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260.00.02
Excerpt from the Oerlikon Leybold Vacuum Full Line Catalog 2015/2016
Catalog Part Vacuum - measuring, controlling

# Vacuum - measuring, controlling

## Vacuum Gauges
## Calibration Service
## VACVISION

## Notes

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## Vacuum - measuring, controlling


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# Applications for Vacuum Gauges

| Gauges | BOURDONVAC A | BOURDONVAC C | Capsule vacuum gauge | DIAVAC DV 1000 | DIAVAC E | Handheld Measuring Instruments | CERAVAC transmitter CTR | CERAVAC transmitter CTR | CERAVAC transmitter CTR | CERAVAC transmitter CTR | CERAVAC transmitter CTR | IONIVAC transmitter ITR | IONIVAC IM 540 | Pressure switch PS 113 A | Pressure switch PS 115 | Diaphragm regulator MR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mechanical engineering** | | | | | | | | | | | | | | | | |
| Automotive industry; filling of brake and air conditioning systems | | | | | | ■ | | ■ | ■ | ■ | | | | | | |
| Vacuum conveying technology | ■ | ■ | ■ | ■ | ■ | | | ■ | | | | | | | | ■ |
| Packaging technology | | | ■ | ■ | ■ | | | ■ | | | | | | | ■ | |
| Isolation vacuum | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | | | | | | ■ | |
| **Isolation vacuum** | | | | | | | | | | | | | | | | |
| Absolute pressure measurements in gas mixtures | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | | | | | | | |
| Drying and degassing processes | | ■ | | ■ | ■ | | | ■ | | | | | | | | ■ |
| Solvent recovery | | | | ■ | ■ | | | | ■ | | | | | | | ■ |
| Vacuum pressure control in existing central vacuum supply systems | | | | | | | | | ■ | | | | | | | ■ |
| **Electrics/electronics/optics** | | | | | | | | | | | | | | | | |
| Evaporation and coating systems | | | | | | | ■ | | ■ | ■ | ■ | | | | | |
| Monitoring and controlling of sputter systems | | | | | | | | | ■ | ■ | ■ | | | | | |
| Semiconductor technology (CVD, plasma etching etc.) | | | | | | | ■ | | ■ | | | ■ | | | | |
| Ion implantation | | | | | | | ■ | | ■ | ■ | | | | | | |
| Lamp production | | | ■ | | | ■ | ■ | ■ | ■ | | | | | | | |
| **Analytical instruments and surface physics** | | | | | | | | | | | | | | | | |
| ESCA, SIMS, AES, XPS | | | | | | | | | ■ | ■ | ■ | ■ | | | | |
| Electron microscopy | | | | | | | | | ■ | ■ | ■ | ■ | | | | |
| Crystal growing | | | | | | | | | | ■ | ■ | ■ | | | | |
| Gas analysis systems, mass spectrometers | | | | | | | | | ■ | ■ | ■ | ■ | | | | |
| **Research** | | | | | | | | | | | | | | | | |
| Measurement of ultimate pressure in UHV systems | | | | | | | | | | | | ■ | | | | |
| Application in MBE systems | | | | | | | | | | ■ | ■ | ■ | | | | |
| Application in MBE systems | | | | | | | | | | | | ■ | | | | |
| Beam guidance systems, cyclotron | | | | | | | | | | ■ | | ■ | | | | |
| Fusion experiments | | | | | | | | | | | | ■ | | | | |
| Space simulation chamber | | | | | | | | | ■ | ■ | ■ | ■ | | | | |
| **System control/pressure control** | | | | | | | | | | | | | | | | |
| Pressure checks on backing pumps and vacuum systems | | | | | | | | | ■ | | | | | ■ | | |
| Safety circuits in vacuum systems, protection of vacuum gate valves | | | | | | | | | ■ | | ■ | | ■ | ■ | | |
| Control of ionization vacuum gauges | | | | | | | | | ■ | | | | | | | |
| Pressure measurements on HV pump systems, e.g. diffusion, TMP, cryopump systems | | | | | | | | | ■ | ■ | ■ | ■ | | | | |
| Venting systems | | | | | | | | | | | | | ■ | ■ | | |
| Valve control, pressure dependant systems control | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| Simple pressure control arrangements | | | | | | ■ | | ■ | | ■ | | | | ■ | ■ | |
| **Calibration** | | | | | | | | | | | | | | | | |
| Calibration of vacuum gauges and mass spectrometers | | | | | | ■ | | | | | | ■ | | | | |
| Reference instruments for the determination of the physical properties of gases | | | | | | ■ | | | | | | | | | | |
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| **Miscellaneous** | | | | | | | | | | | | | | | | |
| Vacuum annealing, melting, soldering and hardening furnaces | | | | | | ■ | | | ■ | ■ | ■ | | | | | |
| Cooling and air conditioning technology | | | | | | ■ | ■ | ■ | ■ | | | | | | | |
| Electron beam welding | | | | | | ■ | | | ■ | ■ | ■ | | | | | |
| Metallurgy | | | | | | | | | ■ | ■ | ■ | | | | | |

# Select the Combination of Sensor and

## Operating Ranges for Active Sensors

| mbar | $10^{-12}$ | $10^{-11}$ | $10^{-10}$ | $10^{-9}$ | $10^{-8}$ | $10^{-7}$ | $10^{-6}$ | $10^{-5}$ | $10^{-4}$ | $10^{-3}$ | $10^{-2}$ | $10^{-1}$ | $10^{0}$ | $10^{1}$ | $10^{2}$ | $10^{3}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capacitance Diaphragm** | | | | | | | | | | | | | | | | |
| CERAVAC Transmitters (x = 2, 3, 4 or 5) [1] | | | | | | | | | | | | | | | | |
| CTR 100 | | | | | | | | | | | | 0.13 | | | | 1330→ |
| CTR 100 | | | | | | | | | | | 0.013 | | | | 133 | |
| CTR 100 | | | | | | | | | | 0.0013 | | | | 13 | | |
| CTR 100 | | | | | | | | | 0.00013 | | | | 1.3 | | | |
| CTR 100 | | | | | | | | 0.000013 | | | | 0.13 | | | | |
| CTR 101 | | | | | | | | | | | | 0.13 | | | | 1330→ |
| CTR 101 | | | | | | | | | | | 0.013 | | | | 133 | |
| CTR 101 | | | | | | | | | | 0.0013 | | | | 13 | | |
| CTR 101 | | | | | | | | | 0.00013 | | | | 1.3 | | | |
| CTR 101 | | | | | | | | 0.000013 | | | | 0.13 | | | | |
| **Thermal Conductivity (according to Pirani)** | | | | | | | | | | | | | | | | |
| THERMOVAC Transmitters [1] | | | | | | | | | | | | | | | | |
| TTR 101 (Pirani combined with capacitance diaphragm) | | | | | | | | | | 0.0005 | | | | | | 1500→ |
| TTR 91 | | | | | | | | | | 0.0005 | | | | | | 1000 |
| TTR 96 S | | | | | | | | | | 0.0005 | | | | | | 1000 |
| TTR 911 | | | | | | | | | | 0.0005 | | | | | | 1000 |
| TTR 911 CC | | | | | | | | | | 0.0005 | | | | | | 1000 |
| TTR 916 | | | | | | | | | | 0.0005 | | | | | | 1000 |
| **Cold Cathode Ionization (according to Penning)** | | | | | | | | | | | | | | | | |
| PENNINGVAC Transmitters | | | | | | | | | | | | | | | | |
| PTR 225, DN 25 ISO-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 ISO-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 | | | 5 x $10^{-10}$ | | | | | | | | | | | | | 1000 |
| ITR 200 with and without display | | | 5 x $10^{-10}$ | | | | | | | | | | | | | 1000 |
| **Linear Pressure Sensors** [1] | | | | | | | | | | | | | | | | |
| DI/DU 200 and 201 | | | | | | | | | | | | 0.1 | | | 200 | |
| DI/DU 2000 and 2001 | | | | | | | | | | | | | 1 | | | 2000→ |
| DI/DU 2001 rel. | | | | | | | | | | | | | -1000 | | | +1000→ |
| DIAVAC E | | | | | | | | | | | | | 1 | | | +1000→ |
| **Handheld Measurement Instruments** | | | | | | | | | | | | | | | | |
| THERMOVAC Sensors | | | | | | | | | | | | | | | | |
| TM 90 | | | | | | | | | | | 1 x $10^{-2}$ | | | | | 1200→ |
| TM 101 | | | | | | | | | 5 x $10^{-4}$ | | | | | | | 1200→ |
| mbar | $10^{-12}$ | $10^{-11}$ | $10^{-10}$ | $10^{-9}$ | $10^{-8}$ | $10^{-7}$ | $10^{-6}$ | $10^{-5}$ | $10^{-4}$ | $10^{-3}$ | $10^{-2}$ | $10^{-1}$ | $10^{0}$ | $10^{1}$ | $10^{2}$ | $10^{3}$ |

[1] Different Part Numbers depend on the vacuum connection

# Gauges which is ideal for your Application

## Operating Units for Active Sensors

| | DISPLAY | | | CENTER | | | IONIVAC | VACVISION |
|---|---|---|---|---|---|---|---|---|
| | ONE | TWO | THREE | ONE | TWO | THREE | IM 540 | |
| **Part No. EURO**<br>**Part No. US** | 230 001<br>230 001 | 230 024<br>230 024 | 230 025<br>230 025 | 230 002<br>235 002 | 230 004<br>235 004 | 230 003<br>235 003 | 230 100<br>230 100 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | | | | | | | | |
| | | | | | | | | |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | 3, 4 | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | 3, 4 | |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | 3, 4 | |
| | | | | | | | | |
| | | | | | | | | |
| | | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | |
| | | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | [1] |
| | 1 | 1, 2 | 1, 2, 3 | 1 | 1, 2 | 1, 2, 3 | | [1] |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | [1] |
| | | | | | | | | [1] |
| | | | | | | | | |
| | 1 (Only DU) | 1, 2 (Only DU) | 1, 2, 3 (Only DU) | | | | | (Only DU [1]) |
| | 1 (Only DU) | 1, 2 (Only DU) | 1, 2, 3 (Only DU) | | | | | (Only DU [1]) |
| | 1 (Only DU) | 1, 2 (Only DU) | 1, 2, 3 (Only DU) | | | | | (Only DU [1]) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

[1] Possible

# Select the Combination of Sensor and

## Operating Ranges for passive Sensors

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

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

# Gauges which is ideal for your Application

## Operating Units for passive Sensors

| | IONIVAC | COMBIVAC | | | | | |
|---|---|---|---|---|---|---|---|
| | IM 540 | CM 51 | CM 52 | | | | |
| **Part No. EURO**<br>**Part No. US** | 230 100<br>230 100 | –<br>– | –<br>– | | | | |
| **Part No. RS 232**<br>**Part No. Profibus** | –<br>– | 230 110<br>230 111 | 230 115<br>230 116 | | | | |
| | | | | | | | |
| | | | | | | | |
| | | 1, 2 | 1, 2 | | | | |
| | | 1, 2 | 1, 2 | | | | |
| | | 1, 2 | 1, 2 | | | | |
| | | 1, 2 | 1, 2 | | | | |
| | | | | | | | |
| | | | | | | | |
| | | 3 | | | | | |
| | | 3 | | | | | |
| | | 3 | | | | | |
| | | 3 | | | | | |
| | | | | | | | |
| | 1, 2 | 3 | 3 | | | | |
| | 1, 2 | 3 | 3 | | | | |
| | | | | | | | |

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

# Basic Terms of Vacuum Metrology

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

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

### BOURDON Vacuum Gauge

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

### Capsule Vacuum Gauge

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

### Diaphragm Vacuum Gauge

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

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

### Capacitance Vacuum Gauge

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

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

### Thermal Conductivity Gauge (Pirani)

This measurement principle utilizes the thermal conductivity of gases for the purpose of pressure measurements in the range from $10^{-4}$ mbar/Torr to atmospheric pressure. Today, only the principle of the controlled Pirani gauge is used by 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 $1 \times 10^{-9}$ mbar/Torr.

### Cold Cathode Ionization Vacuum Gauge (Penning)

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

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

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

### Selection of the right Vacuum Gauge

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

# Connection Accessories for Small Flanges

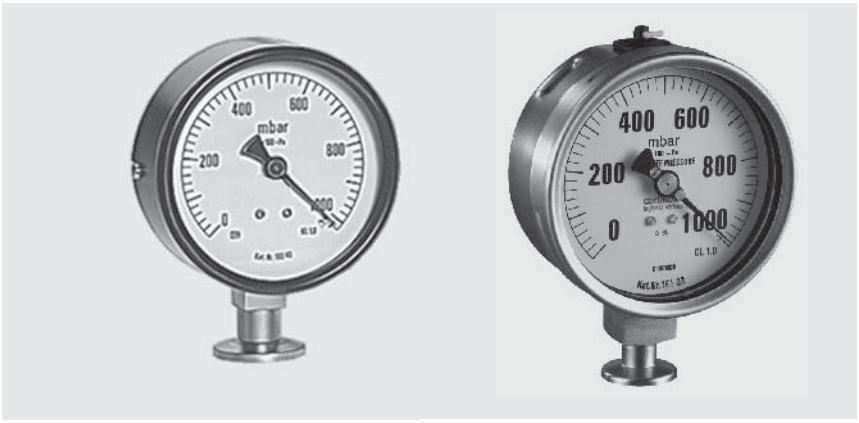
| Ordering Information | DN 10 ISO-KF | DN 16 ISO-KF | DN 25 ISO-KF |
|---|---|---|---|
| | Part No. | Part No. | Part No. |
| Outer centering ring with O-ring | | | |
| Aluminum / FPM (FKM) ((Viton)) | 183 53 | 183 53 | 183 54 |
| Fine filter on centering ring with O-ring | | | |
| Stainless steel / FPM (FKM) ((Viton)) | 883 95 | 883 96 | 883 97 |
| Baffle with centering ring (FPM) ((FKM)) | – | – | 230 078 |
| Connection accessories for metal seals or bake out room up to 150 °C | | | |
| Ultra sealing ring, aluminum (Set of 3) | 883 73 | 883 73 | 883 75 |
| Outer support ring | 883 74 | 883 74 | 883 76 |
| Clamping ring | 882 75 | 882 75 | 882 77 |

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

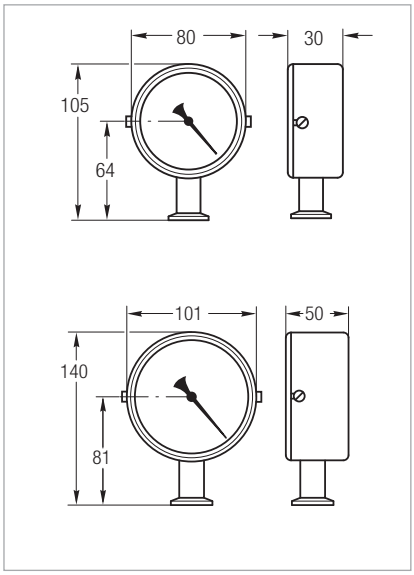
# Products

## Mechanical Gauges

## Bourdon Vacuum Gauges




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




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

### Advantages to the User

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

### Typical Applications

- Vacuum distillation
- Drying processes
- Vacuum conveying systems

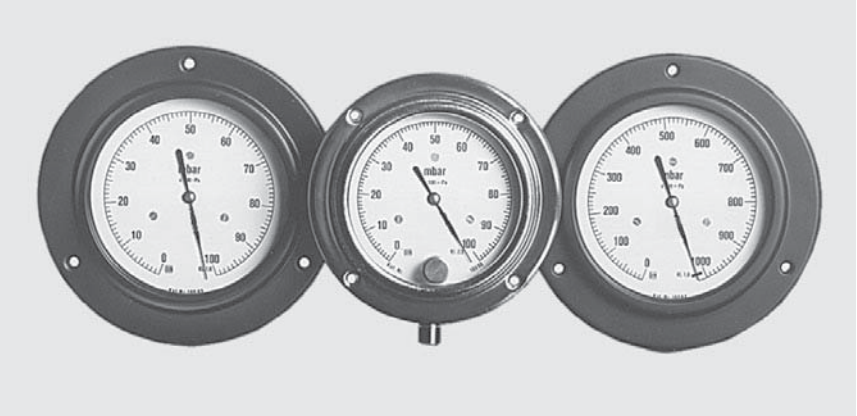
### Technical Data

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

### Ordering Information

| | BOURDONVAC A | BOURDONVAC C |
|---|---|---|
| | Part No. | Part No. |
| Bourdon vacuum gauge | **160 40** | **161 20** |

# Capsule Vacuum Gauges



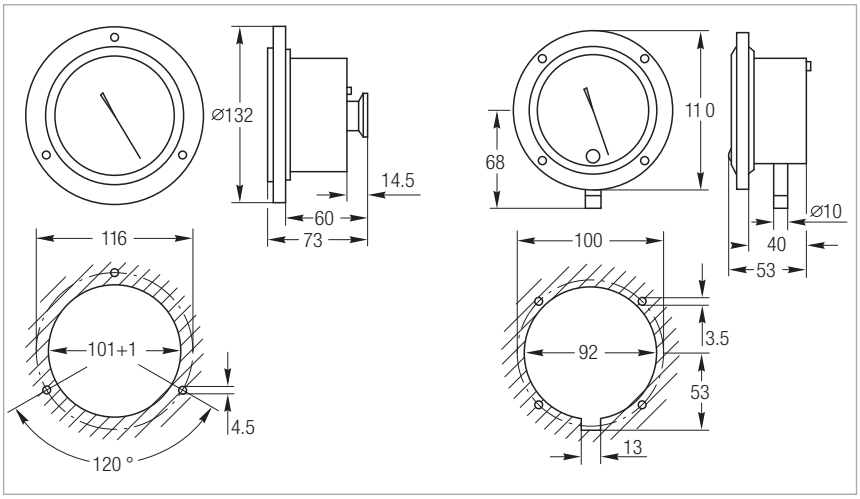
Rugged absolute pressure gauges for the pressure range from 1 to 1000 mbar (0.75 to 750 Torr).

## Advantages to the User

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

## Typical Applications

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




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

## Technical Data

### Capsule Vacuum Gauge

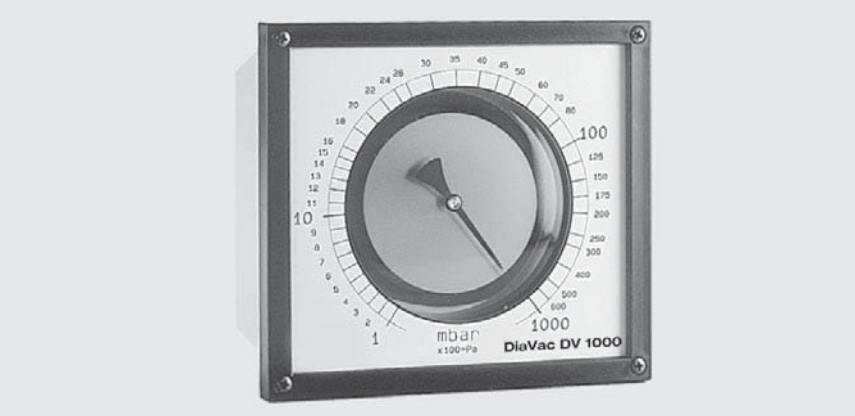
| | | | | |
|---|---|---|---|---|
| **Measurement range** | **mbar (Torr)** | 1 to 100 (0.75 to 75) | 1 to 100 (0.75 to 75) | 1 to 1000 (0.75 to 750) |
| **Measurement uncertainty** | **% FS** | 1.0 | 2.5 | 1.6 |
| **Overload range (abs. briefly)** | **bar** | 1.5 | 1.5 | 1.5 |
| **Storage temperature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

## Ordering Information

### Capsule Vacuum Gauge

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

# Diaphragm Vacuum Gauge DIAVAC DV 1000



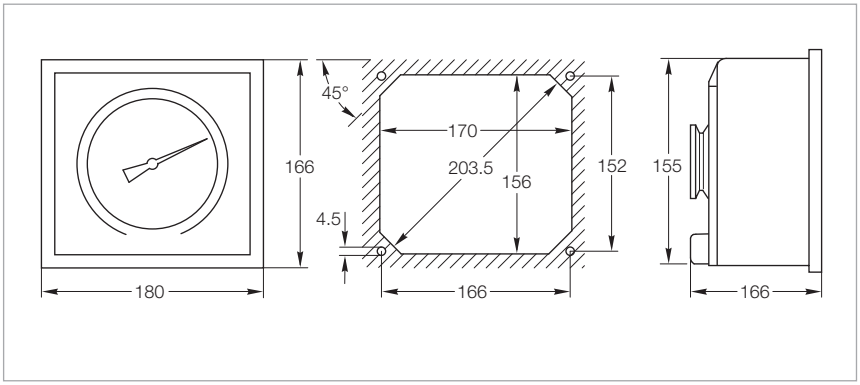

Rugged mechanical diaphragm vacuum gauge of high accuracy for the rough vacuum range from 1 to 1000 mbar (1 to 750 Torr).

## Advantages to the User

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

## Typical Applications

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




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

## Technical Data

## DIAVAC DV 1000

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

## Ordering Information

## DIAVAC DV 1000

| | Part No. |
|---|---|
| DIAVAC DV 1000<br>mbar readout<br>Torr readout | <br>**160 67** [1]<br>**896 06** [1] |
| DAkkS calibration | **157 12** |
| Replacement sinter filter<br>with centering ring, DN 40 ISO-KF | **231 93 515** |
| Replacement housing, complete | **240 000** |

[1] Complete with centering ring and sintered filter

# Diaphragm Vacuum Gauge DIAVAC E




The DIAVAC E is a fully electronic, versatile vacuum gauge for the measuring range from atmospheric pressure to 1 mbar/Torr.
The DIAVAC E has an integrated vacuum sensor made of aluminia ceramic with outstanding corrosion resistance and superior long-term stability. A particular advantage is its cordless, battery-powered operation. Its simple operation and the combined digital/ analog vacuum reading for precise readout and quick trend detection, respectively, make the DIAVAC E very versatile.

