOVE X		CLOSED, 1.0×10^{-5} to $1.0 \times 10^{+2}$ mbar x l/s
with analog output AA 2	mV	0 to 10 000
Measurement uncertainty	%	0.2 FS Sensor
Operating mode		Gas flow regulation (upstream regulation) Pressure regulation (downstream regulation)
Operation		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)

Ordering Information

Controller CMove 1250

Controller CMove 1250	Part No. 230 200
Control valve	
Move 1250	Part No. 230 219
Move X with gas flow	
10 sccm	Part No. 230 202
50 sccm	Part No. 230 203
100 sccm	Part No. 230 204
500 sccm	Part No. 230 205
1000 sccm	Part No. 230 206
5000 sccm	Part No. 230 207
Connection cable	
CMove 1250 - Control valve Move 1250	
3 m	Part No. 230 220
5 m	Part No. 230 221
10 m	Part No. 230 222
15 m	Part No. 230 223
20 m	Part No. 230 224
25 m	Part No. 230 225
CMove 1250 - Control valve Move X	
3 m	Part No. 230 210
5 m	Part No. 230 211
10 m	Part No. 230 212
15 m	Part No. 230 213
20 m	Part No. 230 214
25 m	Part No. 230 215
Sensor cable	
TTR 90, TTR 100, TTR 211, TTR 216	
PTR 225, PTR 237	
5 m	Part No. 124 26
15 m	Part No. 124 27
20 m	Part No. 124 28
30 m	Part No. 124 29
40 m	Part No. 124 30
50 m	Part No. 124 31
75 m	Part No. 124 32
100 m	Part No. 124 33
ITR 90, ITR 100, ITR 200	
5 m	Part No. 124 55
15 m	Part No. 124 56
20 m	Part No. 124 57
30 m	Part No. 124 58
CTR 90, CTR 91, CTR 100	
5 m	Part No. 230 013
10 m	Part No. 230 014
15 m	Part No. 230 015
20 m	Part No. 230 016
30 m	Part No. 230 017
40 m	Part No. 230 018
50 m	Part No. 230 019
75 m	Part No. 230 020
100 m	Part No. 230 021

Interface Module IMove 1250 for Move 1250



Advantages to the User

- Status query and valve position

Typical Applications

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

Technical Data

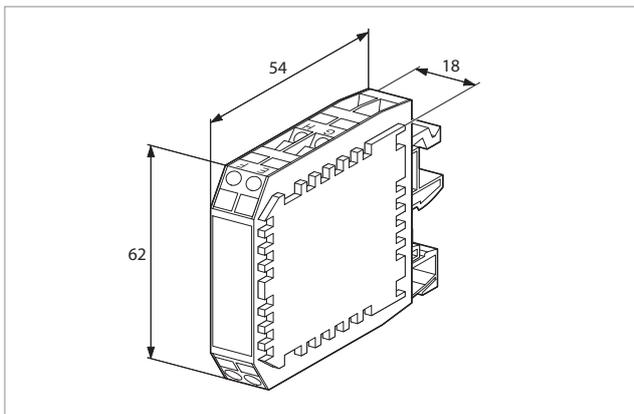
Interface Module IMove 1250

Temperature		
Operation	°C	+5 to +50
Storage	°C	-10 to +65
Protection class	IP	30
Operating 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 (lbs)	40 (0.09)

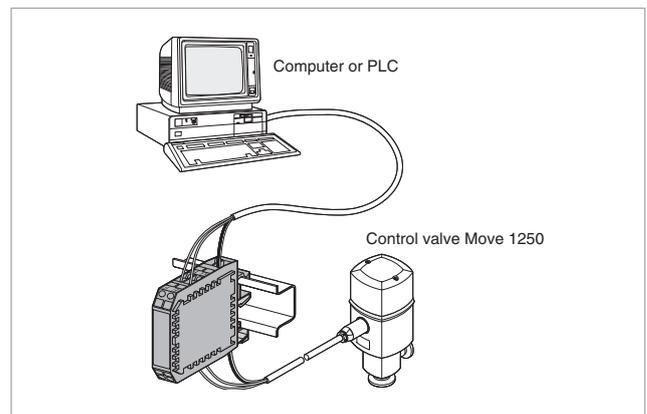
Ordering Information

Interface Module IMove 1250

Interface module IMove 1250	Part No. 230 201
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Dimensional drawing for the IMove 1250



