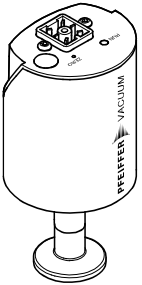
A PASSION FOR PERFECTION

PFEIFFER VACUUM



CMR 361 … CMR 365

Ceramic Capacitance Gauge

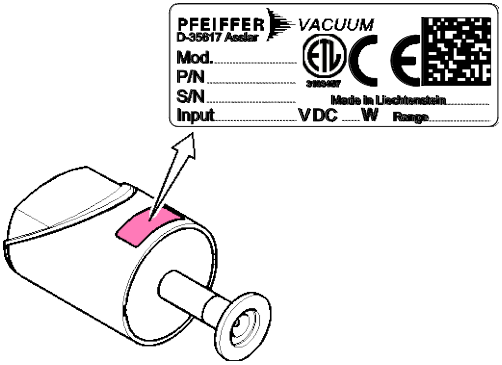
Operating instructions

BG 5136 BEN / C (2019-06)

EN

Product identification

The details on the rating plate are required when communicating with Pfeiffer Vacuum. Therefore, you must specify these details.



Validity

This document is applicable for products with the part numbers:

Type	Part number	Flange	Measuring range min. (0 V) [hPa] [*Pascal*]	Measuring range F.S. (9 V) [hPa] [*Pascal*]	Measuring range max. (9.8 V) [hPa] [*Pascal*]
CMR 361	PT R24 600	½" tube	10^{-1} *10^{1}*	1,000 *100,000*	1,100 *110,000*
	PT R24 601	DN 16 ISO-KF			
	PT R24 602	DN 16 CF-R			
	PT R24 603	8 VCR®			
CMR 362	PT R24 610	½" tube	10^{-2} *10^{0}*	100 *10'000*	110 *11'000*
	PT R24 611	DN 16 ISO-KF			
	PT R24 612	DN 16 CF-R			
	PT R24 613	8 VCR®			
CMR 363	PT R24 620	½" tube	10^{-3} *10^{-1}*	10 *1,000*	11 *1,100*
	PT R24 621	DN 16 ISO-KF			
	PT R24 622	DN 16 CF-R			
	PT R24 623	8 VCR®			
CMR 364	PT R24 630	½" tube	10^{-4} *10^{-2}*	1 *100*	1.1 *110*
	PT R24 631	DN 16 ISO-KF			
	PT R24 632	DN 16 CF-R			
	PT R24 633	8 VCR®			
CMR 365	PT R24 640	½" tube	10^{-5} *10^{-3}*	0.1 *10*	0.11 *11*
	PT R24 641	DN 16 ISO-KF			
	PT R24 642	DN 16 CF-R			
	PT R24 643	8 VCR®			

The part number (P/N) can be obtained from the rating plate.

Figures with no designation relate to gauge CMR 361 with vacuum connection DN 16 ISO-KF. These characteristics apply for all other gauges accordingly.

We reserve the right to make technical changes without prior notification.

All dimensions stated in mm.

Intended use

The Ceramic Capacitance Gauges from the CMR 36X series are vacuum gauges and enable the measuring of absolute pressure of gases in diverse measuring ranges (→ 🗎 3).

Function

The CMR gauge comprises a ceramic capacitive sensor element and an electronic circuit that converts the capacity into a direct voltage output signal.

The output signal is linear with the measured pressure and is independent of the gas type being measured.

Type

VCR® Swagelok Marketing Co.

Patents

EP 1070239 B1, 1040333 B1

US patents 6528008, 6591687, 7107855, 7140085

Scope of delivery

1× CMR 36X gauge
1× stylus
1× calibration certificate
1× operating instructions German
1× operating instructions English
1× operating instructions French

Contents

The (→ 🗎 XY) symbol is used for page references within the text.

1 Safety

1.1 Symbols used

DANGER

Information to prevent any kind of injury to persons.

WARNING

Information to prevent extensive damage to property and the environment.

Caution

Information on handling or use. Failure to observe can lead to malfunctions or minor material damage.

Note

1.2 Personnel qualifications

Skilled personnel

The work described in this document may only be carried out by persons that have suitable technical training and the necessary experience or have been trained accordingly by the operating company.

1.3 General safety instructions

- When handling the respective process media, observe the relevant guidelines and adhere to the safety measures.

  Consider possible reactions between materials and process media.

- All work is only permissible when observing the relevant guidelines and adhering to the protective measures. Additionally, observe the safety instructions specified in this document.

- Inform yourself about any contamination before starting work. When handling contaminated parts, observe the relevant regulations and implement the safety measures.

Pass on safety instructions to all other users.

1.4 Responsibilities and warranty

Pfeiffer Vacuum shall assume no liability nor provide any warranty if the operating company or a third party

- disregards this document
- does not use the product for its intended purpose
- tampers with the product in any way (conversions, modifications, etc.)
- operates the product with accessories that are not listed in the corresponding product documentation.

The operating company is responsible for the process media being used.

Malfunctioning of the gauge as a direct result of contamination is not covered by the warranty.