## Advantages to the User

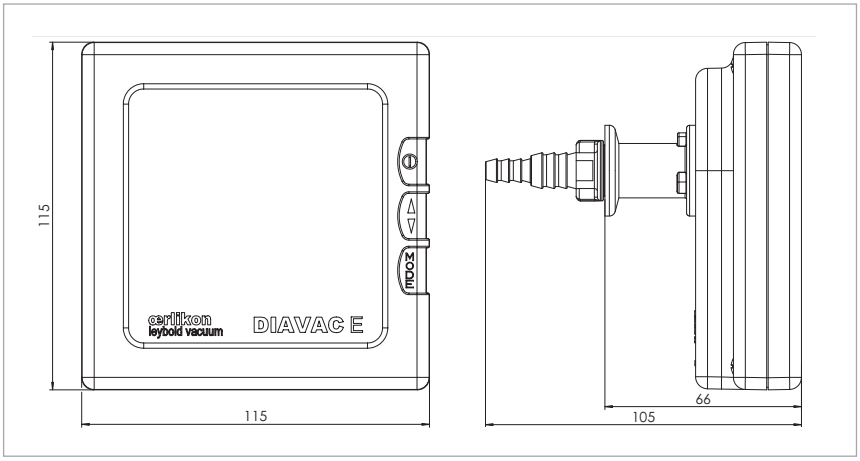
- High electromagnetic compatibility: Low emission level near detection limit, high degree of immunity to electromagnetic interference for use in industrial environments
- Large analog and digital vacuum display:
  Quick trend detection, precise readout
- User-selectable pressure units (mbar, hPa, Torr)
- Digital readjustment
- Capacitive aluminia ceramic diaphragm vacuum sensor with excellent chemical resistance, accuracy and long term stability

## Typical Applications

- Chemical process engineering
- Commissioning of vacuum systems
- Inspection and maintenance of vacuum pumps and systems

## Supplied Equipment

Vacuum gauge complete with integrated vacuum sensor and battery, ready for use, with manual.




Dimensional drawing for the DIAVAC E

## Technical Data

## DIAVAC E

| | | |
|---|---|---|
| Measurement range | mbar (Torr) | 1 (1) to 1080 (810) |
| Measurement uncertainty | | < ±1 mbar/hPa/Torr / ±1 digit (after alignment, constant temperature) |
| Temperature dependence | | < 0.07 mbar/hPa / 0.05 Torr/K |
| Measurement cycle | | Selectable: automatically or<br>1x per 3s, 1x pe 1s, 3x per 1s |
| Automatic switch off | | Selectable: 1-1000 min (factory default 15 min) or continuous operation |
| Storage temperature range | °C | -10 to +60 |
| Nominal temperature range | °C | +10 to +40 |
| Maximum media temperature | | |
| continuous operation | °C | +40 |
| short operation | °C | +80 |
| Power supply | | 9 V lithium battery, 1.2 Ah Ultra-life U9VL |
| Battery life | | |
| typical | h | 8.000 |
| standby | h | 40.000 |
| Protection class | | IP 40 |
| Dimension (W x H x D) | mm | 115 x 115 x 66 |
| Weight | kg (lbs) | 9 V lithium battery, 1.2 Ah Ultra-life U9VL5 |

## Ordering Information

## DIAVAC E

| | Part No. |
|---|---|
| DIAVAC E<br>Ready for operation with pressure sensor and battery,<br>including Operating Instructions | **245008V01** |
| Rubber vacuum tubing for DN 10 mm<br>1000 mm, caoutchouc | **172 02** |
| Rubber vacuum tubing for DN 16 ISO-KF<br>1000 mm | **172 03** |
| DAkkS calibration | **157 12** |
| Factory calibration | **157 22** |

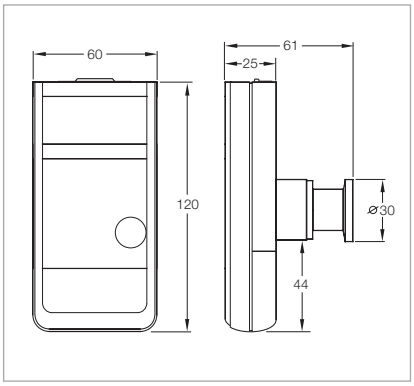
# Handheld Measuring Instruments

# Digital THERMOVAC Sensor TM 101




The digital compact THERMOVAC TM 101 combines high-quality sensor technology with modern process technology in a handy design.
The THERMOVAC TM 101 can operate optionally as a datalogger saving the pressure data during the measurement. Of course a subsequent simple transfer to a PC is possible via a USB.

The fully electronic THERMOVAC TM 101 is capable of measuring pressures within the pressure range of 1200 to 5 x $10^{-4}$ mbar (900 to 3.75 x $10^{-4}$ Torr) (7 decades).
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 101 are independent of the type of gas above pressures of 15 mbar (11.25 Torr). Especially noteworthy is the exceptionally long battery life.




Dimensional drawings for the THERMOVAC TM 101




Windows Software VacuGraph

## Advantages to the User

- Utilization is directly possible in a vacuum
- Measurement range 1200 to 5 x $10^{-4}$ mbar (7 decades)
- Adjustable gas type correction factor
- Pressure measurements above 15 mbar (11.25 Torr) 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

  Data logging function with USB interface and internal memory for up to 2000 measured values
- Minimum and maximum memory function
- Online measurements via USB are possible
- Measurement data can be exported by way of ASCII text to Microsoft Excel, for example
- Protection class IP 40

## Typical Applications

- Mobile pressure measurements of all kinds
- Checking and setting up of vacuum systems
- Ensuring operation and quality of vacuum pumps
- Maintenance and service
- Graphic representation of pump-down curves
- Coating systems
- Pressure measurements
  - on evaporators and vacuum melting furnaces
  - in chemical process engineering
  - on refrigerating and air-conditioning systems before filling in the refrigerant
  - during the production of gas filled pressurised lamps, respectively refilling
- Leak tests

## Technical Data

## THERMOVAC Sensor

## TM 101

| | | |
|---|---|---|
| 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 x $10^{-4}$ (900 to 3.75 x $10^{-4}$) |
| Maximum overload | bar abs. | 2 |
| Accuracy | | |
| 1200 to 10 mbar (900 to 75 Torr) | % | ±0.3 of full-scale |
| 10 to 2 x $10^{-3}$ mbar (7.5 to 1.5 x $10^{-3}$ Torr) | approx. % | 10 of measured value |
| < 2 x $10^{-3}$ mbar (< 1.5 x $10^{-3}$ Torr) | approx. % | < factor 2 |
| Materials in contact with the vacuum | | Stainless steel, gold, tungsten, nickel, glass, Viton |
| Measurement cycle | s | 1.6 |
| Data storing rate | s | 1 to 999 |
| Operating temperature | | |
| TM 101 | °C | +5 to +50 |
| Battery | °C | -20 to +45 |
| Storage temperature | | |
| TM 101 | °C | -20 to +60 |
| Battery | °C | +10 to +25 |
| Supply voltage | | Rechargeable 9 V battery (recommendation: type Panasonic 6LR61PM, 9 V / 500 mAh) or 12 V AC adaptor (miniature jack, + terminal at the tip) |
| Power consumption | | |
| < 200 mbar (< 150 Torr) | mW | 60 |
| > 200 mbar (> 150 Torr) | mW | 0.5 |
| Operating duration | | |
| 6LR61 alkaline (vacuum operation) | h | up to 75 |
| Display | | LCD 12 mm |
| Connection (stainless steel) | DN | 16 ISO-KF |
| PC interface | | Mini USB-B connector |
| Dimensions (without flange) | mm | 60 x 120 x 61 |
| Protection class | IP | 40 |
| Weight (including battery) | kg (lbs) | 0.23 (0.51) |

## Ordering Information

## THERMOVAC Sensor

## TM 101

| | Part No. |
|---|---|
| TM 101, DN 16 ISO-KF<br>Including AlMn battery, 9 V block 6LR 61 | **230 081 V01** |
| Accessory kit<br>for VacuGraph Windows software<br>including<br>USB interface cable (2 m)<br>protection case with foam insert and<br>15 V wall power supply<br>for 100 - 260 V, 50/60 Hz mains<br>and AlMn battery, 9 V block 6LR 61 | **230 082 V01** |

# Active Sensors

# CERAVAC Transmitters CTR 100 and CTR 101




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

### Typical Applications

- 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

### 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 aluminum 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.

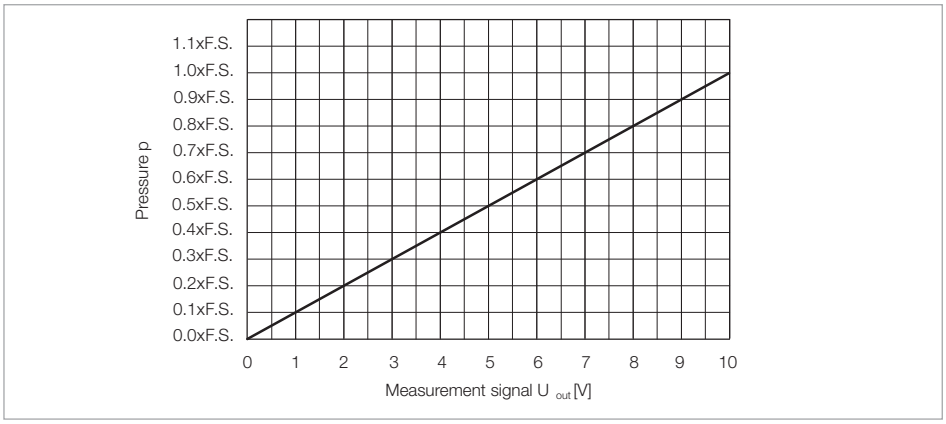
Whereas metal diaphragms suffer from residual tensions and unavoidable irregularities due to their production process, diaphragms made of aluminium oxide ceramics are exceptionally homogeneous, and owing to the firing process at 2500 °C entirely free of tensions. This considerably reduces part to part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

## Technical Data

## CERAVAC Transmitter

## CTR 100
## (Temperature Compensated)

| | | | |
|---|---|---|---|
| **Full scale (FS) / Measurement range** | | 0.1 Torr / 1 x $10^{-5}$ - 0.1 Torr<br>1 Torr / 1 x $10^{-4}$ - 1 Torr<br><br>Pressure Units:<br>1 Torr = 1.33 mbar = 133 Pascal | 10 Torr / 1 x $10^{-3}$ - 10 Torr<br>100 Torr / 0.01 - 100 Torr<br>1000 Torr / 0.1 - 1000 Torr<br>Pressure Units:<br>1 Torr = 1.33 mbar = 133 Pascal |
| **Materials in contact with the medium** | | Ceramic ($Al_2O_3$), stainless steel 316, Vacon 70 | Ceramic ($Al_2O_3$), stainless steel 316, Vacon 70 |
| **Max. overrange pressure** | | 2000 Torr for 1/10/100 Torr sensors,<br>3000 Torr for 1000 Torr sensors | 2000 Torr for 1/10/100 Torr sensors,<br>3000 Torr for 1000 Torr sensors |
| **Measurement uncertainty** | | 0.2% of reading ± temperature effect | 0.2% of reading ± temperature effect |
| **Resolution** | | 0.003% of Full scale<br>for 0.1/1 Torr sensors. | 0.003% of Full scale<br>for 10/100/1000 Torr sensors |
| **Temperature effects** | | | |
| **Zero coefficient** | **%/°C** | 0.015 of Full scale (1 Torr)<br>0.02 of Full scale (0.1 Torr) | 0.005 of Full scale |
| **Span coefficient** | **%/°C** | 0.01 of reading (1 Torr)<br>0.03 of reading (0.1 Torr) | 0.01 of reading |
| **Response time** | **ms** | ≤ 30 | ≤ 30 |
| **Nominal temperature range** | **°C** | +5 to +50 | +5 to +50 |
| **Supply voltage** | **V DC** | +14 to +30 | +14 to +30 |
| **Power consumption** | **W** | ≤ 1 | ≤ 1 |
| **Signal output** | **V** | 0 - 10; linear | 0 - 10; linear |
| **Interface** | | RS 232 C | RS 232 C |
| **Weight, approx.** | **kg (lbs)** | 0.33 (0.73) | 0.33 (0.73) |
| **Dead volume** | **$cm^3$** | 6 | 6 |
| **Connection cable** | | see chapter “Products”, para.<br>“Connection Cable for Active Sensors” | see chapter “Products”, para.<br>“Connection Cable for Active Sensors” |
| **Calibration** | | see chapter “Miscellaneous”, para.<br>“Oerlikon Leybold Vacuum Calibration Service” | see chapter “Miscellaneous”, para.<br>“Oerlikon Leybold Vacuum Calibration Service” |



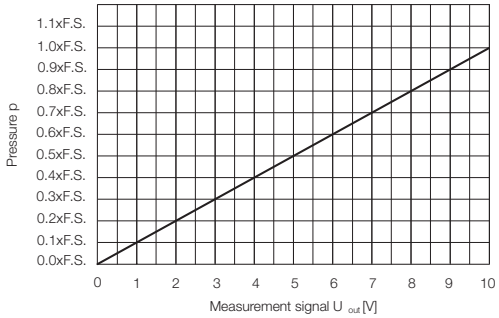

Characteristic of the CERAVAC Transmitter CTR 101

## Technical Data

## CERAVAC Transmitter

### CTR 101
### (45 °C heated)

| | | | |
|---|---|---|---|
| **Full scale (FS) / Measurement range** | | 0.1 Torr / 1 x $10^{-5}$ - 0.1 Torr<br><br>Pressure Units:<br>1 Torr = 1.33 mbar = 133 Pascal | 1 Torr / 1 x $10^{-4}$ - 1 Torr<br>10 Torr / 1 x $10^{-3}$ - 10 Torr<br>100 Torr / 0,01 - 100 Torr<br>1000 Torr / 0,1 - 1000 Torr<br>Pressure Units:<br>1 Torr = 1.33 mbar = 133 Pascal |
| **Materials in contact with the medium** | | Ceramic ($Al_2O_3$), stainless steel 316, Vacon 70 | Ceramic ($Al_2O_3$), stainless steel 316, Vacon 70 |
| **Max. overrange pressure** | | 1000 Torr for 0.1 Torr sensors | 2000 Torr for 1/10/100 Torr sensors,<br>3000 Torr for 1000 Torr sensors |
| **Measurement uncertainty** | | 0.2% of reading ± temperature effect | 0.15% of reading ± temperature effect |
| **Resolution** | | 0.0025% of Full scale<br>for 0.1 Torr sensors | 0.0025% of Full scale<br>for 1 Torr sensors<br>0.0015% of Full scale<br>for 10/100/1000 Torr sensors |
| **Temperature effects** | | | 1/10/100/1000 Torr-Sensor |
| **Zero coefficient** | **%/°C** | 0.005 of Full scale | 0.0025 of Full scale |
| **Span coefficient** | **%/°C** | 0.01 of reading | 0.01 of reading |
| **Rating** | **ms** | ≤ 30 | ≤ 30 |
| **Nominal temperature 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)** | 0.89 (1.97) | 0.89 (1.97) |
| **Dead volume** | **$cm^3$** | 6 | 7 |
| **Connection cable** | | see chapter “Products”, para.<br>“Connection Cable for Active Sensors” | see chapter “Products”, para.<br>“Connection Cable for Active Sensors” |
| **Calibration** | | see chapter “Miscellaneous”, para.<br>“Oerlikon Leybold Vacuum Calibration Service” | see chapter “Miscellaneous”, para.<br>“Oerlikon Leybold Vacuum Calibration Service” |



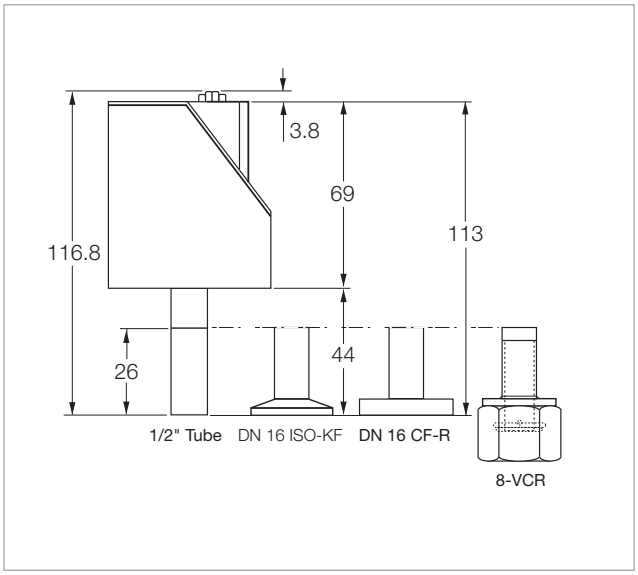

Characteristic of the THERMOVAC Transmitter CTR 101

## Ordering Information

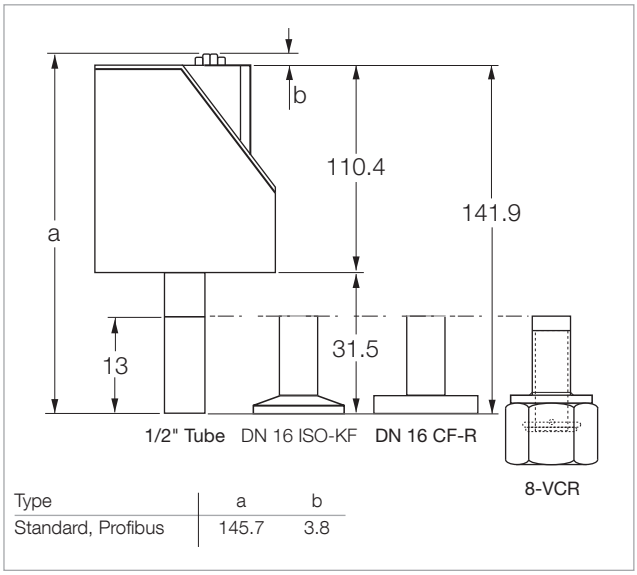
## CERAVAC Transmitter

| | CTR 100 | CTR 101 |
|---|---|---|
| | **Part No.** | **Part No.** |
| DN 16 ISO-KF | | |
| 1000 Torr | **230 300** | **230 320** |
| 100 Torr | **230 301** | **230 321** |
| 20 Torr | **230 340 V01** | **–** |
| 10 Torr | **230 302** | **230 322** |
| 1 Torr | **230 303** | **230 323** |
| 0.1 Torr | **230 304 V01** | **230 324** |
| DN 16 CF-R | | |
| 1000 Torr | **230 305** | **230 325** |
| 100 Torr | **230 306** | **230 326** |
| 10 Torr | **230 307** | **230 327** |
| 1 Torr | **230 308** | **230 328** |
| 0.1 Torr | **230 309 V01** | **230 329** |
| Cajon 8-VCR | | |
| 1000 Torr | **230 310** | **230 330** |
| 100 Torr | **230 311** | **230 331** |
| 10 Torr | **230 312** | **230 332** |
| 1 Torr | **230 313** | **230 333** |
| 0.1 Torr | **230 314 V01** | **230 334** |
| 1/2" Tube | | |
| 1000 Torr | **230 315** | **230 335** |
| 100 Torr | **230 316** | **230 336** |
| 10 Torr | **230 317** | **230 337** |
| 1 Torr | **230 318** | **230 338** |
| 0.1 Torr | **230 319 V01** | **230 339** |
| 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




| Type | a | b |
|---|---|---|
| Standard, Profibus | 145.7 | 3.8 |

Dimensional drawing for the CERAVAC Transmitter CTR 101

# 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 (TTR 91 S) can be switched easily on the analog output and be shown on the display of the operating unit.