Connection of the IMove 1250

Low Pressure Safety Switch PS 113 A



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

Advantages to the User

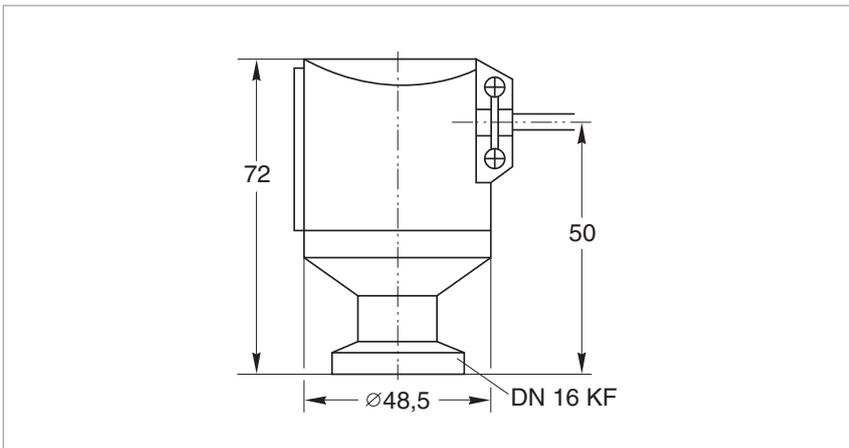
- Rugged design
- High switching capacity
- Corrosion protected
- Easy to use
- IP 44 protection
- Can be connected to a programmable control

Typical Applications

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

Technical Note

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



Dimensional drawing for the low pressure safety switch PS 113 A

Technical Data**Low Pressure Safety Switch**

Switching pressure	mbar (Torr)	Approx. 6 (4.5) below atmospheric pressure
Return switching pressure	mbar (Torr)	3 (2.3) below atmospheric pressure
Switching inaccuracy	mbar (Torr)	2 (1.5)
Max. permissible operating pressure (abs.)	mbar (Torr)	2000 (1500)
Storage temperature range	°C	-25 to +85
Nominal temperature range	°C	0 to +85
Switching contact		Changeover contacts, gold-plated, for prog. controls
Contact life		> 10 ⁵ switching cycles
Switching capacity		100 mA / 24 V AC 30 mA / 24 V DC
Electrical connection		6.3 mm flat plug
Vacuum connection	DN	16 KF
Helium permeation	mbar x l/s	≤ 1 x 10 ⁻⁴
Internal 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 (lbs)	315 (0.70)
Protection class	IP	44

Ordering Information**Low Pressure Safety Switch**

Low pressure safety switch PS 113 A, DN 16 KF; complete with 3 m long cable	Part No. 230 011
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Pressure Switch PS 115

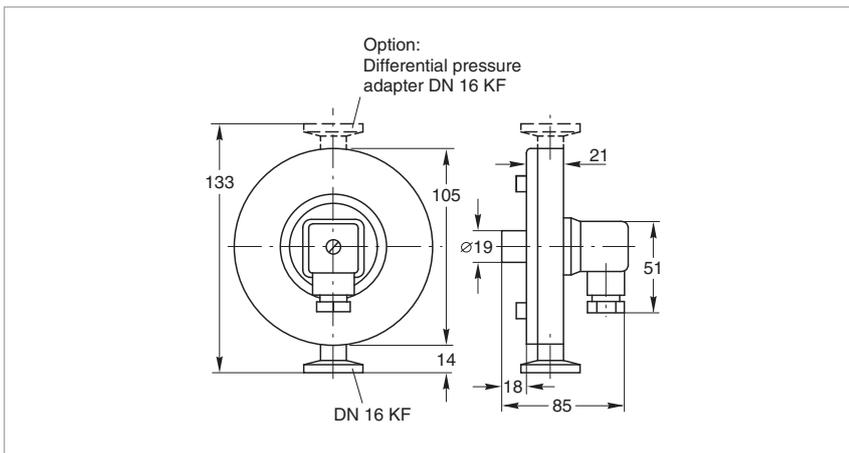


Rugged absolute pressure switch with electrical switching contact and an adjustable switching pressure between 0.5 and 2000 mbar (0.4 and 1500 Torr).