## Advantages to the User

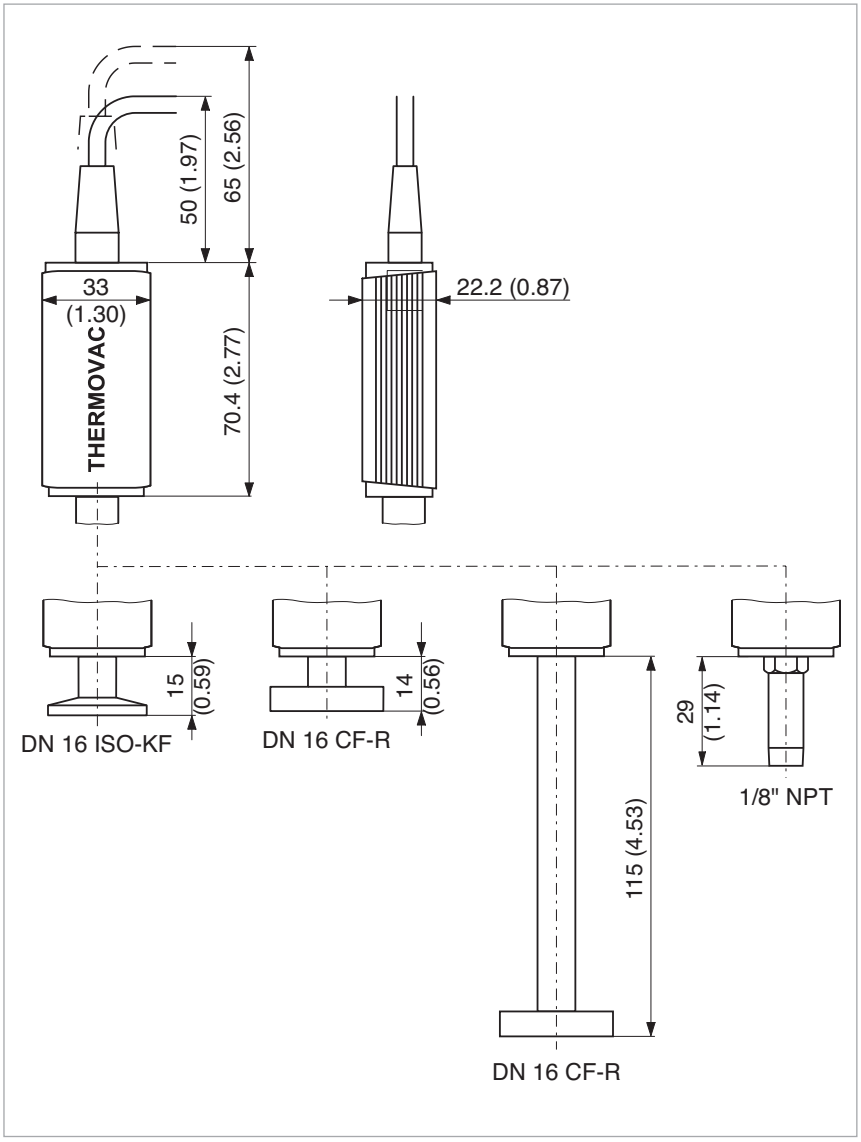
- Rugged sensing cells made of stainless steel
- Compact design
- Stable measurements within a wide temperature range
- Highly resistant to overpressures
- Exchangeable sensing cells
- Fast response
- Available with integrated switching relay (TTR 91 S, TTR 96 S)
- TTR 91 (Part No. 230 035) is GOST standard compliant

## Typical Applications

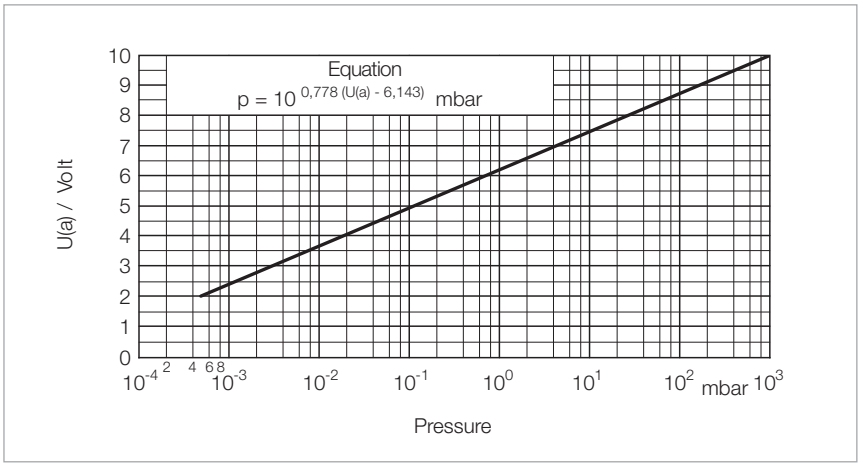
- Analytical engineering
- Safety circuits in vacuum systems
- Controlling ionization gauges
- General pressure measurement and control on systems in the fine and rough vacuum range

## 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 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.




Dimensional drawing for the TTR 91 / TTR 91 S / TTR 96 S (measures in brackets are in inch)




Characteristic of the THERMOVAC Transmitters TTR 91 / TTR 91 S / TTR 96 S

## Technical Data

## THERMOVAC Transmitter

## TTR 91 / TTR 91 S / TTR 96 S

| | | |
|---|---|---|
| **Measurement range** | **mbar (Torr)** | 5 x $10^{-4}$ to 1000 (3.75 x $10^{-4}$ to 750) |
| **Measurement uncertainty** | | 15% in the range 1 x $10^{-3}$ to 100 mbar (0.75 x $10^{-3}$ to 75 Torr) |
| **Measurement principle** | | Thermal conductivity according to Pirani |
| **Supply voltage** | | 14 to 30 V DC<br>Hum voltage ≤ 1 $V_{ss}$ |
| **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 ISO-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**<br>**the medium**<br>**the filament** | | <br>Stainless steel, Nickel, Glass, NiFe<br>Tungsten (TTR 91, TTR 91 S) or Nickel (TTR 96 S) |
| **Overpressure rating (abs.)** | **bar** | 10 |
| **Signal output ($R_a$ > 10 kΩ)**<br>**Measurement signal**<br><br>**Status signal** | | 0 to 10.3 V<br>1.9 to 10 V DC, corresp. 5 x 10-4 to 1 x 103 mbar<br>1.286 V/decade, logarithmic<br>Error: ≤ 0.5 V |
| **Trigger (only TTR 91 S/TTR 96 S)**<br>**Adjustment range**<br>**Hysteresis**<br>**Rating**<br>**Error status** | <br>**mbar (Torr)**<br><br>**ms** | Normally open relay contact<br>2 x $10^{-3}$ to 500 (1.5 x $10^{-3}$ to 375)<br>10%<br>30 V; 0.5 A DC<br>Relay contact open |
| **Status indicators (only TTR 91 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

| | Part No. |
|---|---|
| Without switching threshold | |
| TTR 91, DN 16 ISO-KF | **230 035** |
| TTR 91, 1/8" NPT | **230 038** |
| TTR 91, DN 16 CF | **230 036** |
| TTR 91, 1/2" Tube, DN 16 CF bakeable | **230 037** |
| With switching threshold | |
| TTR 91 S, DN 16 ISO-KF | **230 040** |
| TTR 91 S, 1/8" NPT | **230 043** |
| TTR 91 S, 1/2" Tube, DN 16 CF bakeable | **230 042** |
| TTR 96 S, DN 16 ISO-KF | **230 045** |
| TTR 96 S, 1/2" Tube, DN 16 CF bakeable | **230 047** |
| Replacement sensing cell | |
| for TTR 91 / TTR 91 S | |
| DN 16 ISO-KF | **230 050** |
| 1/8" NPT | **230 053** |
| DN 16 CF | **230 051** |
| 1/2" Tube, DN 16 CF, bakeable | **230 052** |
| for TTR 96 S | |
| DN 16 ISO-KF | **230 055** |
| 1/8" NPT | **230 058** |
| DN 16 CF | **230 056** |
| Calibration | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” |
| Connection cable, FCC 68 on both ends, 8-polig mit Abschirmung | **Type A** |
| 5 m | **124 26** |
| 10 m | **230 012** |
| 15 m | **124 27** |
| 20 m | **124 28** |
| 30 m | **124 29** |
| 50 m | **124 31** |
| 75 m | **124 32** |
| 100 m | **124 33** |
| Accessories, optional | |
| Spiral tube DN 16 ISO-KF | **230 082** |

# THERMOVAC Transmitters with Fieldbus Interface Profibus or DeviceNet TTR 911 / TTR 911 PB / TTR 911 D / TTR 911 CC / TTR 911 CC PB / TTR 916 / TTR 916 PB




Transmitter TTR 911; left with PB interface, right with display

The THERMOVAC transmitters are active sensors (pressure/voltage converters) the operation of which is based on the thermal conductivity principle according to Pirani. The transmitters offer a display range from 5 x $10^{-5}$ to 1000 mbar.

A selection of 3 different filament materials (TTR 911 = tungsten, TTR 916 = nickel, TTR 911 CC = ceramics coated tungsten) allows the selection of the matching sensor for every application.

In particular, the new TTR 911 CC models with sensing cells fully coated with ceramic material are especially well suited for demanding applications like dry etching, Atomic Layer Deposition (ALC) because these offer, compared to traditional sensing cells made of metal, an optimised degree of corrosion protection. Optionally the TTR 911/916 transmitters are available with a built-in display facilitating reading off of the measured values directly at the transmitter itself. As Fieldbus interfaces both Profibus and DeviceNet are available.

## Advantages to the User

- 2 switching thresholds with a wide adjustment range (5 x $10^{-5}$ to 1000 mbar)
- Rugged Pirani sensing cells for different media are available
  - Tungsten (standard applications, without corrosive media)
  - Nickel (slightly corrosive media)
  - Ceramics coated (highest degree of corrosion protection)
- LED display for operation and switching threshold function
- High degree of reproducibility
- Sensing cells which are easy to replace
- Logarithmic signal output
- High level of EMI compatibility through shielded housing, FCC 68 compliant connectors and cables
- Computer interface (optional)
  - Profibus
  - DeviceNet
- Versions with display but without Fieldbus are available
- Complies with CE, ETL, ANSI/UL, CAN/CSA, RoHs and WEEE requirements

## Typical Applications

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

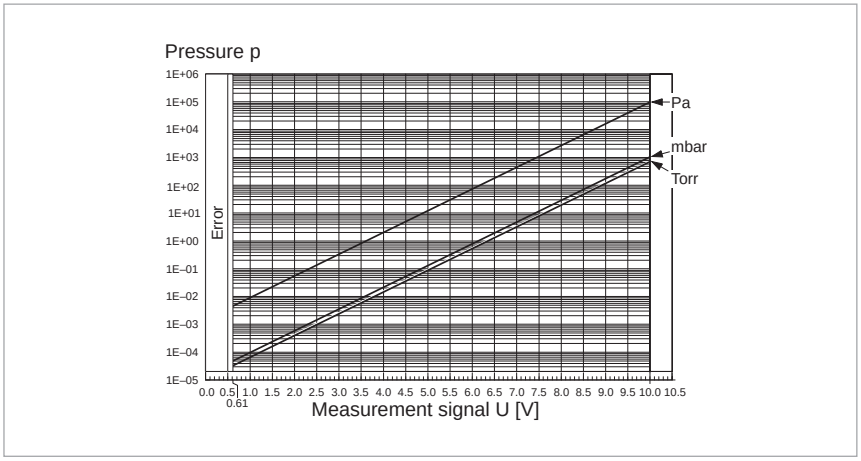
## Sensor

The THERMOVAC transmitter TTR 911 is equipped with a tungsten sensing filament which is suited for standard applications.
The transmitter models TTR 916 are equipped with a nickel sensing filament for applications involving increased quantities of water vapour or corrosive media.

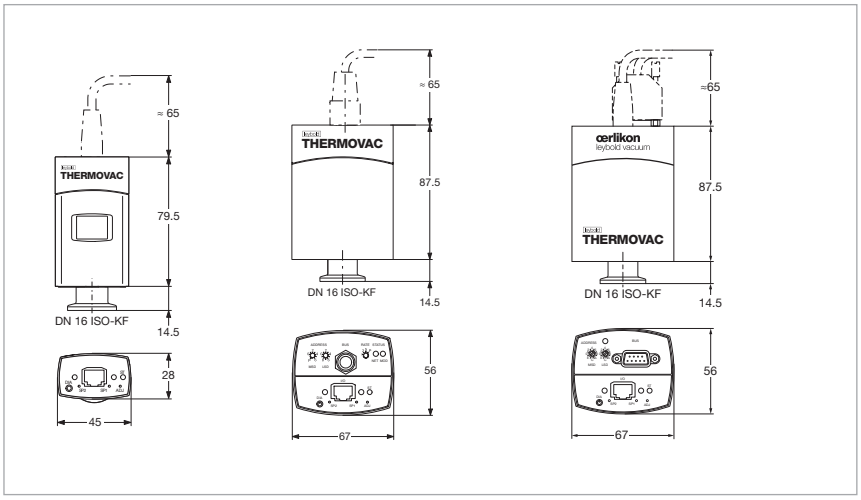
The THERMOVAC transmitter TTR 911 CC is suited for applications involving extremely corrosive media since the sensing filament coated with a ceramic material offers the highest degree of corrosion protection.

In all transmitter models, the sensing cells can be easily replaced should this be required.

Integration of the transmitter in programmable control systems is facilitated by the linear 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 PLC.




Characteristics of the TTR 911 and TTR 916




Dimensional drawing of the TTR 911 and TTR 916 with DN 16 ISO-KF flange.
On the left with display, at the centre with DeviceNet interface, on the right with Profibus interface

## Technical Data

## THERMOVAC Transmitters

## TTR 911 / TTR 911 PB / TTR 911 D / TTR 911 CC / TTR 911 CC PB/ TTR 916 / TTR 916 PB

| | | |
|---|---|---|
| Display range | mbar (Torr) | 5 x $10^{-5}$ to 1000 (3.75 x $10^{-5}$ to 750) |
| Measurement uncertainty ($N_2$) | | |
| | mbar (Torr) | 5 x $10^{-4}$ to 1 x $10^{-3}$ (3.75 x $10^{-4}$ to 1 x $10^{-3}$), ± 50% of the measured value |
| | mbar (Torr) | 1 x $10^{-3}$ to 100 (1 x $10^{-3}$ to 750), ± 15% of the measured value |
| | mbar (Torr) | 100 to 1000 (75 to 750), ± 50% of the measured value |
| Principle of measurement | | Thermal conductivity acc. to Pirani |
| Supply voltage | V DC | +15 to +30, typ. 24 V |
| Power consumption | | |
| without Fieldbus | W | ≤ 2.5 |
| Profibus | W | ≤ 3 |
| DeviceNet | W | ≤ 3 |
| Storage temperature range | °C | -20 to +65 |
| Nominal temperature range | °C | +10 to +50 |
| Type of protection | | IP 40 |
| Dimensions (H x W x D) | mm | See dimensional drawing |
| Weight, approx. | kg (lbs) | 0.23 to 0.25 (0.51 to 0.55) |
| Sensor | | Exchangeable sensing cell |
| Filament | | Tungsten (TTR 911) / $Al_2O_3$ coated tungsten (TTR 911 CC)/nickel (TTR 916) |
| Vacuum connection | DN | 16 ISO-KF |
| Degassing temperature, max. | °C | 80 at the flange |
| Dead volume, approx. | $cm^3$ | 4.7 |
| Materials in contact with the medium | | |
| Vacuum connection | | Stainless steel 1.4435 |
| Filament | | TTR 911: tungsten, TTR 911 CC: $Al_2O_3$ coated tungsten, TTR 916: nickel |
| Vacuum feed through | | Glass |
| Orifice | | Stainless steel 1.4301 |
| Further materials | | $Al_2O_3$, Ni, NiFe, stainless steel 1.4301 |
| Overpressure rating (abs.) | bar | 5 |
| Signal output ($R_a$ > 10 kΩ) | | 0 to 10 V |
| Measurement signal | | 0.61 to 10 V |
| | | 1.286 V/decade |
| Error signal | | 0 to 0.5 |
| Switching threshold | | Semiconductor relay contact, normally open |
| Adjustment range | mbar (Torr) | 5 x $10^{-5}$ to 1000 (3.75 x $10^{-5}$ to 750) |
| Hysteresis | | Approximately 10% of the setup pressure value |
| Reaction time | ms | < 30 |
| Switching capacity | | < 30 V AC/DC, ≤ 0.3 A |
| Status indicators | | Operation indicator (power): LED green; error: LED red<br>Switching threshold (enabled): LED green |
| Electrical connection | | FCC-68 socket, 8-way with shield |
| Cable length, max. | m | 100 (for the FCC connection),<br>different maximum cable lengths apply to the Fieldbus interfaces |
| Interface | | |
| TTR 911 PB / 916 PB / TTR 911 CC PB | | Profibus |
| TTR 911 D | | DeviceNet |

## Ordering Information

# THERMOVAC Transmitters
# TTR 911 / TTR 911 PB / TTR 911 D / TTR 911 CC / TTR 911 CC PB/ TTR 916 / TTR 916 PB

| | Part No. |
|---|---|
| TTR 911, DN 16 ISO-KF, with display<br>Tungsten filament (2 switching thresholds)<br>Replacement sensing cell | **89654V01**<br>**230650V01** |
| TTR 911 PB, DN 16 ISO-KF<br>Tungsten filament (2 switching thresholds)<br>Profibus interface<br>Replacement sensing cell | **89650V01**<br>**230650V01** |
| TTR 911 D, DN 16 ISO-KF<br>Tungsten filament (2 switching thresholds)<br>DeviceNet interface<br>Replacement sensing cell | **89651V01**<br>**230650V01** |
| TTR 911 CC, DN 16 ISO-KF<br>Tungsten filament (2 switching thresholds)<br>Ceramics coated<br>Replacement sensing cell | **89658V01**<br>**230651V01** |
| TTR 911 CC PB, DN 16 ISO-KF<br>Tungsten filament (2 switching thresholds)<br>Ceramics coated<br>Profibus interface<br>Replacement sensing cell | **89659V01**<br>**230651V01** |
| TTR 916, DN 16 ISO-KF, with display<br>Nickel filament (2 switching thresholds)<br>Replacement sensing cell | **89656V01**<br>**230652V01** |
| TTR 916 PB, DN 16 ISO-KF<br>Nickel filament (2 switching thresholds)<br>Profibus interface<br>Replacement sensing cell | **89652V01**<br>**230652V01** |
| Calibration | See Section “Miscellaneous”, paragraph “Oerlikon Leybold Vacuum calibration service” |
| Connection cable, FCC 68 on both ends, 8-way with shield | **Type A** |
| 5 m | **124 26** |
| 10 m | **230 012** |
| 15 m | **124 27** |
| 20 m | **124 28** |
| 30 m | **124 29** |
| 50 m | **124 31** |
| 75 m | **124 32** |
| 100 m | **124 33** |
| Optional accessories<br>Spiral tube DN 16 ISO-KF | <br>**230 082** |

# THERMOVAC Transmitters
# TTR 101 / TTR 101 S2 / TTR 101 S2 PB




The Pirani Capacitance Diaphragm Gauge is the first vacuum gauge which combines ceramic capacitance diaphragm and thermal conductivity technologies. The Oerlikon Leybold Vacuum TTR 101 offers superior accuracy and gas type independent readings between 10 mbar and 1500 mbar.

## Advantages to the User

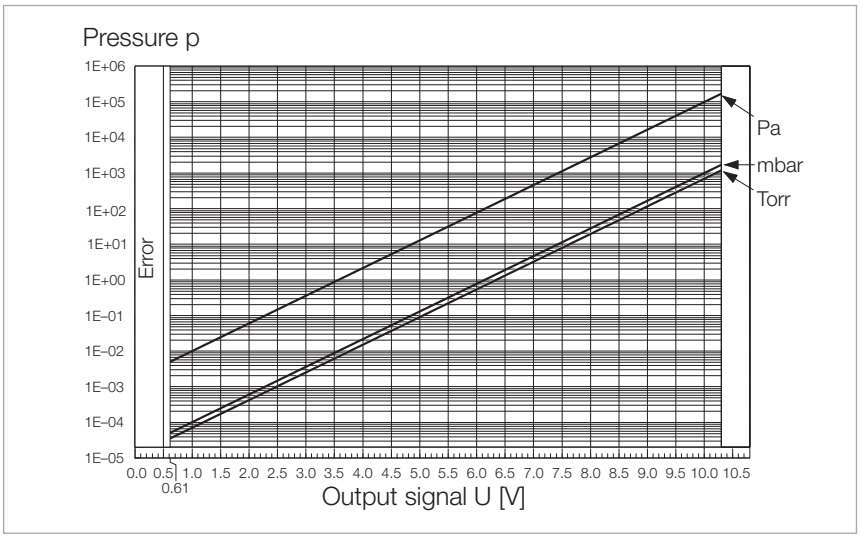
- Large display range 5 x $10^{-5}$ to 1500 mbar
- Gas type independent above 10 to 1500 mbar
- Available optional display, or with up to two integrated setpoints
- Easy to exchange plug & play sensor element with on-board calibration data - guarantees high reproducibility and low cost of ownership
- Compact design
- LED signal for set point relay status
- Rapid cycling
- NRTL, ETL, RoHs and WEEE standards

## Typical Applications

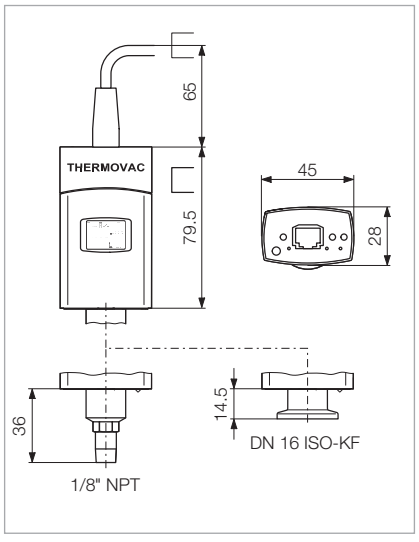
- General vacuum measurement and control from low to the high vacuum range
- Forevacuum pressure measurement
- Safety circuits in vacuum systems
- Load lock control
- Control of high vacuum ionization gauge

## 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 chapter “General”, para. “Connection Accessories for Small Flanges”.




Kennlinie des THERMOVAC-Transmitters TTR 101 (S2)




Maßzeichnung des TTR 101 (S2)

## Technical Data

## THERMOVAC Transmitter

## TTR 101 / TTR 101 S2 / TTR 101 S2 PB

| | |
|---|---|
| **Measurement principle** | |
| **10 to 1500 mbar (7.5 to 1125 Torr)** | Capacitive diaphragm sensor |
| **1 to 10 mbar (0.75 to 7.5 Torr)** | Mixed range |
| **5 x $10^{-4}$ to 1 mbar (3.75 x $10^{-4}$ to 0.75 Torr)** | Thermal conductivity acc. to Pirani |
| **Measurement range mbar (Torr)** | 5 x $10^{-5}$ to 1500 (3.8 x $10^{-5}$ to 1125) |
| **Measurement range mbar (Torr)** | 5 x $10^{-4}$ to 1500 (3.8 x $10^{-4}$ to 1125) |
| **Measurement uncertainty ($N_2$)** | |
| **5 x $10^{-4}$ to 1 x $10^{-3}$ mbar** | ± 50% of reading |
| **1 x $10^{-3}$ to 100 mbar** | ± 15% of reading |
| **100 to 950 mbar** | ± 5% of reading |
| **950 to 1050 mbar** | ± 2,5% of reading |
| **Repeatability ($N_2$)** | |
| **1 x $10^{-3}$ to 1100 mbar** | ± 2% of reading |
| **Output signal (measurement signal)** | |
| **Voltage range** | 0 to 10.23 V |
| **Measurement range** | +0.61 to +10.23 V |
| **Error signal** | 0 V (factory default) |
| **Relationship between voltage and pressure** | 1.286 V / decade, logarithmic |
| **Output impedance** | 2 x 4.7 Ohm, short circuit-proof |
| **Load impedance** | > 10 kΩ |
| **Response time** | < 30 ms |
| **Transmitter identification** | 71.5 kΩ |
| **HV transmitter alignment** | at < $10^{-5}$ mbar |
| **ATM transmitter alignment** | at > 100 mbar |
| **Semiconductor relay** | Switching thresholds SP 1/2 |
| **Adjustment range ($N_2$)** | 5.0 x $10^{-5}$ to 1500 mbar |
| **Hysteresis** | 10% of the threshold |
| **Switching characteristic** | Low trip point |
| **Contact rating** | < 30 V AC/DC, # 0.3 A resistive |
| **closed** | LED on |
| **open** | LED off |
| **Switching time** | < 30 ms |

## Further Technical Data

## THERMOVAC Transmitter

## TTR 101 / TTR 101 S2 / TTR 101 S2 PB

| | | |
|---|---|---|
| **Supply voltage** | | Class 2 / LPS |
| **at the transmitter** | **V DC** | +15 to +30 |
| **Ripple** | | < 1 $V_{ss}$ |
| **Power consumption** | **W** | ≤ 2.5 |
| **Fuse to connect ahead** | | 1 AT |
| **Electrical connection** | | FCC 68 socket |
| **Measurement cord** | | with shield: 0.14 mm2/ wire |
| **Cable length** | **m** | ≤ 100 |
| **Earthing concept** | | --> “Electrical connection” |
| **Vacuum connection and signal earth** | | connected via 10 kV, 10 nF |
| **Materials exposed to vacuum** | | |
| **Vacuum connection** | | Stainless steel 1.4435 |
| **Heating filament** | | W |
| **Vacuum feedthrough** | | Glass |
| **Orifice (for DN 16 ISO-KF only)** | | Stainless steel |
| **Diaphragm** | | Ceramic |
| **Further materials** | | Ni, NiFe, Stainless steel 1.4301, SnAg |
| **Internal volume** | | |
| **DN 16 ISO-KF** | **$cm^3$** | 4.7 |
| **1/8" NPT** | **$cm^3$** | 5.2 |
| **Admissible pressure** | **bar (abs.)** | ≤ 5 |
| **Burst pressure** | **bar (abs.)** | 10 |
| **Admissible temperature** | | |
| **Operation (ambient)** | **°C** | +10 to +50 |
| **Bakeout at flange [1], max.** | **°C** | ≤ 80 |
| **Heating filament** | **°C** | < 160 |
| **Storage** | **°C** | -20 to +65 |
| **Relative humidity** | | |
| **Annual average** | | ≤ 65% (non condensing) |
| **on 60 days** | | ≤ 85% (non condensing) |
| **Mounting orientation** | | Horizontal and vertical |
| **Use** | | Indoors only, altitudes up to 2000 m (6562 ft.) |
| **Protection class** | **IP** | 40 |
| **Weight** | **kg (lbs)** | 0.120 (0.265) |

[1] For horizontal installation. While baking out, the technical data for measurement range, inaccuracy and repeatability may deviate

## Ordering Information

## THERMOVAC Transmitter

## TTR 101 / TTR 101 S2 / TTR 101 S2 PB

| | Part No. |
|---|---|
| THERMOVAC TTR 101 | |
| without switching threshold | |
| without Display | |
| DN 16 ISO-KF | **230 350 V01** |
| 1/8" NPT | **230 351 V01** |
| with Display | |
| DN 16 ISO-KF | **230 354 V01** |
| 1/8" NPT | **230 355 V01** |
| THERMOVAC TTR 101 S2 | |
| with two switching thresholds | |
| without Display | |
| DN 16 ISO-KF | **230 352 V01** |
| 1/8" NPT | **230 353 V01** |
| with Display | |
| DN 16 ISO-KF | **230 356 V01** |
| 1/8" NPT | **230 357 V01** |
| THERMOVAC TTR 101 S2 PB | |
| with two switching thresholds | |
| without Display | |
| DN 16 ISO-KF | **230 358 V01** |
| with Display | |
| DN 16 ISO-KF | **230 360 V01** |
| Replacement sensor | |
| DN 16 ISO-KF | **230 361 V01** |
| 1/8" NPT | **230 362 V01** |
| Centering ring with fine filter DN 16 ISO-KF | **883 96** |
| Calibration | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” |
| Connection cable, FCC 68 on both ends, 8-way, shielded | **Type A** |
| 5 m | **124 26** |
| 10 m | **230 012** |
| 15 m | **124 27** |
| 20 m | **124 28** |
| 30 m | **124 29** |
| 50 m | **124 31** |
| 75 m | **124 32** |
| 100 m | **124 33** |
| Accessories, optional | |
| Spiral tube DN 16 ISO-KF | **230 082** |

# PENNINGVAC Transmitters
# PTR 225/ PTR 225 S/ PTR 225 PB/ 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 x $10^{-9}$ to 1 x $10^{-2}$ mbar (0.75 x $10^{-9}$ to 0.75 x $10^{-2}$ 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 x $10^{-9}$ to 1 x $10^{-2}$ mbar (0.75 x $10^{-9}$ to 0.75 x $10^{-2}$ 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 ISO-KF, with centering ring,
Part No. 230 078

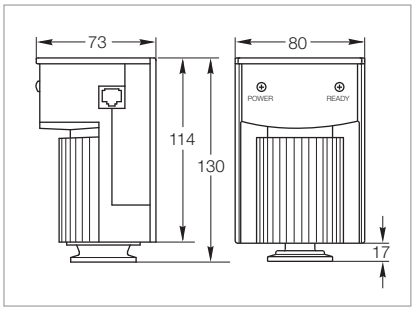
## Sensor

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 ISO-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 feedthrough. 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.

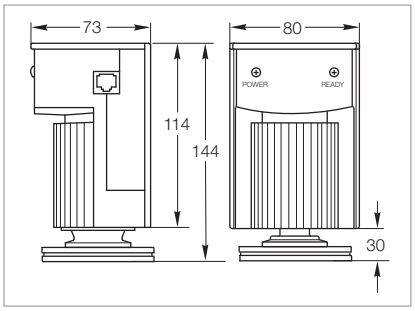
The anode ring and the titanium cathode plates can be exchanged easily for quick maintenance of the sensors in case of contamination. The shape of the cathode plates is such that they also act as a baffle for the sensors.

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.

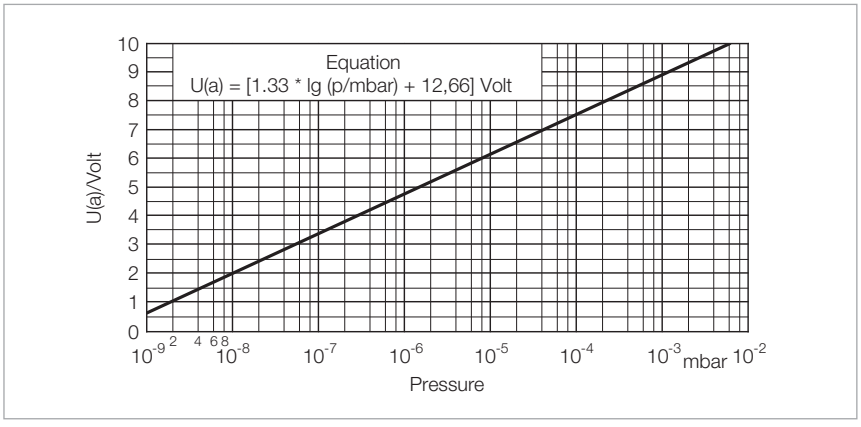
Built-in relays (PTR 225 S) allow switching functions to be performed directly by the transmitter, without the need of a programmable control.




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 225 PB / PTR 237

| | | |
|---|---|---|
| **Measurement range** | **mbar (Torr)** | 1 x $10^{-9}$ to 1 x $10^{-2}$ (0.75 x $10^{-9}$ to 0.75 x $10^{-2}$) |
| **Measurement uncertainty** | | 30% in the range 1 x $10^{-8}$ to 1 x $10^{-4}$ mbar<br>(0.75 x $10^{-8}$ to 0.75 x $10^{-4}$ Torr) |
| **Measurement principle** | | Cold cathode ionization according to Penning |
| **Supply voltage** | | 14.5 to 36 V DC typ. 24 V DC<br>hum voltage < 2 $V_{ss}$ |
| **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 |
| **Inflammability** | | UL 94 - V 2 |
| **Sensor** | | Detachable for cleaning |
| **Vacuum connection** | | |
| **PTR 225 (S)** | **DN** | 25 ISO-KF |
| **PTR 237** | **DN** | 40 CF |
| **Degassing temperature, max.** | **°C** | 250 with electronics detached |
| **Dead volume, approx.** | **$cm^3$** | 21 |
| **Materials in contact with the medium** | | Stainless steel, CrNi, $Al_2O_{3250\ with\ electronics\ detached}$,<br>NiFe, Mo, Cu, Ni, Ti |
| **Overpressure rating (abs.)** | **bar** | 10 |
| **Signal output ($R_a$ > 10 kΩ)** | | 0 to 10,6 V |
| **Measurement signal** | | 0.66 to 10 V,<br>corresponds to 1 x 10-9 to 1 x $10^{-2}$ mbar<br>logarithm. divisions 1.333 V/decade |
| **Trigger (PTR 225 S)** | | Changeover relay contact |
| **Adjustment range** | **mbar (Torr)** | 1 x $10^{-9}$ to 1 x $10^{-3}$ (0.75 x $10^{-9}$ to 0.75 x $10^{-3}$) |
| **Hysteresis** | | About 30% of the adjusted pressure |
| **Rating** | | 60 V, 0.5 A DC |
| **Error status** | | Contact in its rest position when “no ignition” / “HT off” |
| **High voltage control input** | | ON: At U < 2.9 V, or U > 12 V<br>OFF: At U > 3 V, or U < 7 V |
| **Status output** | | Voltage level |
| **Ready to measure** | | HIGH (typ. 24 V DC) |
| **Error (no ignition)** | | LOW (0 V) |
| **Status indicators** | | Operation: Orange LED<br>Ready to measure (ignited): Green LED<br>Trigger (active): Green LED |
| **Monitor output ($R_a$ > 100 kΩ)** | | 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 P** | | Profibus DP |

## Ordering Information

## PENNINGVAC Transmitter

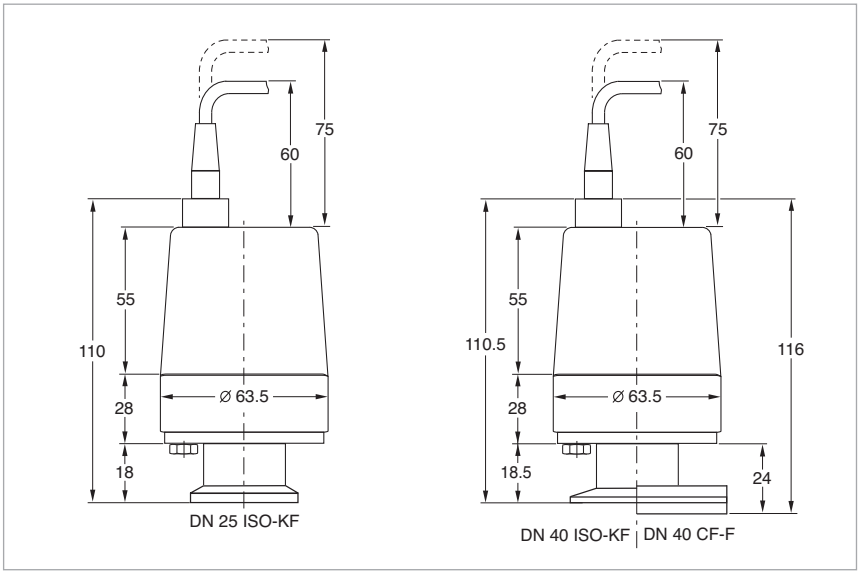
## PTR 225 / PTR 225 S / PTR 225 PB / PTR 237

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

# 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 x $10^{-9}$ 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.



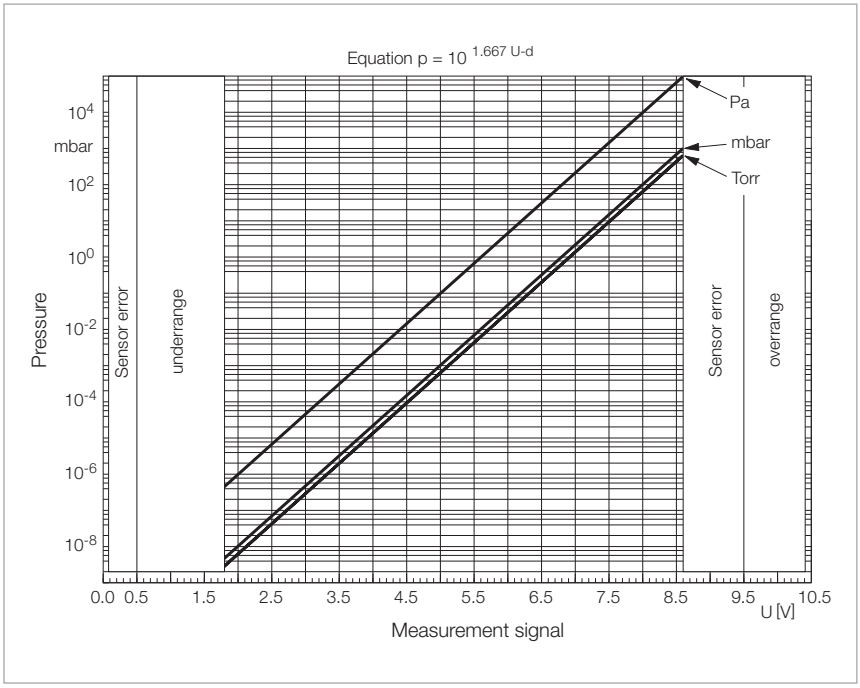

Dimensional drawing for the PENNINGVAC transmitters PTR 90

## 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 ISO-KF connections is integrated in a centering ring.



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

## Technical Data

## PENNINGVAC Transmitter

## PTR 90

| | | |
|---|---|---|
| Measurement 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<br>(in the range 0.75 x $10^{-8}$ … 75 Torr) |
| Measurement principle | | Cold cathode measurement system based on the principle<br>of the inverted magnetron and Pirani measurement system |
| Reproducibility | % | 5 in the range 1 x $10^{-8}$ … 100 mbar<br>(in the range 0.75 x $10^{-8}$ … 75 Torr) |
| Output signal (measurement signal) | | |
| Voltage range | V | 0 - 10.5 |
| Measurement range | V | 1.82 to 8.6 |
| Relationship between voltage and pressure | | Logarithmic, 0.6 V/decade |
| Error signal | | < 0.5 V no power supply<br>> 9.5 V Pirani sensor is defective (broken filament) |
| Supply voltage | 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, Viton |
| Overpressure rating (abs.) | bar | 10 |
| Protection class | IP | 40 |

## Ordering Information

## PENNINGVAC Transmitter

## PTR 90

| | Part No. |
|---|---|
| PTR 90 | |
| DN 25 ISO-KF | **230 070** |
| DN 40 ISO-KF | **230 071** |
| DN 40 CF | **230 072** |
| Baffle, with centering ring (FPM (FKM)) | |
| DN 25 ISO-KF | **230 078** |
| DN 40 ISO-KF | **230 079** |
| Magnet shield for PTR 90 | **230 073 V01** |
| Calibration | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” |
| Connection cable, FCC 68 on both ends, 8-way, shielded | **Type A** |
| 5 m | **124 26** |
| 10 m | **230 012** |
| 15 m | **124 27** |
| 20 m | **124 28** |
| 30 m | **124 29** |
| 50 m | **124 31** |
| 75 m | **124 32** |
| 100 m | **124 33** |

## Notes

# IONIVAC Transmitter ITR 90




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

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

## Advantages to the User

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

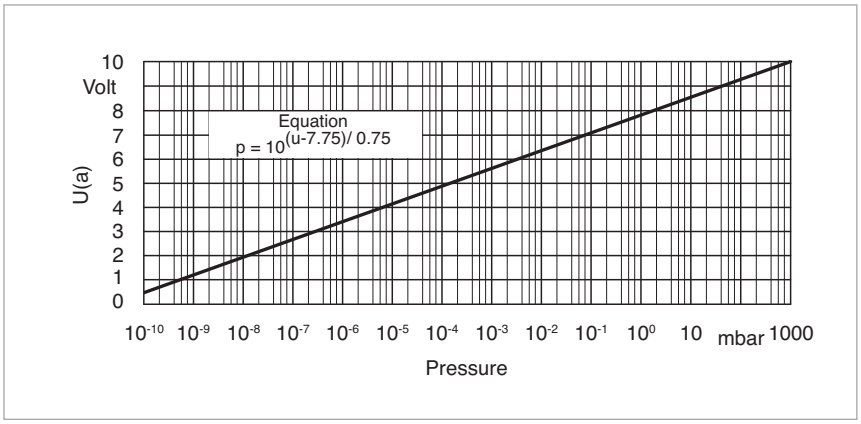
## Typical Applications

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

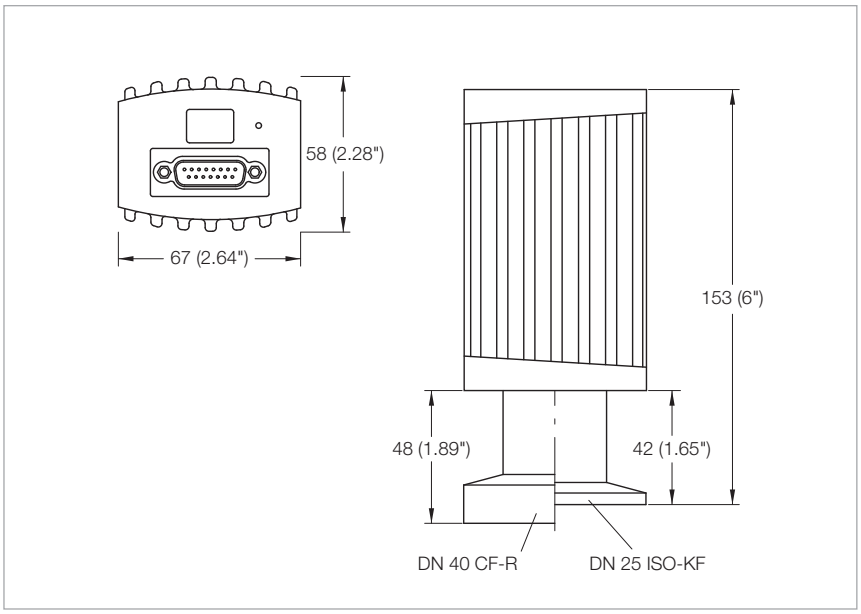
## Sensor

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

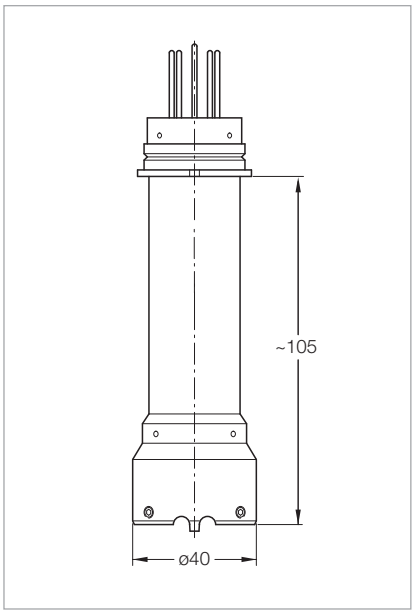
When using the bake out extension, measurements will be possible also at flange temperatures up to 150 °C.