Through the differential pressure adapter (optional) the PS 115 pressure switch may be converted to operate as a differential pressure switch. The adapter consists of a DN 16 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 overloading to 3000 mbar (2250 Torr) is permissible without impairing switching accuracy. In this operating range differential values of +5 to -20 mbar (+3.75 to -15 Torr) can be adjusted via the set screw.

Advantages to the User

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



Dimensional drawing for the pressure switch PS 115

Technical Data

Pressure Switch

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		Normally closed, gold-plated, for prog. controls
Switching voltage	V	24
Switching current (max.)	mA	10
Contact resistance, max.	kΩ	1
Electrical connection		Plug (DIN 43 650)
Protection class	IP	65
Vacuum connection	DN	16 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	cm ³	4
Volume of the reference chamber	cm ³	20
Weight	kg (lbs)	1.3 (2.87)

Ordering Information

Pressure Switch

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

Switching Amplifier SV 110

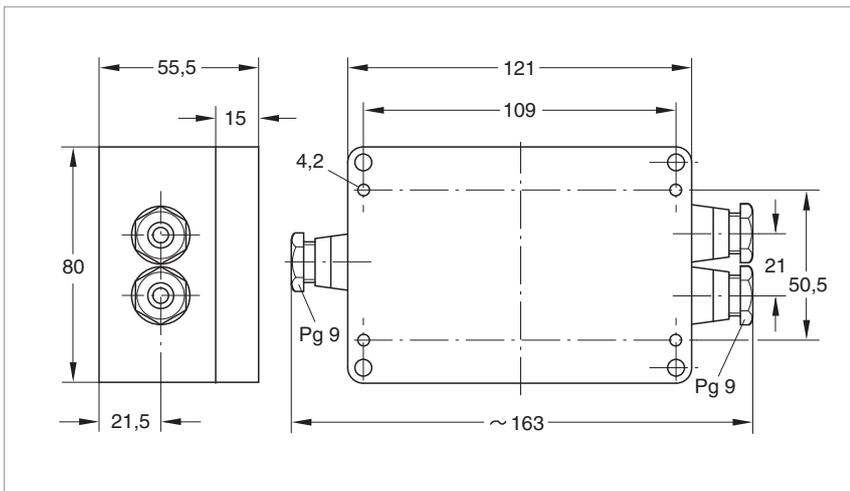
The diaphragm contact of the pressure switches is connected on one side to ground and is rated to 24 V / 10 mA max. When wanting to switch higher voltages or currents, a switching amplifier will be needed. The switching amplifier is equipped with powerful floating changeover contacts. The output relay

is energized as soon as the pressure drops below the switching threshold set up on the pressure switch.

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

Advantages to the User

- Increased ratings for the switch
- Changeover contact



Dimensional drawing for the switching amplifier SV 110

Technical Data**Switching Amplifier**

Mains supply, 50/60 Hz		110/130/220/240 V, selectable
Power consumption	VA	3
Output relay		
Switching voltage / current	V / A	250 / 5
Switching power, max.	VA	500
Response time	ms	30
Relaise 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**

Switching amplifier SV 110	Part No. 160 78
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Diaphragm Pressure Regulators MR 16/MR 50



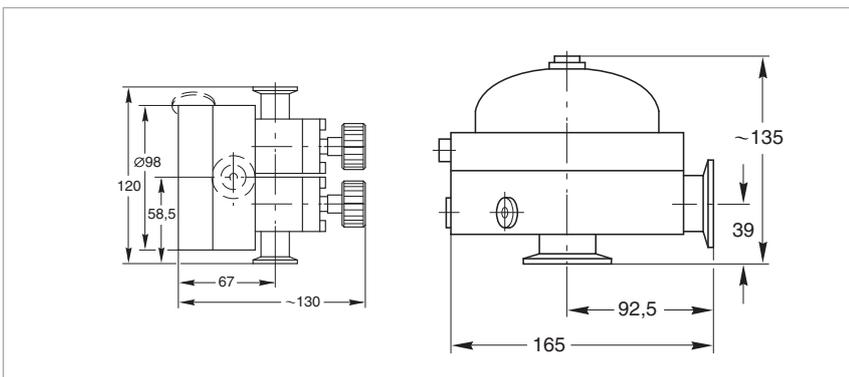
The MR 16/50 diaphragm regulators are absolute pressure regulators which automatically adapt the pumping speed of a vacuum pump depending on the amount of gas, without the need for an external power supply.