Characteristic of the ITR 90




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




Dimensional drawing for the bake out extension

## Technical Data

## IONIVAC-Transmitter

## ITR 90

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

[1] Flange temperature when using the bake out extension

## Ordering Information

## IONIVAC-Transmitter ITR 90

| | without Display | with Display |
|---|---|---|
| | **Part No.** | **Part No.** |
| ITR 90, DN 25 ISO-KF | **120 90** | **120 91** |
| ITR 90, DN 25 ISO-KF, Profibus interface | **230 030** | **–** |
| ITR 90, DN 40 CF-R, rotatable CF flange | **120 92** | **120 94** |
| ITR 90, DN 40 CF-R, rotatable CF flange Profibus interface | **230 031** | **–** |
| Power supply for IONIVAC transmitter 100 - 240 V AC / 24 V DC incl. 5 m connection cable and 5 m RS 232 C cable | **121 06** | **121 06** |
| Bake out extension (100 mm, approx.) | **127 06** | **127 06** |
| Baffle, DN 25 ISO-KF, with Installation baffle for CF/ISO-KF variant | **121 07** | **121 07** |
| Replacement sensor | | |
| IE 90, DN 25 ISO-KF [1)] | **E 121 02** | **E 121 02** |
| IE 90, DN 40 CF-R [1)] | **E 121 03** | **E 121 03** |
| Calibration | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service |
| Connection cable | see chapter “Products”, para. “Connection Cable for Active Sensors” | see chapter “Products”, para. “Connection Cable for Active Sensors” |

1) Including hex. socket screw key

# IONIVAC Transmitter ITR 200 S




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

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

## Advantages to the User

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

## Typical Applications

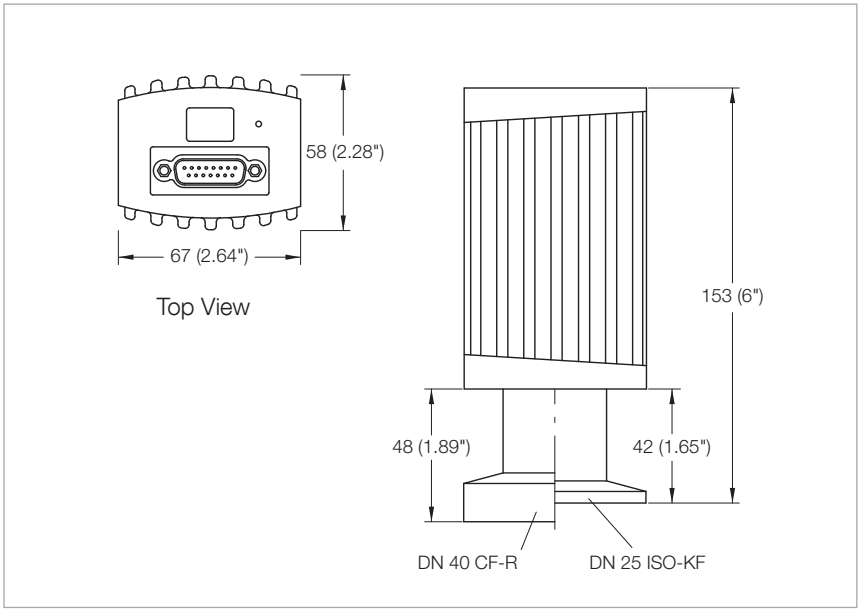
- Analytical engineering
- Sputtering and coating technology
- Vacuum furnaces
- Multipurpose pressure measurement in the medium and high vacuum range

## Options

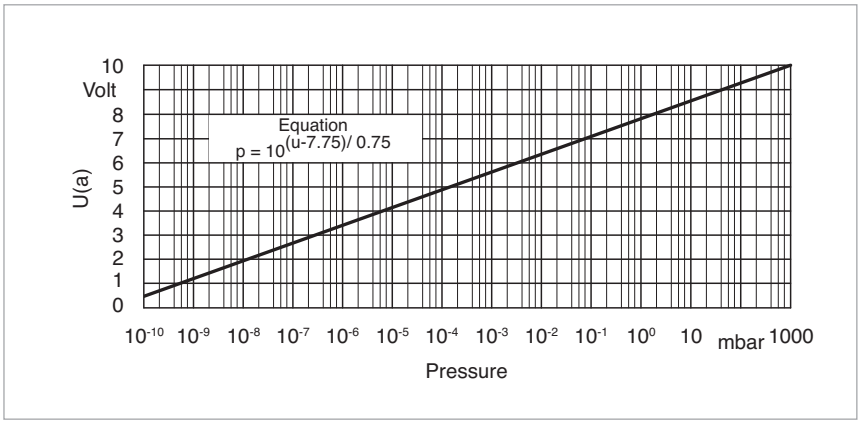
Upon request, the ITR 200 S can be supplied with an integrated display or a Profibus interface.

## Sensor

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




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




Characteristic of the ITR 200 S

## Technical Data

## IONIVAC-Transmitter
## ITR 200 S

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

[1] Flange temperature when using the bake out extension

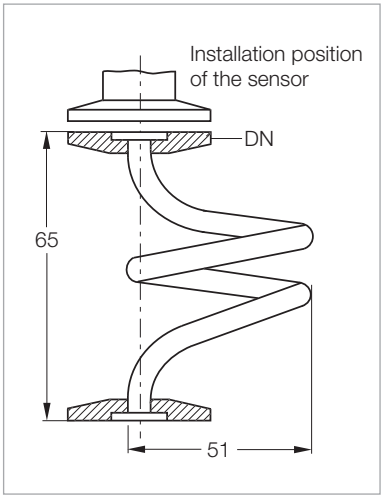
## Ordering Information

## IONIVAC-Transmitter ITR 200 S
### without Display with Display

| | Part No. | Kat.-Nr |
|---|---|---|
| ITR 200 S, DN 25 ISO-KF<br>1 switching function | **230 250** | **230 251** |
| ITR 200 SP, DN 25 ISO-KF,<br>Profibus interface, 2 switching functions | **230 252** | **–** |
| ITR 200 S, DN 40 CF-R, rotatable CF flange<br>1 switching function | **230 254** | **230 255** |
| ITR 200 SP, DN 40 CF-R, rotatable CF flange<br>Profibus interface, 2 switching functions | **230 256** | **–** |
| Options<br>Power supply for IONIVAC transmitter<br>100 - 240 V AC / 24 V DC<br>incl. 5 m connection cable and<br>5 m RS 232 C cable<br>Baffle, DN 25 ISO-KF, with<br>Installation baffle for CF/ISO-KF variant | <br><br><br><br>**121 06**<br><br>**121 07** | <br><br><br><br>**121 06**<br><br>**121 07** |
| Replacement sensor<br>IE 200, DN 25 ISO-KF [2]<br>IE 200, DN 40 CF-R [2]<br>IE 200 SL [1], DN 40 CF-R [2] | <br>**240 020**<br>**240 021**<br>**–** | <br>**240 020**<br>**240 021**<br>**240 022** |
| Calibration | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” | see chapter “Miscellaneous”, para. “Oerlikon Leybold Vacuum Calibration Service” |
| Connection cable | see chapter “Products”, para. “Connection Cable for Active Sensors” | see chapter “Products”, para. “Connection Cable for Active Sensors” |

[1] SL = long version (bake out version)
[2] Including hex. socket screw key

# Spiral Tube




Dimensional drawing for the spiral tube

## Advantages to the User

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

Installation is recommended in connection with

- measurement system TTR (preferred)
- CERAVAC CTR

## Operating Principle

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

## Maintenance

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

## Note

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

## Technical Data

### Spiral Tube

| | |
|---|---|
| **Materials** | Stainless steel |

## Ordering Information

### Spiral Tube

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

## Notes

# Connection Cables for Active Sensors

| Active Sensors | Operating Units for Active Sensors | | |
|---|---|---|---|
| | DISPLAY ONE | DISPLAY TWO<br>DISPLAY THREE | CENTER ONE<br>CENTER TWO<br>CENTER THREE |
| THERMOVAC Transmitter<br>TTR 91, TTR 91 S, TTR 96 S a. o.<br>TTR 100, TTR 101, TTR 101 S2<br>TTR 911 PB/D/CC/CC PB, TTR 916 PB/D | **Type A** | **Type A** | **Type A** |
| PENNINGVAC Transmitter<br>PTR 90, PTR 225, PTR 225 S, PTR 237 | **Type A** (only PTR 90) | **Type A** | **Type A** |
| CERAVAC Transmitter<br>CTR 100, CTR 101 (digital signal) | – | – | **Type C** |
| IONIVAC Transmitter<br>ITR 90, ITR 200 S | – | – | **Type C** |

| Active Sensors | Operating Units for Active Sensors | | |
|---|---|---|---|
| | IONIVAC IM 540<br>(Channel 3 and 4) | CMove | Bare wire ends |
| THERMOVAC Transmitter<br>TTR 91, TTR 91 S, TTR 96 S a. o.<br>TTR 100, TTR 101 | **Type A** | **Type A** | – |
| CERAVAC Transmitter<br>CTR 91, CTR 100, CTR 101<br>(analog signal) | **Type B** | **Type B** | **Type E** |
| IONIVAC Transmitter<br>ITR 90, ITR 200 S | – | **Type C** | **Type E** |

| Active Sensors | Operating Unit for Active Sensors |
|---|---|
| | VACVISION |
| THERMOVAC Transmitter<br>TTR 91, TTR 91 S, TTR 96 S a. o.<br>TTR 100, TTR 101 | **Type F** |
| PENNINGVAC Transmitter<br>PTR 90, PTR 225, PTR 225 S, PTR 237 | **Type F** |

## Technical Data

## Connection Cable

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

## Ordering Information

## Connection Cable

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

## Ordering Information

## Connection Cable

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

## Ordering Information

## Connection Cable

| | Type F |
|---|---|
| | Part No. |
| Cable length | |
| 5 m | **230 032 V01** |
| 10 m | **230 033 V01** |

# Operating Units for Active Sensors

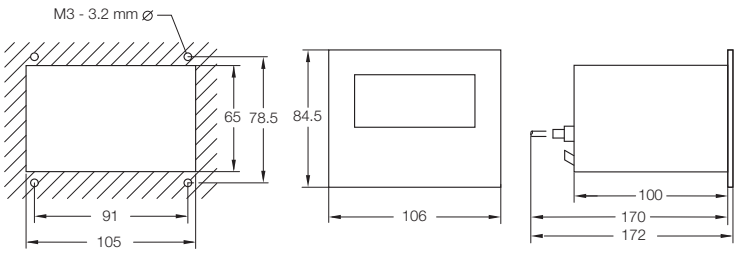
# DISPLAY ONE




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

## Advantages to the User

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




Dimensional drawing and panel cut-out for the DISPLAY ONE

## Connectable Sensors

THERMOVAC

- TTR 100 *)
- TTR 101
- TTR 101 S2
- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 90 S *)
- TTR 91
- TTR 91 S
- TTR 96 S
- TTR 911
- TTR 916

PENNINGVAC

- PTR 90

Linear pressure sensor

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

*) Connecting of older sensors possible

## Technical Data — DISPLAY ONE

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

## Ordering Information — DISPLAY ONE

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

# DISPLAY TWO / THREE

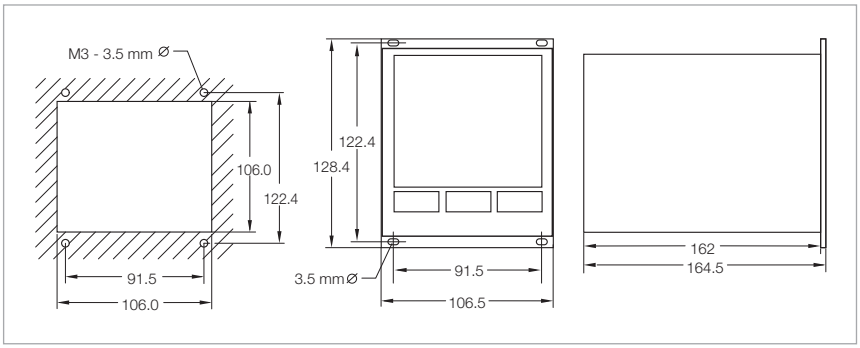



Cost-effective, operating and display units for the transmitters from the THERMOVAC and PENNINGVAC series.

All channels are displayed simultaneously.

## Advantages to the User

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




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

## Connectable Sensors

THERMOVAC

- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 91
- TTR 96 S
- TTR 100 *)
- TTR 100 S2 *)
- TTR 101
- TTR 101 S2
- TTR 911
- TTR 916

PENNINGVAC

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

Linear pressure sensor

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

*) Connecting of older sensors possible

## Technical Data

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

## Ordering Information

| | DISPLAY TWO<br>Part No. | DISPLAY THREE<br>Part No. |
|---|---|---|
| DISPLAY TWO / THREE<br>with mains cord (EURO and US) | **230 024** | **230 025** |
| THERMOVAC Transmitter | see chapter “Products”, para. “Active Sensors” | see chapter “Products”, para. “Active Sensors” |
| PENNINGVAC Transmitter | see chapter “Products”, para. “Active Sensors” | see chapter “Products”, para. “Active Sensors” |
| Connection cables<br>for THERMOVAC and<br>PENNINGVAC (Type A) | see chapter “Products”, para. “Connection Cables for Active Sensors” | see chapter “Products”, para. “Connection Cables for Active Sensors” |

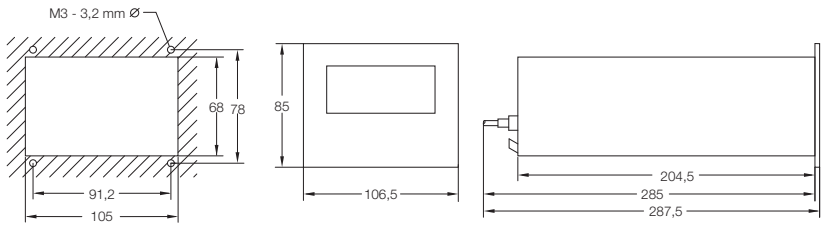
# CENTER ONE




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 x $10^{-10}$ 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 changeover 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", 2 HU)
- For fitting into 19", 3 HU racks
- CE and GOST standards compliant




Dimensional drawing and panel cut-out for the CENTER ONE

## Connectable Sensors

THERMOVAC
- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 91
- TTR 96 S
- TTR 100 *)
- TTR 100 S2 *)
- TTR 101
- TTR 101 S2
- TTR 911
- TTR 916

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

CERAVAC
- CTR 90 *)
- CTR 91 *)
- CTR 100
- CTR 101

IONIVAC
- ITR 90
- ITR 100 *)
- ITR 200 S
- ITR 200 SL

*) Connecting of older sensors possible

## Technical Data — CENTER ONE

| | |
|---|---|
| Number of measurement channels | 1 |
| Display for measured values | digital, 7 segment LED, 5 digits |
| Measurement range mbar (Torr) | 1 x $10^{-10}$ to 2000 (0.75 x $10^{-10}$ to 1500) |
| Unit of measurement (selectable) | mbar, Torr, microns, Pa |
| 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 thresholds<br>Number<br>Adjustment range<br>Hysteresis<br>Relay contact<br>Load rating | <br>1<br>sensor dependent<br>adjustable<br>floating changeover contact<br>60 V, 0.5 A DC / 30 V, 0.5 A AC |
| Error message<br>Relay contact<br>Load rating | <br>floating normally open contact<br>60 V, 0.5 A DC / 30 V, 0.5 A AC |
| Chart recorder output ($R_a$ > 10 kΩ) | 0 - 10 Volt, characteristic corresponds to the connected transmitter |
| Control input | PTR: high voltage on<br>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

| | Part No. |
|---|---|
| EURO version with 2 m EURO mains cord<br>US version with 2 m US mains cord | **230 002**<br>**235 002** |
| THERMOVAC, PENNINGVAC, CERAVAC and IONIVAC transmitter | see chapter “Products”, para. “Active Sensors” |
| Connection cables for<br>THERMOVAC and PENNINGVAC (Type A), CERAVAC (Type B analog, Type C digital) and IONIVAC (Type C) | see chapter “Products”, para. “Connection Cables for Active Sensors” |
| Adapter panel<br>for installation in a 3 HU, 19" rack | **230 005** |
| Screw terminal<br>for the 9-way output socket | **230 006** |

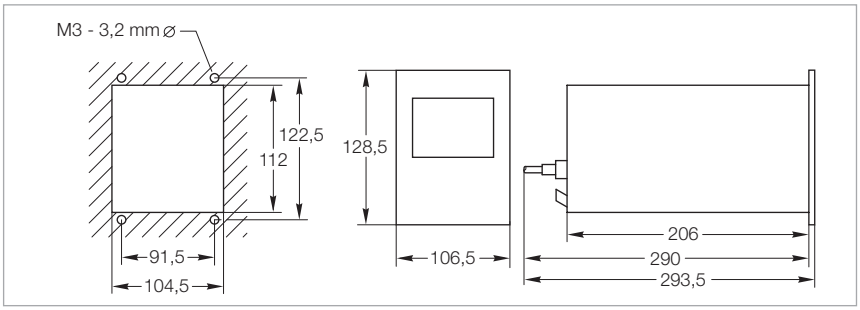
# CENTER TWO / THREE




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 x $10^{-10}$ to 2000 mbar (0.75 x $10^{-10}$ 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 changeover 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", 3 HU)
- For fitting into 19", 3 HU racks




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

## Connectable Sensors

THERMOVAC

- TTR 211 *)
- TTR 216 S *)
- TTR 90 *)
- TTR 91
- TTR 96 S
- TTR 100 *)
- TTR 100 S2 *)
- TTR 101
- TTR 101 S2
- TTR 911
- TTR 916

PENNINGVAC

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

CERAVAC

- CTR 90 *)
- CTR 91 *)
- CTR 100
- CTR 101

IONIVAC

- ITR 90
- ITR 200 S
- ITR 200 SL

*) Connecting of older sensors possible

## 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 |
| Measurement range mbar (Torr) | 1 x $10^{-10}$ to 2000 (0.75 x $10^{-10}$ to 1500) | 1 x $10^{-10}$ to 2000 (0.75 x $10^{-10}$ to 1500) |
| Unit of measurement (selectable) | mbar, Torr, microns, Pa | mbar, Torr, microns, Pa |
| 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 | 24 |
| Electrical outputs | 25-way Sub-D socket | 25-way Sub-D socket |
| Switching thresholds<br>Number<br>Adjustment range<br>Hysteresis<br>Relay contact<br>Load rating | independently assignable<br>4<br>sensor dependent<br>adjustable<br>floating changeover contact<br>60 V, 0.5 A DC / 30 V, 0.5 A AC | independently assignable<br>6<br>sensor dependent<br>adjustable<br>floating changeover contact<br>60 V, 0.5 A DC / 30 V, 0.5 A AC |
| Error message<br>Relay contact<br>Load rating | <br>floating normally open contact<br>60 V, 0.5 A DC / 30 V, 0.5 A AC | <br>floating normally open contact<br>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 | 90 - 250 / 50/60 |
| Power consumption W | < 45 | < 65 |
| Nominal temperature range °C | +5 to +50 | +5 to +50 |
| Weight kg (lbs) | 1.1 (2.43) | 1.2 (2.65) |
| Protection class IP | 20 | 20 |

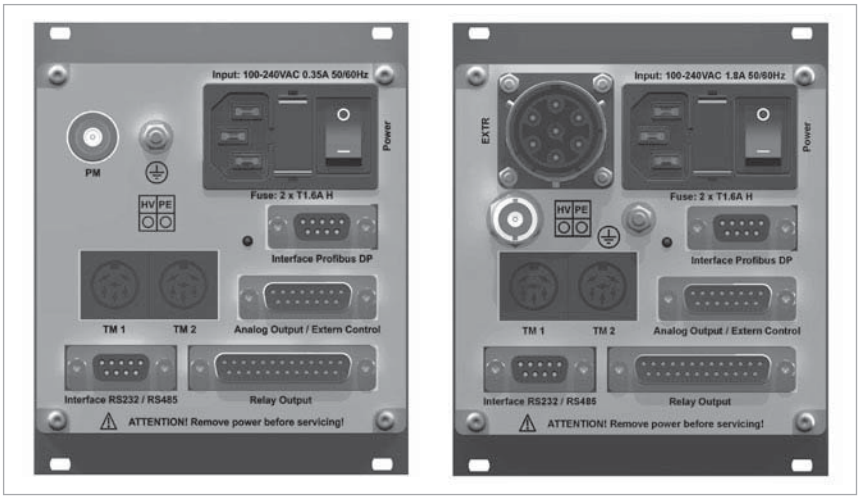
## Ordering Information

| | CENTER TWO<br>Part No. | CENTER THREE<br>Part No. |
|---|---|---|
| EURO version with 2 m EURO mains cord<br>US version with 2 m US mains cord | **230 004**<br>**235 004** | **230 003**<br>**235 003** |
| THERMOVAC, PENNINGVAC, CERAVAC and IONIVAC transmitters | see chapter “Products”, para. “Active Sensors” | see chapter “Products”, para. “Active Sensors” |
| Connection cables for<br>THERMOVAC and PENNINGVAC (Type A), CERAVAC Type B analog, Type C digital) and IONIVAC (Type C) | see chapter “Products”, para. “Connection Cables for Active Sensors” | see chapter “Products”, para. “Connection Cables for Active Sensors” |
| Screw terminal<br>for the 9-way output socket | **230 006** | **230 006** |

# Ultra High Vacuum Operating Units and Passive Sensors

# COMBIVAC CM 51/CM 52




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

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

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

## Advantages to the User

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

## Typical Applications

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

## Connectable Sensors

THERMOVAC

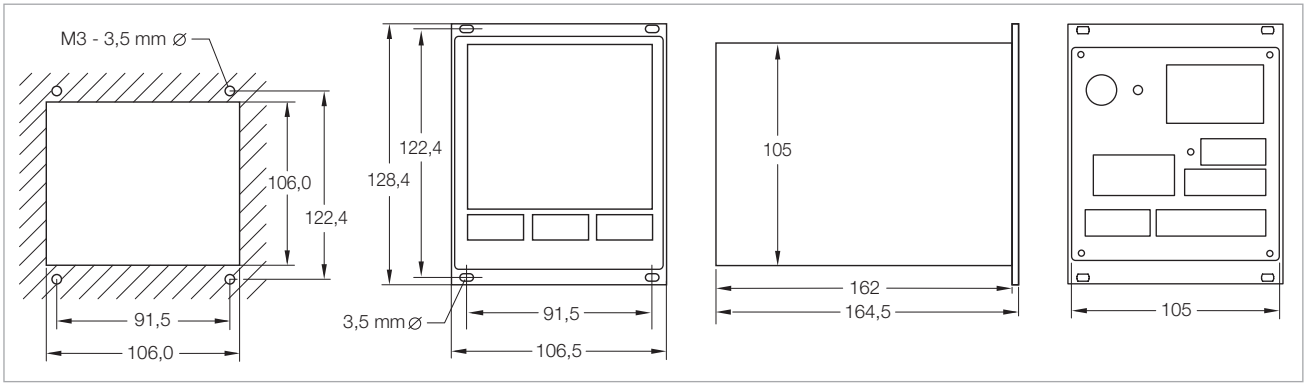
- TR 211
- TR 211 NPT
- TR 212
- TR 216

PENNINGVAC (only CM 51)

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

IONIVAC (only CM 52)

- IE 414
- IE 514




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

## Technical Data

## COMBIVAC

| | | CM 51 | CM 52 |
|---|---|---|---|
| Number of measurement channels | | 3 | 3 |
| Measurement range | | | |
| Channel 1, 2 (THERMOVAC) | mbar (Torr) | 5 x $10^{-4}$ to 1000 (3.5 x $10^{-4}$ to 750) | 5 x $10^{-4}$ to 1000 (3.5 x $10^{-4}$ to 750 |
| Channel 3 (PENNINGVAC) | mbar (Torr) | $10^{-9}$ to $10^{-2}$ ($10^{-9}$ to $10^{-2}$) | – |
| Channel 3 | | | |
| (IE 414 Bayard-Alpert) | mbar (Torr) | – | 2 x $10^{-11}$ to 1 x $10^{-2}$ (1.5 x $10^{-11}$ to 0.75 x $10^{-2}$) |
| (IE 514 Extractor) | mbar (Torr) | – | 2 x $10^{-12}$ to 1 x $10^{-4}$ (1.5 x $10^{-12}$ to 0.75 x $10^{-4}$) |
| Unit of measurement (selectable) | | mbar, Torr, Pa | mbar, Torr, Pa |
| Measurement uncertainty | | | |
| THERMOVAC | | ≤ 20% of the measured value in the range $10^{-3}$ to $10^{-2}$ mbar (± 20%) in the range $10^{-2}$ to $10^{2}$ mbar (± 15%) | ≤ 20% of the measured value in the range $10^{-3}$ to $10^{-2}$ mbar (± 20%) in the range $10^{-2}$ to $10^{2}$ mbar (± 15%) |
| PENNINGVAC | | ± 30% of the measured value in the range $10^{-8}$ to $10^{-4}$ mbar | – |
| IE 414/514 | | – | ± 10% of the displayed value (however, this value may increase depending on the type of application) |
| Measurement cable | m | up to 100 (application dependent) | up to 100 (application dependent) |
| Display for measured values | | digital, 7 segment LED, 4 digit mantissa and 2 digit exponent | digital, 7 segment LED 4 digit mantissa and 2 digit exponent |
| Type of gas (selectable) | | factor adjustable | factor adjustable |
| Switching thresholds | | 2 per channel | 2 per channel |
| Operating mode | | single, interval-trigger | single, interval-trigger |
| Adjustable switching thresholds | | | |
| THERMOVAC | mbar (Torr) | 5 x $10^{-3}$ to 500 (5 x $10^{-3}$ to 375) | 5 x $10^{-3}$ to 500 (5 x $10^{-3}$ to 375) |
| PENNINGVAC | mbar (Torr) | 1 x $10^{-8}$ to 9.9 x $10^{-3}$ (0.75 x $10^{-8}$ to 7.4 x $10^{-3}$) | – |
| Bayard-Alpert | mbar (Torr) | – | 1 x $10^{-8}$ to 5 x $10^{-3}$ (0.75 x $10^{-8}$ to 3.75 x $10^{-3}$) |
| Extractor | mbar (Torr) | – | 1 x $10^{-11}$ to 1 x $10^{-11}$ (0.75 x $10^{-11}$ to 0.75 x $10^{-11}$) |
| Switching relay hysteresis | | 10% of the trigger value (default), freely adjustable for THERMOVAC and PENNINGVAC | 10% of the trigger value (default), freely adjustable for THERMOVAC and IE 414 or 514 |
| Relay contact load rating | | AC/DC, max. 30 V / 1 A | AC/DC, max. 30 V / 1 A |
| Chart recorder output (default) | | 0 to 10 V, log. divisions linear: 3 decades, | 0 to 10 V, log. divisions linear: 3 decades, |
| THERMOVAC | | approximately 10.5 V in case of a failure, logarithmic: (1 x $10^{-3}$ mbar), 1.67 V/decade | approximately 10.5 V in case of a failure logarithmic: (1 x $10^{-3}$ mbar), 1.67 V/decade |
| PENNINGVAC | | logarithmic: (1 x $10^{-9}$ mbar), 1.43 V/ decade | – |
| IE 414 or 514 | | – | logarithmic: (1 x $10^{-12}$ mbar), 1.00 V/decade |
| Interface | | RS 232 C, RS 485 and Profibus | RS 232 C, RS 485 and Profibus |
| Mains connection 50/60 Hz | V AC | 100 - 240 | 100 - 240 |
| Power consumption | W | < 10 | 65 |
| Storage temperature range | °C | -20 to +60 | -20 to +65 |
| Nominal temperature range | °C | +5 to +50 | +5 to +50 |
| Max. rel. humidity | % n.c. | 80 | 80 |
| Weight | kg (lbs) | 1.4 (3.09) | 1.4 (3.09) |
| Dimension (W x H x D) | mm | 106.4 x 128.5 x 164.5 | 106.4 x 128.5 x 164.5 |
| Installation depth | mm | approx. 220 | approx. 220 |
| Protection class | IP | 40 | 40 |

## Ordering Information

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

# THERMOVAC Sensors
# TR 211 / TR 211 NPT / TR 212 / TR 216



These passive sensors use thermal conductivity technology according to Pirani.

### Advantages to the User

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

### TR 211

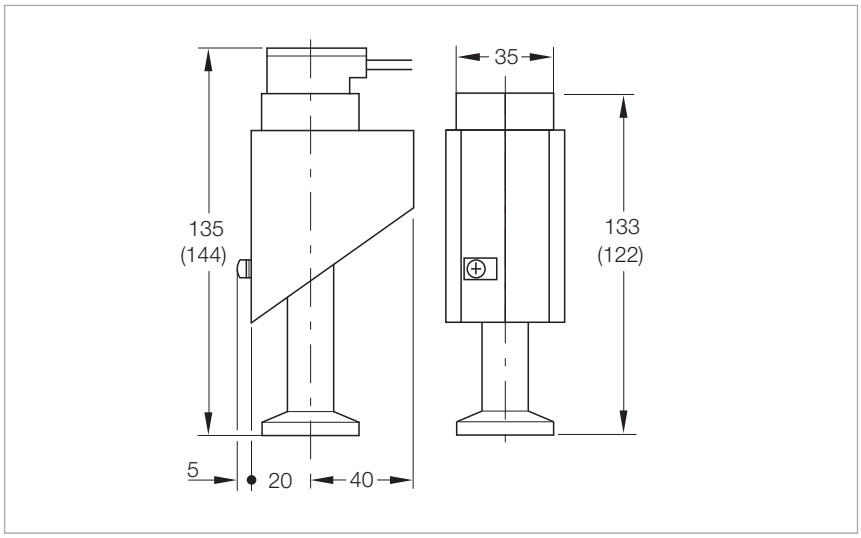
- Aluminum sensing cell with tungsten filament
- Improved temperature compensation

### TR 211 NPT/TR 212

- Stainless steel sensing cell with tungsten filament
- Overpressure resistant

### TR 216

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




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

## Technical Data

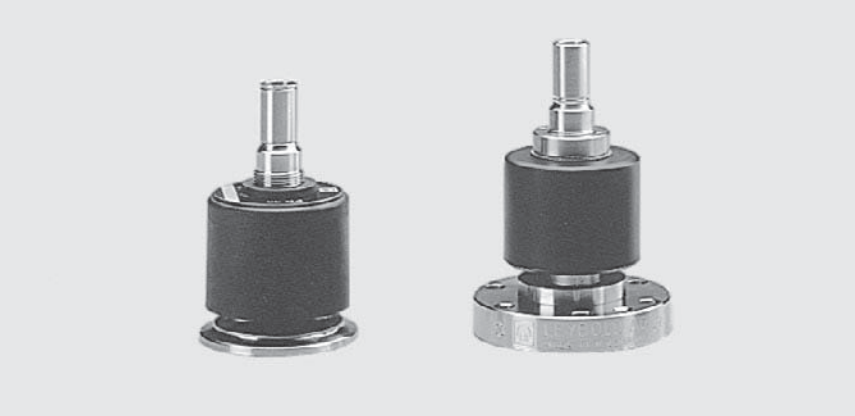
| | | TR 211 | TR 211 NPT | TR 212 | TR 216 |
|---|---|---|---|---|---|
| Measurement range | mbar (Torr) | 5 x $10^{-4}$ to 1000 (3.8 x $10^{-4}$ to 7.5 x $10^{2}$) | 5 x $10^{-4}$ to 1000 (3.8 x $10^{-4}$ to 7.5 x $10^{2}$) | 5 x $10^{-4}$ to 1000 (3.8 x $10^{-4}$ to 7.5 x $10^{2}$) | 5 x $10^{-4}$ to 1000 (3.8 x $10^{-4}$ to 7.5 x $10^{2}$) |
| Operating temperature range (compensated) | °C | 0 to +40 | 0 to +40 | 0 to +40 | 0 to +40 |
| Storage temperature range, max. | °C | 80 | 80 | 80 | 80 |
| Filament | | Tungsten | Tungsten | Tungsten | Platin |
| Filament temperature | °C | 110 | 110 | 110 | 110 |
| Permissible overload (abs.), max. | bar | 3 | 3 | 10 | 10 |
| Volume of the sensing cell, approx. | $cm^3$ | 11 | 11 | 11 | 11 |
| Vacuum connection | DN | 16 ISO-KF | 1/8" NPT | 16 ISO-KF/16 CF | 16 ISO-KF |
| Materials in contact with the medium | | Aluminum, Vacon, Glass, Tungsten CrNi 8020, | Stainless steel, Vacon, Glass, Tungsten CrNi 8020 epoxy cement | Stainless steel, Vacon, Glass, Tungsten CrNi 8020 | Stainless steel 1.4301 (SS 304), $Al_2O_3$[2], CrNi 8020, Platinum |
| Operating units | | THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20 | THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20 | THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20 | THERMOVAC TM 21, 22, 23 / COMBIVAC CM 31, 32, 33, 51 / PIEZOVAC PV 20 |



## Ordering Information

| | TR 211 | TR 211 NPT | TR 212 | TR 216 |
|---|---|---|---|---|
| | **Part No.** | **Part No.** | **Part No.** | **Part No.** |
| THERMOVAC sensors Series 200 | | | | |
| DN 16 ISO-KF | **157 85** | **–** | **158 52** | **157 87** |
| DN 16 CF | **–** | **–** | **157 86** | **–** |
| DN 1/8" NPT | **–** | **896 33** | **–** | **–** |
| Replacement sensing cell | **E 157 75** | **E 896 34** | **–** | **E 157 77** |

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



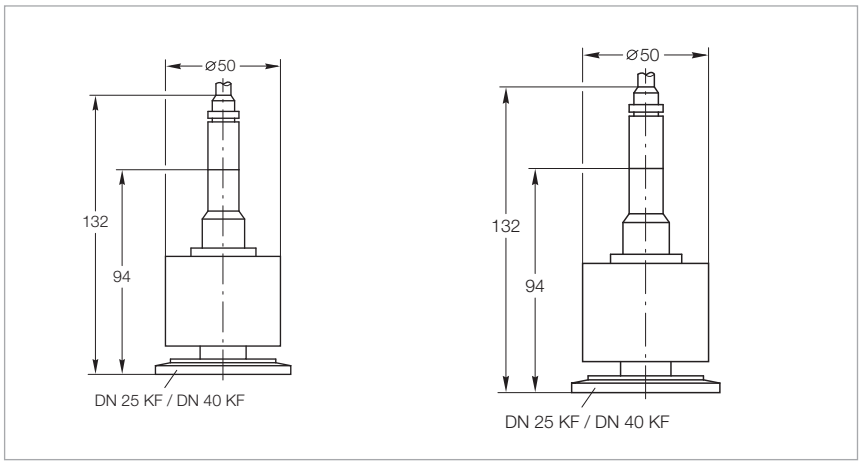
These passive sensors use cold cathode ionization technology according to Penning.

## Advantages to the User

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

## Option

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




Dimensional drawing for the PENNINGVAC PR sensors

## Technical Data

| | | PR 25 | PR 26 | PR 27 | PR 28 |
|---|---|---|---|---|---|
| Measurement range | mbar (Torr) | 1 x $10^{-9}$ to $10^{-2}$ (0.75 x $10^{-9}$ to $10^{-2}$) | 1 x $10^{-9}$ to $10^{-2}$ (0.75 x $10^{-9}$ to $10^{-2}$) | 1 x $10^{-9}$ to $10^{-2}$ (0.75 x $10^{-9}$ to $10^{-2}$) | 1 x $10^{-9}$ to $10^{-2}$ (0.75 x $10^{-9}$ to $10^{-2}$) |
| High voltage supply (anode potential) | | | | | |
| Trigger voltage | kV | 3.3 | 3.3 | 3.3 | 3.3 |
| Operation voltage | kV | 1.6 | 1.6 | 1.6 | 1.6 |
| Storage temperature range | °C | -25 to +80 | -25 to +80 | -25 to +80 | -25 to +80 |
| Nominal temperature range | °C | 0 to +80 | 0 to +80 | 0 to +80 | 0 to +200 |
| Bake out temperature (flange) | °C | – | – | – | 200 |
| Permissible overload (abs.) | bar | 6 [1] | 6 [1] | 6 [1] | 6 [1] |
| Dead volume | $cm^3$ | 21 | 21 | 21 | 21 |
| Materials in contact with the medium | | Stainless steel, Nichrome, Ceramics, Titanium | Stainless steel, Nichrome, Ceramics, Titanium | Stainless steel, Nichrome, Ceramics, Titanium | Stainless steel, Nichrome, Ceramics, Titanium |
| Weight, approx. | kg (lbs) | 0.75 (1.66) | 0.75 (1.66) | 0.8 (1.66) | 0.8 (1.66) |
| Vacuum connection | DN | 25 ISO-KF | 40 ISO-KF | 40 CF | 40 CF |
| Operating units | | COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31 | COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31 | COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31 | COMBIVAC CM 31, 32, 33, 51 / PENNINGVAC PM 31 |



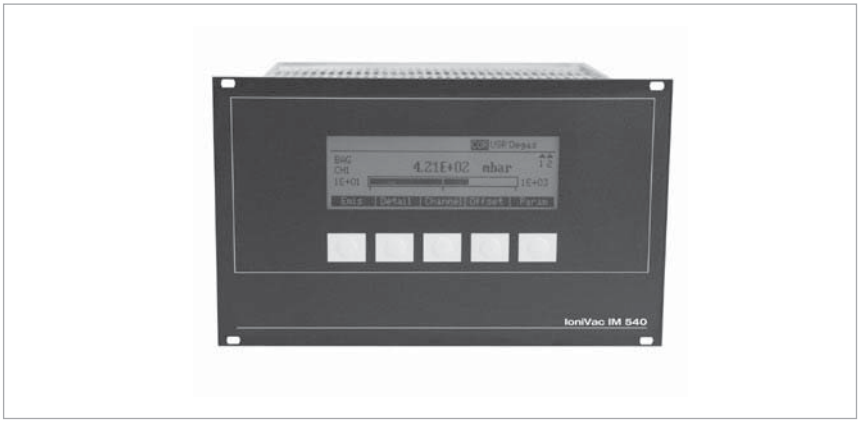
## Ordering Information

| | PR 25 | PR 26 | PR 27 | PR 28 |
|---|---|---|---|---|
| | **Part No.** | **Part No.** | **Part No.** | **Part No.** |
| PENNINGVAC sensors | **157 52** | **136 46** | **136 47** | **136 48** |
| Replacement cathode plate, titanium (5 pcs., incl. 5 ceramics discs) | **EK 162 91** | **EK 162 91** | **EK 162 91** | **EK 162 91** |
| Replacement anode ring | **200 28 711** | **200 28 711** | **200 28 711** | **200 28 711** |
| Baffle, with centering ring (FPM (FKM)) | | | | |
| DN 25 | **230 078** | **–** | **–** | **–** |
| DN 40 | **–** | **230 079** | **–** | **–** |

[1] When using an ultra sealing gasket at the vacuum connection

**Note:**
PR 26 replaces PR 31, 32, 35
PR 27 replaces PR 36

# IONIVAC IM 540




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

## Advantages to the User

- Precise UHV pressure measurements with the Bayard-Alpert sensor IE 414 (offering excellent longterm stability) or the Extractor sensor IE 514 (offering an extremely low X-ray limit of < 1 x $10^{-12}$ mbar)
- 1 measurement channel for IONIVAC sensor (Bayard-Alpert or Extractor)
- Possibility of simultaneously connecting a second IONIVAC sensor
- Degassing of the anode through electron bombardment with time-limit
- Continuous UHV measurement also during the degassing phase (up to +250 °C with bakeable gauge head cable)
- 2 measurement channels for direct connection of transmitters from the series THERMOVAC TTR and CERAVAC CTR
- Selectable pressure units (mbar, Torr, Pascal, Micron)
- Display of a single measurement channel with pressure trend through analogue bargraph or simultaneous display of all measurement channels
- Two adjustable thresholds with adjustable hysteresis and freely assignable to the measurement channels
- Compact benchtop enclosure (1/2 19", 3 HU)
- RS 232 C interface provided as standard
- Simple software updates possible through the RS 232 interface
- Profibus interface (optional)
- CE mark

## Typical Applications

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

## Connectable Sensors

- Bayard-Alpert sensor IE 414
- Extractor sensor IE 514

(see Chapter “Additional Sensors”)

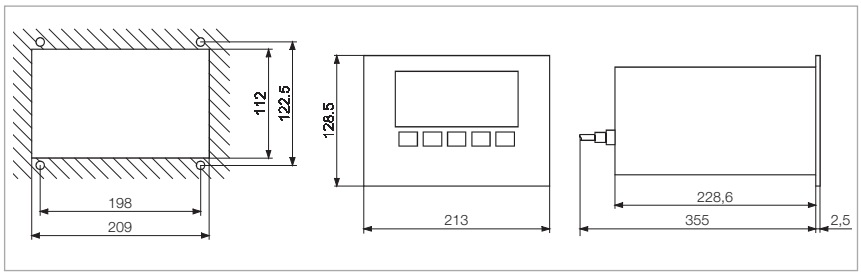
combined with

- THERMOVAC TTR 211, TTR 216 S, TTR 90, TTR 91 and TTR 96 S
- CERAVAC CTR 90, CTR 91 and CTR 100

(see Chapter “Active Sensors”)

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

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




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

## Technical Data

## IONIVAC IM 540

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

## Ordering Information

## IONIVAC IM 540

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

## Notes

# IONIVAC Sensors IE 414 and IE 514



These passive sensors use hot cathode ionization technology.

## IE 414

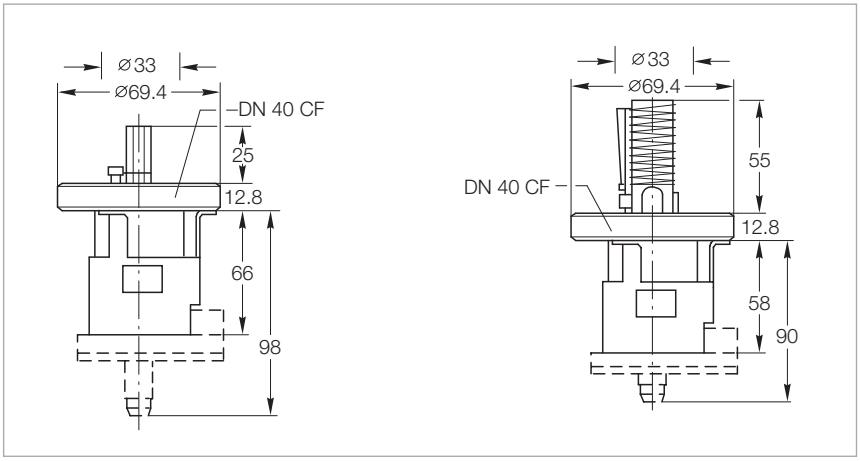
- Bayard-Alpert sensing system
- Measurement range to 2 x $10^{-11}$ mbar (1.5 x $10^{-11}$ Torr)
- Protection shield welded in place

## IE 514

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

## Advantages to the User

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




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

## Technical Data

| | | IE 414 | IE 514 |
|---|---|---|---|
| Measurement range | mbar (Torr) | 2 x $10^{-11}$ to $10^{-2}$ (1.5 x $10^{-11}$ to $10^{-2}$) | $10^{-12}$ to 1 x $10^{-4}$ ($10^{-12}$ to 7.5 x $10^{-5}$) |
| X-ray limit | mbar (Torr) | ≤ $10^{-11}$ (≤ $10^{-11}$) | ≤ $10^{-12}$ (≤ $10^{-12}$) |
| Operating temperature range | °C | 0 to +80 | 0 to +80 |
| Degassing temperature at the flange, max. | °C | 200 [1] / 350 [2] | 200 [1] / 350 [2] |
| Material | | | |
| Cathode | | Iridium with yttric oxid coating | Ilridium with yttric oxid coating |
| Feedthrough pins | | NiFe 42 | NiFe 42 |
| Anode | | Pt/Ir 90/10/pt wire | Mo and CoNiCr |
| Vacuum connection | DN | 40 CF | 40 CF |
| Adjustment data | | | |
| Ion detector potential | V | 0 | 0 |
| Cathode potential | V | 80 | 100 |
| Anode potential | V | 220 | 220 |
| Emission current | mA | 0.06 to 0.6 | 1.6 |
| Heating current for the hot cathode | A | 1.4 | 1.4 |
| Heating current for the hot cathode | V | .7 | 3.7 |
| Heating current for the hot cathode | mbar $^{-1}$ | 17.0 | 6.6 |
| Bake out operation, Electron bombardment | V / mA | 700 / 30 | 700 / 30 |
| Operating units | | IM 520, 510, 540 | IM 520, 510, 540 |

## Ordering Information

| | IE 414 | IE 514 |
|---|---|---|
| | **Part No.** | **Part No.** |
| IONIVAC sensors | **158 66** | **158 67** |
| Replacement cathode | **158 63** | **158 61** |