Advantages to the User

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

Typical Applications

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



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

Technical Data

Diaphragm Pressure Regulator

MR 16

MR 50

		MR 16	MR 50
Control range	mbar (Torr)	10 to 1000 (7.5 to 750)	10 to 1000 (7.5 to 750)
Control inaccuracy		± 2% of the pressure control (10 - 90% of flow)	± 2% of the pressure control (10 - 90% of flow)
Throughput	m ³ /h	16	50
Nominal temperature range	°C	+5 to +100	+5 to +100
Storage temperature range	°C	-25 to +60	-25 to +60
Temperature coefficient	%/K	0.3	0.3
Settling 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 KF	40 KF
Measurement connection	3x thread R	1/8"	1/8"
Weight, approx.	kg (lbs)	2.7 (6.0)	8.0 (17.6)

Ordering Information

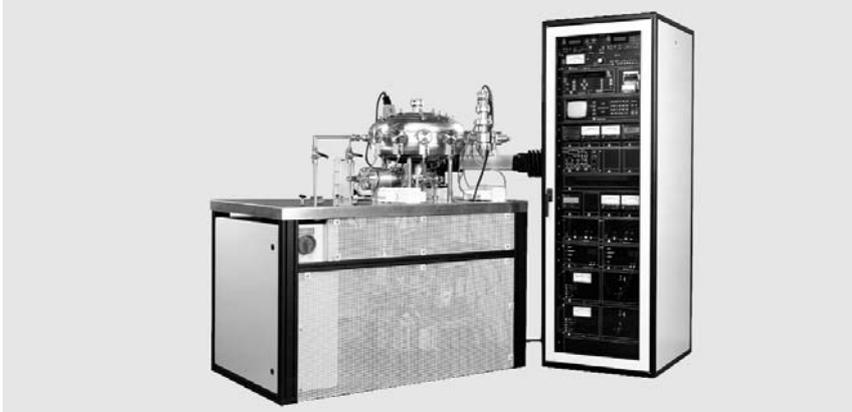
Diaphragm Pressure Regulator

MR 16

MR 50

	MR 16	MR 50
Diaphragm pressure regulator MR 16, DN 16 KF MR 50, DN 40 KF	Part No. 160 25 -	- Part No. 160 27
Options Stainless steel measurement flange, DN 16 KF, for connection to a reference and/or process chamber or pumping stud KALREZ diaphragm	Part No. 160 26 -	Part No. 160 26 Part No. 200 28 597
Spare Parts EPDM diaphragm and seal kit	Part No. EK 160 29	-
Viton diaphragm and seal kit	Part No. EK 160 31	-
Seal kit MR 50, incl. EPDM and Viton diaphragms	-	Part No. EK 160 32
Adjustment screw for the adjustable valve, complete with seal	-	Part No. 240 001

Oerlikon Leybold Vacuum Calibration Service



Calibration of vacuum gauges in the pressure range from 10^{-9} to 1000 mbar (10^{-9} to 750 Torr) as DKD 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 Oerlikon Leybold Vacuum has been offering to all customers an impartial calibration service for gauges and sensors of any make. A DKD 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

DKD / Factory Calibration

It is the task of the German Calibration Service (DKD) to ensure traceability of industrial measurements and testing to national standards.

The German Calibration Service 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 DKD calibration facility used by Oerlikon Leybold Vacuum are checked regularly (recalibrated) by the PTB.

Within the framework of the German Calibration Service, the calibration system at Oerlikon Leybold Vacuum 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 DKD calibration service are used. Thus traceability to national standards is ensured in both cases.

Technical Data**DKD Calibration**

Calibration range	mbar	to 10 ⁻³	to 10 ⁻⁵	to 10 ⁻⁹
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Ordering Information**DKD Calibration**

DKD calibration	Part No. 157 12	Part No. 157 13	Part No. 157 14
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Technical Data**Factory Calibration**

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

Factory calibration	Part No. 154 22	Part No. 154 23	Part No. 154 24
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Calibration Systems are described in the Product Section C10.

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