[1] With bakeable gauge head cable
[2] With gauge head cable detached

# Additional Sensors

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



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

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

### Advantages to the User

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

### Typical Applications

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

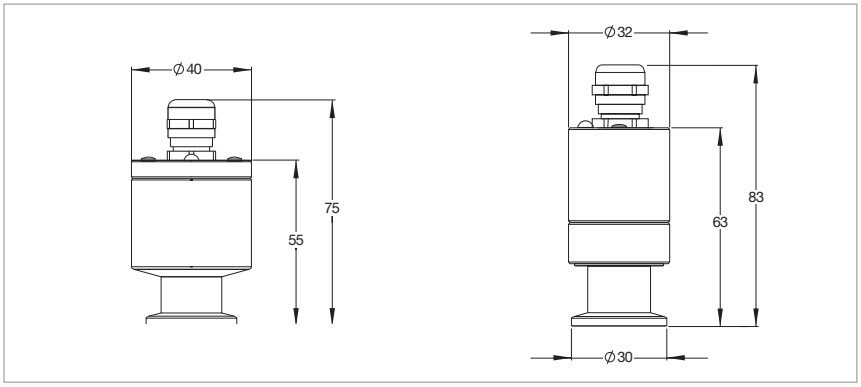
### Operating Units for DU sensors

DISPLAY

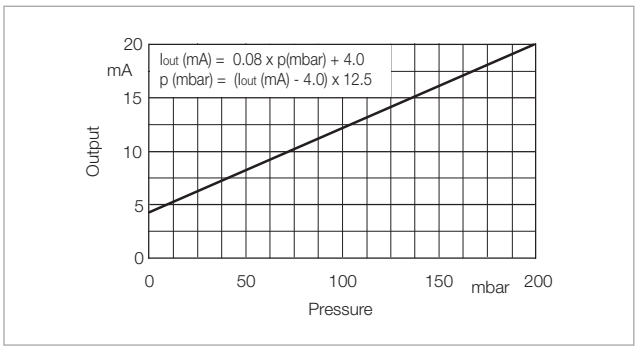
- ONE
- TWO
- THREE

CENTER

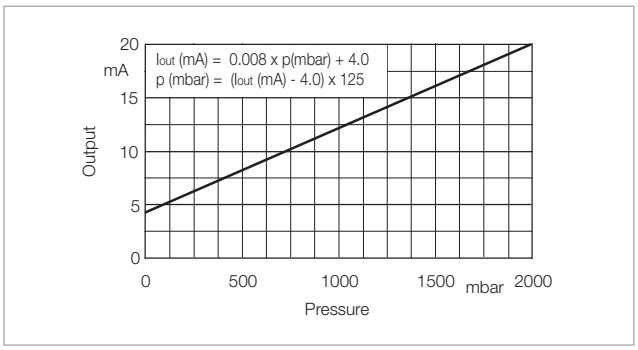
- ONE
- TWO
- THREE



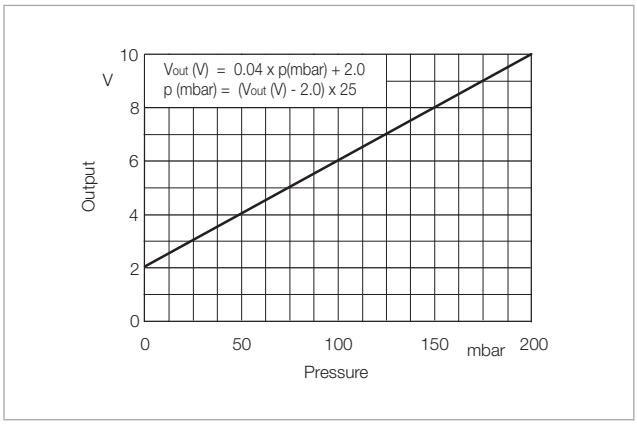

Dimensional drawing for the sensors
DI/DU 200 and DI/DU 201 (left), DI/DU 2000 and DI/DU 2001 (right)



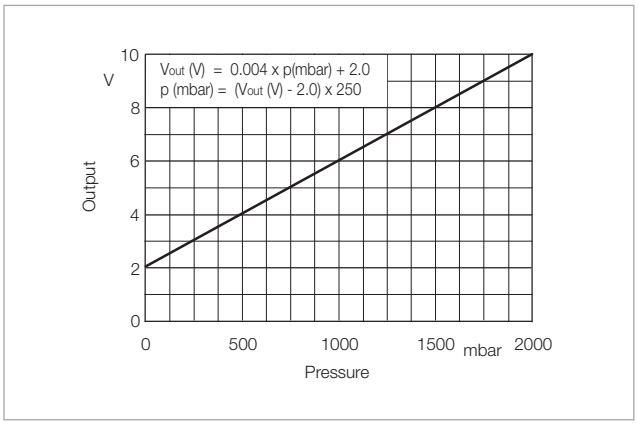

Characteristic of the DI 200 and DI 201 Sensors




Characteristic of the DI 2000 and DI 2001 Sensors




Characteristic of the DU 200 and DU 201 Sensors




Characteristic of the DU 2000 and DU 2001 Sensors

| Technical Data | | DI/DU 200 | DI/DU 201 | DI/DU 2000 | DI/DU 2001 | DI/DU 2001 rel. |
|---|---|---|---|---|---|---|
| Measurement range | mbar (Torr) | 0.1 to 200 (0.075 to 150) | 0.1 to 200 (0.075 to 150) | 1 to 2000 (0.75 to 1500) | 1 to 2000 (0.75 to 1500) | -1000 to +1000 (-750 to +750) relative pressure |
| Overload range, max. (flange side) | bar | 6 | 6 | 5 | 5 | 5 |
| Nominal temperature range | °C | 0 to +60 | 0 to +60 | 0 to +60 | 0 to +60 | 0 to +60 |
| Measurement uncertainty [1] | % FS | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 [3] |
| Repeatability | % FS | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Temperature error | | | | | | |
| Zero drift | % FS/10°K | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Sensitivity drift | % FS/10°K | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Measurement principle, gas type independent | | Capacitive | Capacitive | Piezoresistive | Piezoresistive | Piezoresistive |
| Sensing head supply | | | | | | |
| DI | | Two-wire system | Two-wire system | Two-wire system | Two-wire system | Two-wire system |
| DU | | Four-wire system | Four-wire system | Four-wire system | Four-wire system | Four-wire system |
| Output signal | | | | | | |
| DI | mA | 4 to 20 | 4 to 20 | 4 to 20 | 4 to 20 | 4 to 20 |
| DU | V | 2 to 10 | 2 to 10 | 2 to 10 | 2 to 10 | 2 to 10 |
| Supply voltage | | | | | | |
| Operating range | | | | | | |
| DI | V DC | 12 to 30 | 12 to 30 | 12 to 30 | 12 to 30 | 12 to 30 |
| DU | V DC | 14.5 to 30 | 14.5 to 30 | 14.5 to 30 | 14.5 to 30 | 14.5 to 30 |
| Dead volume | $cm^3$ | 3,9 | 3,9 | 1,8 | 1,8 | 1,8 |
| Vacuum connection | DN | 16 ISO-KF | 16 ISO-KF | 16 ISO-KF | 16 ISO-KF | 16 ISO-KF |
| Electrical connection | | | | | | |
| DI | | diode plug 7pole, cable 5 m | diode plug 7pole, cable 5 m | diode plug 7pole, cable 5 m | diode plug 7pole, cable 5 m | diode plug 7pole, cable 5 m |
| DU | | plug FCC 68, cable 5 m | plug FCC 68, cable 5 m | plug FCC 68, cable 5 m | plug FCC 68, cable 5 m | plug FCC 68, cable 5 m |
| Weight, approx. | | | | | | |
| DI | kg (lbs) | 0.36 (0.79) | 0.36 (0.79) | 0.26 (0.57) | 0.26 (0.57) | 0.26 (0.57) |
| DU | kg (lbs) | 0.34 (0.75) | 0.34 (0.75) | 0.24 (0.53) | 0.24 (0.53) | 0.24 (0.53) |
| Protection class | IP | 54 | 54 | 54 | 54 | 54 |
| Materials in contact with the medium | | Stainless Steel 1.4305 $Al_2O_3$ (96 %) Ceramics FPM (FKM) | Stainless Steel 1.4305 $Al_2O_3$ (96 %) Ceramics EPDM | Stainless Steel 1.4305 $Al_2O_3$ (96 %) Ceramics FPM (FKM) | Stainless Steel, 1.4305 $Al_2O_3$ (96 %) Ceramics, EPDM | Stainless Steel 1.4305 $Al_2O_3$ (96 %) Ceramics EPDM |
| Operating units | | | | | | |
| DI series | | – | – | – | – | – |
| DU series [2] | | DISPLAY ONE, TWO, THREE<br>CENTER ONE, TWO, THREE | DISPLAY ONE, TWO, THREE<br>CENTER ONE, TWO, THREE | DISPLAY ONE, TWO, THREE<br>CENTER ONE, TWO, THREE | DISPLAY ONE, TWO, THREE<br>CENTER ONE, TWO, THREE | DISPLAY ONE, TWO, THREE<br>CENTER ONE, TWO, THREE |

[1] Sum of linearity, hysteresis and reproducibility

[2] May possibly require a firmware update

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

## Ordering Information DI 200 DI 201 DI 2000 DI 2001 DI 2001 rel.

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

## Ordering Information DU 200 DU 201 DU 2000 DU 2001 DU 2001 rel.

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

# Older Sensors / Replacement Sensors



Linear pressure sensor



Replacement sensor TTR 211



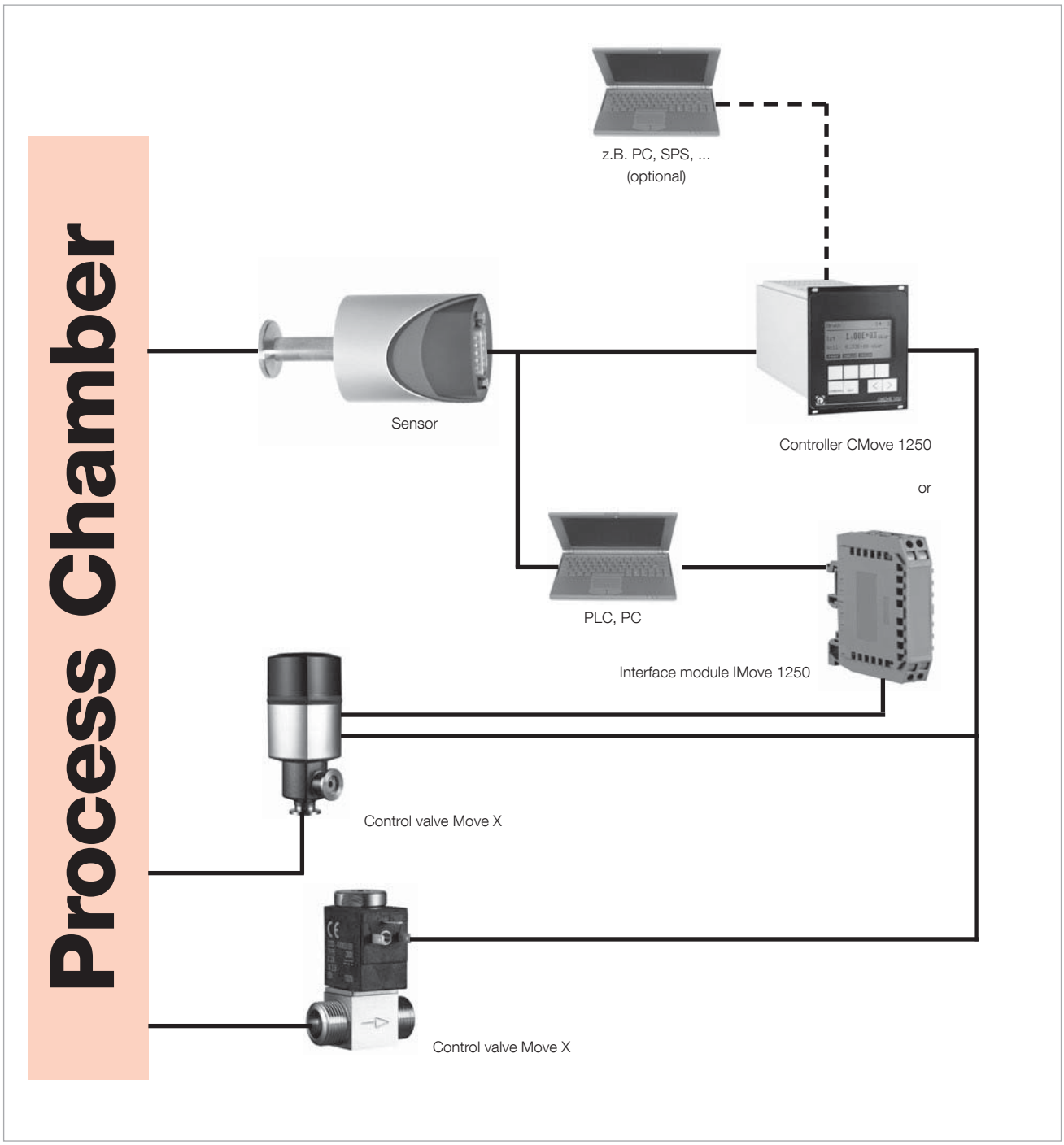
Replacement sensor TTR 216

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

[1)] For all DI-Sensors

## Notes

# Pressure Control System Move



# Control Valves Move 1250 and Move X



Control valve Move 1250

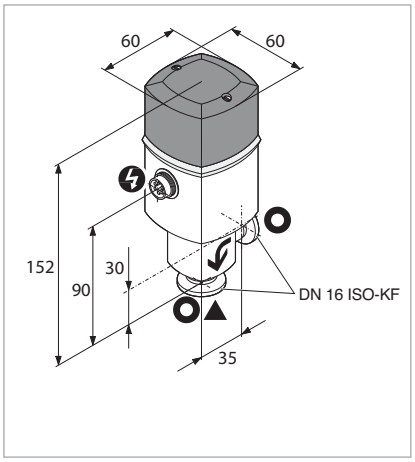


Control valve Move X

## Control Valve Move 1250

### Advantages to the User

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

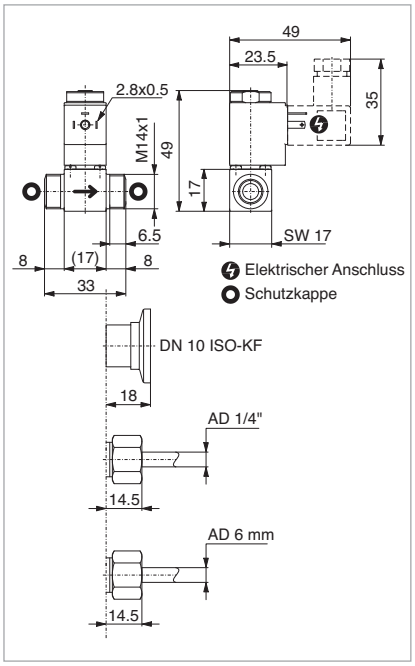



Dimensional drawing for the Move 1250

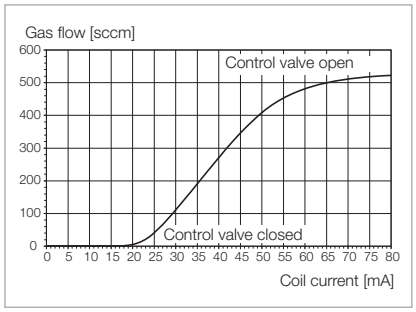
## Control Valve Move X

### Advantages to the User

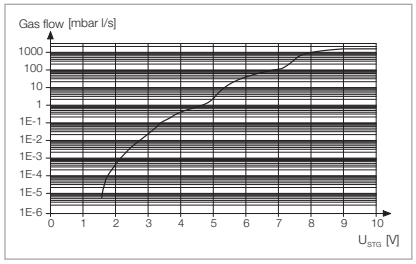
- 6 different valves for the gas flows ranging from 10 sccm FS to 5000 sccm FS
- Fast response
- Electromagnetic pressure regulation with variable gas flow (upstream regulation)
- Normally closed
- Many adapters are available




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 Δp = 1 bar for Move X




Gas flow curve of the Move 1250

## Technical Data

## Control Valve

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

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

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

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

## Ordering Information

## Control Valve

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

[1] To select the right components please ask us for information

# Controller CMove 1250




Controller CMove 1250

## Technical Applications

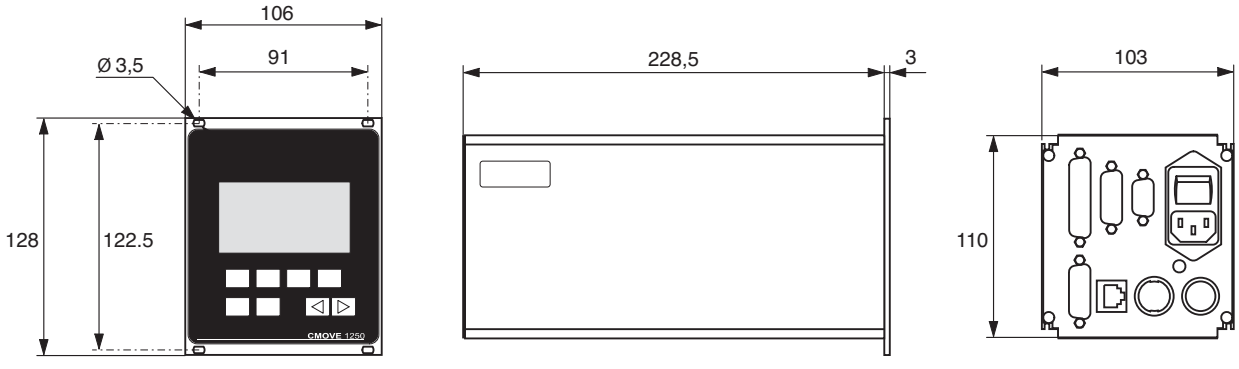
- Simple to operate
  - Self-explanatory LCD display and function keys
- Analog/digital inputs/outputs and interfaces
  - Digital input valve control, switch-over
    Pressure and gas flow adjustment
    Digital output valve control, error message
- Adjustable PID control algorithms
- 99 pre-programmed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

## Typical Applications

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

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

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




Dimensional drawing for the CMove 1250

## Technical Data

## Controller CMove 1250

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

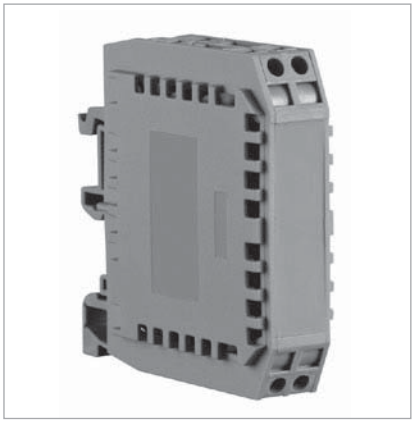
[1] Valid for sensor setting 0 to +10 V linear and analog output A02

## Ordering Information

## Controller CMove 1250

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

# Interface Module IMove 1250 for Move 1250



## Advantages to the User

- Status query and valve position

## Typical Applications

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

## Technical Data

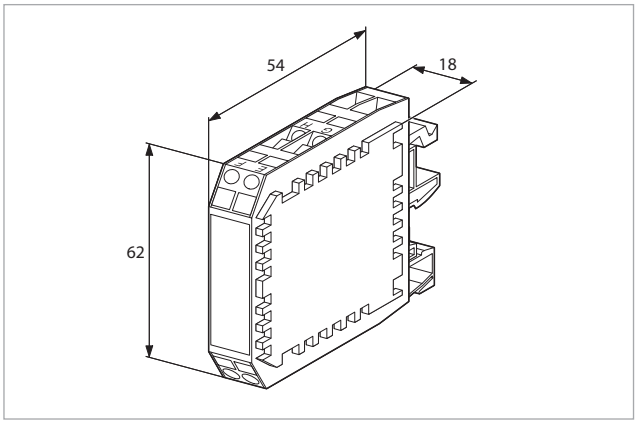
### Interface Module IMove 1250

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

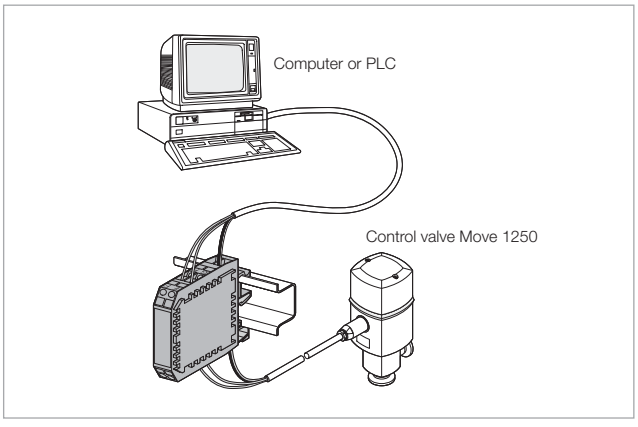
## Ordering Information

### Interface Module IMove 1250

| | Part No. |
|---|---|
| Interface-Modul IMove 1250 | **230 201** |




Dimensional drawing for the IMove 1250




Connection of the IMove 1250

# Low Pressure Safety Switch PS 113 A



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

## Advantages to the User

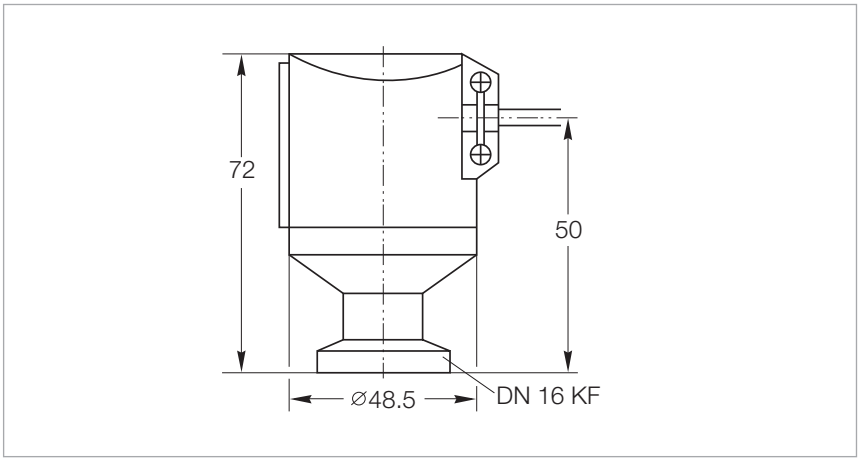
- Rugged design
- High switching capacity
- Corrosion protected
- Easy to use
- IP 44 protection
- Can be connected to a programmable control

## Typical Applications

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

## Technical Note

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




Dimensional drawing for the low pressure safety switch PS 113 A

## 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<br>30 mA / 24 V DC |
| Electrical connection | | 6.3 mm flat plug |
| Vacuum connection | DN | 16 ISO-KF |
| Helium permeation | mbar (Torr) | ≤ 5 x $10^{-5}$ |
| Dead volume | $cm^3$ | 2 |
| Materials in contact with the medium | | Stainless steel 1.4305, Stainless steel 1.4310,<br>Stainless steel 1.4300 PTFE coated, EPDM |
| Weight | g | 315 (0.70) |
| Protection class | IP | 44 |

## Ordering Information — Low Pressure Safety Switch

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

# Pressure Switch PS 115

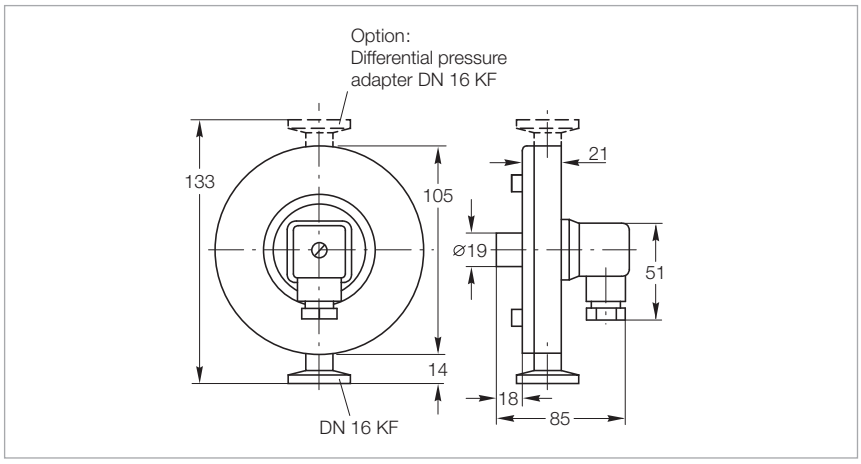


Rugged absolute pressure switch with electrical switching contact and a adjustable switching pressure between 0.5 and 2000 mbar (0.4 and 1500 Torr).

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

## Advantages to the User

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




Dimensional drawing for the pressure switch PS 115

## Technical Data — Pressure Switch PS 115

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

## Ordering Information — Pressure Switch PS 115

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

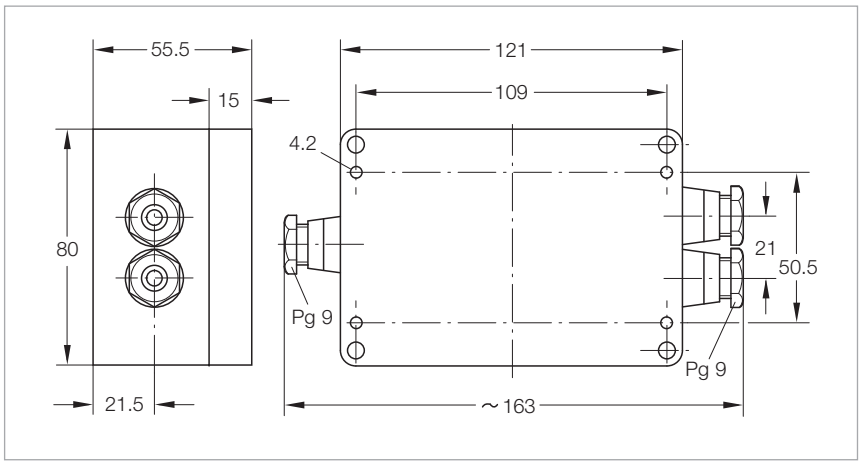
# Switching Amplifier SV 110

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

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

### Advantages to the User

- Increased ratings for the switch
- Changeover contact




Dimensional drawing for the switching amplifier SV 110

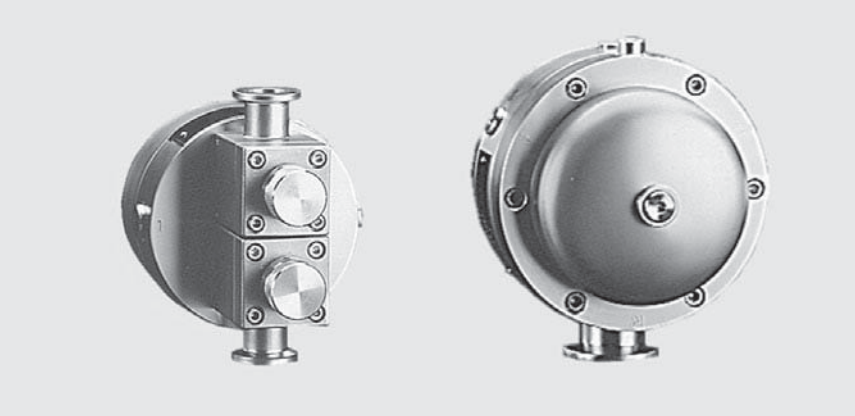
## Technical Data — Switching Amplifier SV 110

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

## Ordering Information — Switching Amplifier SV 110

| | Part No. |
|---|---|
| Switching amplifier SV 110 | **160 78** |

# Diaphragm Pressure Regulators MR 16/MR 50



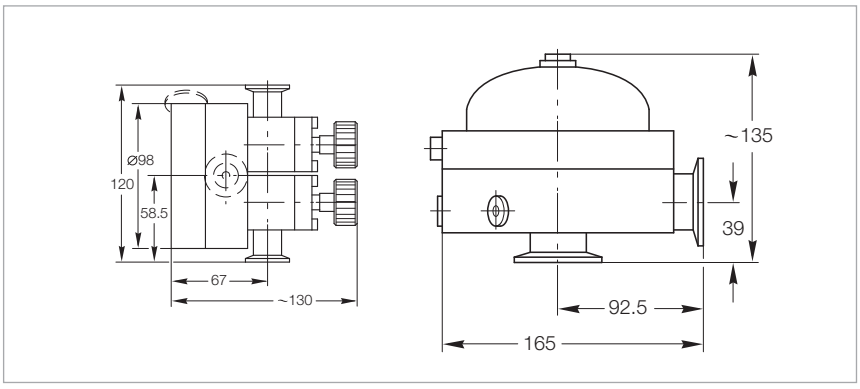
The MR 16/50 diaphragm regulators are absolute pressure regulators which automatically adapt the pumping speed of a vacuum pump depending on the amount of gas, without the need for an external power supply.

## Advantages to the User

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

## Typical Applications

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




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

## Technical Data

### Diaphragm Pressure Regulator

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

## Ordering Information

### Diaphragm Pressure Regulator

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

# Oerlikon Leybold Vacuum Calibration Service



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

## Advantages to the User

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

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

## Typical Applications

Calibrated vacuum gauges are used under the following conditions:

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

## DAkkS / Factory Calibration

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

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

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

Within the framework of the DAkkS, 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 calibration service are used. Thus traceability to national standards is ensured in both cases.

## Technical Data

## DAkkS Calibration

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

## Ordering Information

## DAkkS Calibration

| | Part No. | Part No. | Part No. |
|---|---|---|---|
| DAkkS calibration | **157 12** | **157 13** | **157 14** |

## Technical Data

## Factory Calibration

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

## Ordering Information

## Factory Calibration

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

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

# Product VACVISION

## Vacuum Controller for Monitoring and Controlling the entire Vacuum Process

## Applications

## Components supported by the VACVISION

| Rotary Vane Vacuum Pumps TRIVAC and Rotary Vane Vacuum Pumps SOGEVAC | VACVISION |
|---|---|
| S 1,5 | ■ |
| **TRIVAC** | |
| D 2.5 E | ■ |
| D 4 B | ■ |
| D 8 B | ■ |
| D 16 B | ■ |
| D 25 B | ■ |
| D 40 B | ● |
| D 65 B, D 65 B $^{3}$He | ● |
| D 16 B-DOT/ NT 16-DOT | ■ |
| D 16 B-Ex | ■ |
| D 16 BCS, D 25 BCS | ■ |
| D 40 BCS | ■ |
| D 65 BCS | ● |
| D 16 + D 25 BCS-PFPE | ■ |
| D 40 BCS-PFPE | ● |
| D 65 BCS-PFPE | ● |
| | |
| **SOGEVAC** | |
| SV 16, SV 25 | ■ |
| SV 40, SV 65 | ■ |
| SV 100 | |
| SV 200, SV 300 | ■ |
| SV 500, SV 630, SV 750 | |
| SV 1200 | |
| SV 10 B SV 16 B, SV 16 D | ■ |
| SV 25 B, SV 25 D | ■ |
| SV 40 B | ● |
| SV 65 B, SV 100 B, SV 120 B | ● |
| SV 300 B | ● |
| SV 500 B [1] | ● |
| SV 630 B(F), SV 750 B(F) | |
| SV 16 BI, SV 28 BI, SV 40 BI | ■ |
| SV 40 B Kategorie 1(i)/2(o) IIA | ■ |
| SV 40 B Kategorie 1(i)/2(o) IIB + H2 | ■ |
| SV 40 B Kategorie 3(i)/3(o) | ■ |

| Dry Compressing Scroll Pumps SCROLLVAC and Diaphragm Vacuum Pumps DIVAC | VACVISION |
|---|---|
| **SCROLLVAC** | |
| SC 5 D | ■ |
| SC 15 D | ■ |
| SC 30 D | ■ |
| SC 60 D | ● |
| | |
| **DIVAC** | |
| 0.6 to 2.2 | ■ |
| 0.6 L to 2.2 L | ■ |
| 1.2 L AD und 2.2 L AD | ■ |
| 0.8 T und 0.8 LT | ■ |
| 2.5 T und 2.5 VT | ■ |
| 3.5 TC und 4.8 VT | ■ |

| Turbomolecular Pumps TURBOVAC with Mechanical Rotor Suspension and Frequency Converter | VACVISION |
|---|---|
| **TURBOVAC** | |
| 50 | ■ |
| 151 (C) | ■ |
| 361 (C) | ■ |
| 600 C | ■ |
| 1000 C | ■ |
| 1100 C | ■ |
| T 1600 / T 1601 [2] | ■ |
| SL 80 | ■ |
| SL 300 | ■ |
| SL 700 | ■ |
| TW 250 S [3] | ■ |
| TW 501 | |
| TW 1600 [2] | ■ |
| TW 2401 | |
| | |
| **Frequency Converter** | |
| TURBOTRONIK NT 10 | ▲ |
| TURBO.DRIVE TD 20 classic | ■ |
| TURBO.DRIVE TD 300 | ■ |
| TURBO.DRIVE TD 400 | ■ |
| TURBO.DRIVE TD 700 | ■ |
| TURBO.DRIVE TD 35 | |
| TURBO.DRIVE TD 240 | |

[1] Up to 11 kW

[2] Integated Frequency Converter

[3] With and without integated Frequency Converter

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

# Components supported by the VACVISION

| Turbomolecular Pumps TURBOVAC with Magnetic Rotor Suspension and Frequency Converter | VACVISION |
|---|---|
| **TURBOVAC MAG** | |
| W 300 iP and W 400 iP | ■ |
| W 600 iP and W 700 iP | ■ |
| 1500 CT | ■ |
| W 300 P and W 400 P | ■ |
| W 600 P and W 700 P | ■ |
| W 830 and 830 C | ■ |
| W 1300 and 1300 C | ■ |
| W 1500 CT | ■ |
| W 2000 C and W 2000 CT | ■ |
| W 2200 C/T and W 2200 | ■ |
| W 2800 and C/CT | ■ |
| W 3200 and C/CT | ■ |
| | |
| **Frequency Converter** | |
| TURBO.DRIVE iS | ■ |
| MAG.DRIVE S | ■ |
| MAG.DRIVE digital | ■ |

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

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

| Active Sensors (Transmitter) | VACVISION |
|---|---|
| **Active Sensors** | |
| CTR 100/101 | ■ |
| TTR 91/91S/96S | ■ |
| TTR 100/100S2 | ■ |
| PTR 225/235S/237 | |
| PTR 90 | ■ |
| ITR 90 | ■ |
| ITR 200S | ■ |

■ = Direct connection is possible

# Products

## Vacuum Controller for Monitoring and Controlling the entire Vacuum Process

# **VAC**VISION




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

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

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

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

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

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

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

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

### Advantages to the User

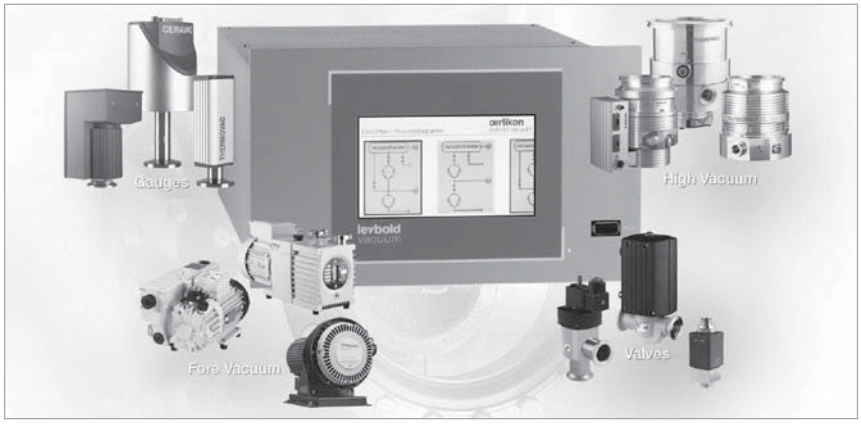
- Compact multipurpose vacuum controller
- Automatic control, controlling and regulating function of the vacuum system
- Simple configuration of vacuum systems with utmost flexibility
- Plug and play function
- Colour TFT grafic display 4.3", 480*272 pixel with touch panel
- USB interface (front panel)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

### Typical Applications

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

### Connectable Components

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




Full fore and high vacuum systems support

## Technical Data

## VACVISION

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

## Ordering Information

## VACVISION

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

# Accessories
## Connection Cables

| Technical Data | Mains Cable Set EU VACVISION |
|---|---|
| Mains cable set contains<br>1x EURO resp. IEC connector, male MAINS IN, ident. POWER IN, 3 m long<br>1x EURO resp. IEC connector, female for forepump, 1 m long<br>1x EURO resp. IEC connector, earthed plug, female for TMP heater, 1 m long | |

| Ordering Information | Mains Cable Set EU VACVISION |
|---|---|
| | **Part No.** |
| Mains cable set EU **VAC**VISION | **230415V01** |

| Technical Data | Mains Cable Set US VACVISION |
|---|---|
| Mains cable set contains<br>1x mains cord, ident. POWER IN, 3 m long<br>1x mains cord, ident. forepump, 1 m long<br>1x mains cord, ident. heater, 1 m long | |

| Ordering Information | Mains Cable Set US VACVISION |
|---|---|
| | **Part No.** |
| Mains cable set US **VAC**VISION | **230416V01** |

| Technical Data | Cable Set VACVISION 10 m |
|---|---|
| The cable set contains 10 m of each cable<br>1x Fan extension, ident. FAN COOLER<br>1x TMP pump (all except Anybus CC), D-Sub 9-way female/male, ident. RS 232<br>1x TMP pump (Anybus CC), D-Sub 9-way female/male, ident. RS 232 Anybus<br>2x valve cables M12 male, ident. PURGE and Vent<br>2x valve cables D-Sub 9-way male (with position indicator), ident. Valve and VV Valve<br>2x valve cables Phoenix 8-way, ident. X3 and X4<br>2x gauge heads, D-Sub 15-way female/male, ident. Gauge CTR/ITR; type C<br>2x gauge heads, D-Sub 15-way male/RJ 45, ident. Gauge PTR/TTR; type F<br>1x UPS , M9 male, ident. X17 USV | |

| Ordering Information | Cable Set VACVISION 10 m |
|---|---|
| | **Part No.** |
| Cable set **VAC**VISION 10 m | **230410V01** |

## Technical Data — Cable Set Limited VACVISION 5 m

The cable set contains 5 m of each cable

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

and plug

- 1 x valve plug, D-Sub 9-way male
- 2 x analog/digital I/O, Phoenix plug
- 1 x valve plug, M12 male EMC

## Ordering Information — Cable Set Limited VACVISION 5 m

| | Part No. |
|---|---|
| Cable set Limited **VAC**VISION 5 m | **230411V01** |

## Technical Data — Plug Set VACVISION

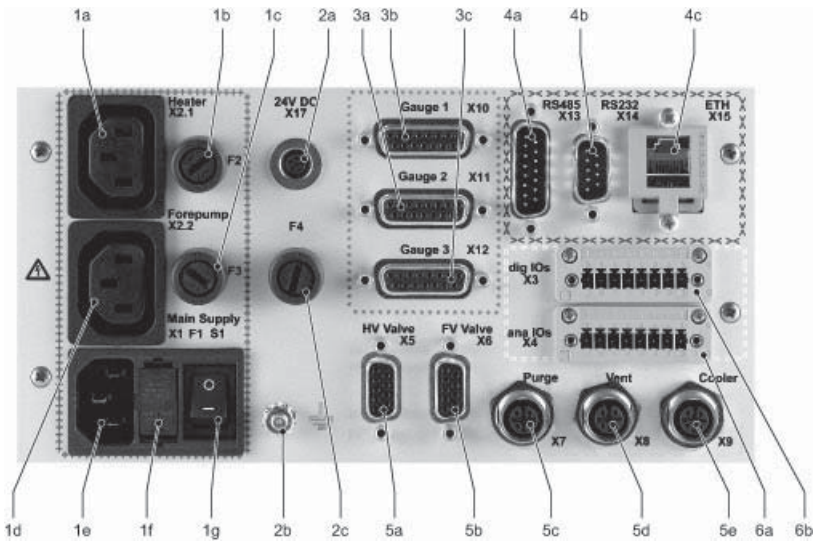
Plug set contains the following plugs

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

## Ordering Information — Plug Set VACVISION

| | Part No. |
|---|---|
| Plug set **VAC**VISION | **230420V01** |

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




5d Venting valve without return signalling X8
M12 socket 24 V DC/12 W
5e Cooler valve without return signalling X9
M12 socket 24 V DC/12 W

6a Terminal strip X4
(X3, X4 totalling 12 W)
6b Terminal strip X3
(X3, X4 totalling 12 W)

Rear side of the **VAC**VISION

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

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

[1] The electrical box is required for pumps > 750 W

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

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

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

| | Part No. |
|---|---|
| **Turbomolecular pumps with magnetic rotor suspension (control via RS 232 C) with integrated or separate electronic frequency converter MAG.DRIVE iS or MAG.DRIVE S** | |
| TURBOVAC MAG W 300 iP | |
| DN 100 ISO-K | **410300V0505** |
| DN 100 CF | **410300V0506** |
| TURBOVAC MAG W 400 iP | |
| DN 160 ISO-K | **410400V0505** |
| DN 160 CF | **410400V0506** |
| TURBOVAC MAG W 600 iP | |
| DN 160 ISO-K | **410600V0505** |
| DN 160 CF | **410600V0506** |
| TURBOVAC MAG W 700 iP | |
| DN 200 ISO-K | **410700V0505** |
| DN 200 CF | **410700V0506** |
| TURBOVAC MAG W 300 P | |
| DN 100 ISO-K | **410300V0005** |
| DN 100 CF | **410300V0006** |
| TURBOVAC MAG W 400 P | |
| DN 160 ISO-K | **410400V0005** |
| DN 160 CF | **410400V0006** |
| TURBOVAC MAG W 600 P | |
| DN 160 ISO-K | **410600V0005** |
| DN 160 CF | **410600V0006** |
| TURBOVAC MAG W 700 P | |
| DN 200 ISO-K | **410700V0005** |
| DN 200 CF | **410700V0006** |
| TURBOVAC MAG W 1500 CT | |
| DN 200 ISO-F | **400026V0002** |
| DN 250 ISO-F | **400027V0002** |
| DN 250 CF | **400030V0002** |

| | |
|---|---|
| **Turbomolecular pumps with magnetic rotor suspension (control via RS 232 C) with separate electronic frequency converter MAG.DRIVE iS, MAG.DRIVE S or MAG.DRIVE digital** | Part Nos. see Catalog Part "High Vacuum Pumps" Section "Turbomolecular Pumps TURBOVAC MAG" |
| TURBOVAC MAG 1500 CT | |
| TURBOVAC MAG W 830 (C) | |
| TURBOVAC MAG W 1300 (C) | |
| TURBOVAC MAG W 2000 C/CT | |
| TURBOVAC MAG W 2000 | |
| TURBOVAC MAG W 2200 C/CT | |
| TURBOVAC MAG W 2800 C/CT | |
| TURBOVAC MAG W 3200 C/CT | |

## Notes

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