2 Technical data

Measuring range	→ "Validity"
Accuracy [1]	
PT R24 600 … PT R24 633	0.2% of measured value
PT R24 640 … PT R24 643	0.5% of measured value
Temperature influence at zero point	
PT R24 600 … PT R24 623	0.005% F.S./ °C
PT R24 630 … PT R24 633	0.015% F.S./ °C
PT R24 640 … PT R24 643	0.02% F.S./ °C
Temperature influence in range	
PT R24 600 … PT R24 633	0.01% of measured value / °C
PT R24 640 … PT R24 643	0.03% of measured value / °C
Resolution	0.003% F.S.
Gas type dependence	None

Output signal analog (measuring signal)	
Voltage range	0 … +11 V
Measuring range	+1.0 … +9.8 V
Relation voltage-pressure	Linear
Error signal	<0.4 V (no supply, sensor error) >9.8 V (above the range ("over-range")
Output impedance	<10 Ω
Load impedance	10 kΩ (short-circuit-proof)
Response time	
PT R24 600 … PT R24 633	30 ms
PT R24 640 … PT R24 643	130 ms

[1] Non-linearity, hysteresis, repeat accuracy within calibrated range at 25 °C ambient temperature without influence of temperature after 2 hours of operation.

Identification of gauge	Resistance 13.2 kΩ against supply earth

Supply

DANGER

The gauge may only be connected to supply devices or measurement instruments that comply with the requirements of the earthed protective extra low voltage (PELV). Protection must be provided for the cable leading to the gauge.

Supply voltage	
at the gauge	+14 … +30 VDC
ripple	≤1 V_{pp}
Power input	<500 mA (max. switch-on current)
Power input (dependent on supply voltage)	≤1.0 W
Internal fuse	1 AT (slow), automatic reset (polyfuse)

Gauge is protected against polarity reversal of the supply voltage.

Electric connection	Compact connector Hirschmann , type GO 6, 6-pin, contact pins
Measurement cable	5-pin, including shielding
Cable length	≤120 m (0.25 mm² conductor)

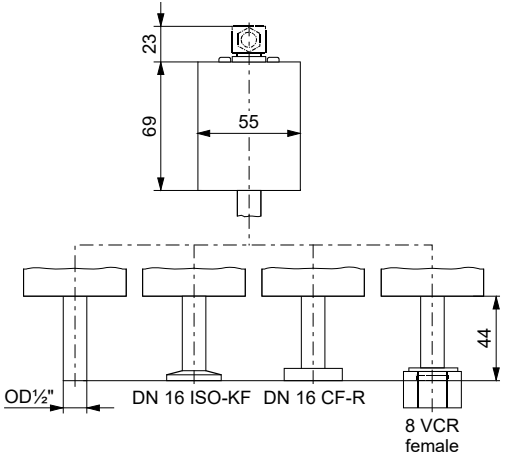
Larger conductor cross sections are required for longer cables ($R_{conductor}$ ≤1.0 Ω).

Earthing concept	
Vacuum flange – signal earth	→ "Electric connection"
Supply earth – signal earth	arranged separately for differential measurement (10 Ω)

Material against vacuum	
Flange, tube	Stainless steel AISI 316L
Sensor and diaphragm	Ceramic (Al_2O_3 ≥99.5%)
Connection sensor–diaphragm	Glass ceramic solder
Connection ceramic–metal	AgTiCu-hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
Internal volume	≤3.6 cm^3
Maximum pressure (absolute)	
PT R24 600 … PT R24 603	300 kPa
PT R24 610 … PT R24 633	200 kPa
PT R24 640 … PT R24 643	130 kPa
Burst pressure (absolute)	500 kPa

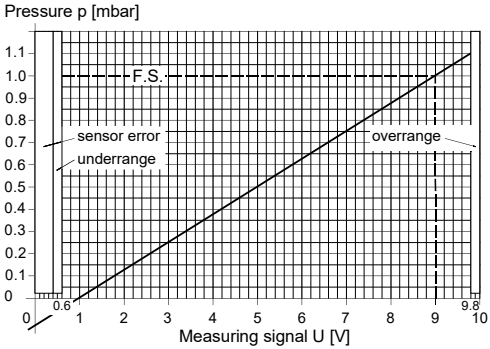
Permissible temperature	
Storage	–40 °C … +65 °C
Operation	+5 °C … +50 °C
Bake out (when not in operation)	≤110 °C at flange
Relative humidity	≤80% at temperatures ≤+31 °C reducing to 50% at +40 °C
Use	Indoors only, altitude up to 2,000 m (mean sea level)
Protection category	IP 30

Dimensions [mm]



Weight	≤370 g

Relation measuring signal analog – pressure



$$p = (U - 1) \times c\ (F.S.)$$

	hPa	Pa	Torr
c	0,125	12.5	0,094

Example: Gauge CMR 361 with 1,000 hPa F.S.
Measuring signal U_{out} = 6 V

$$p = (6\ V - 1\ V) \times 0.125 \times 1{,}000\ hPa$$
$$= \mathbf{625\ hPa}$$

3 Installation

WARNING

WARNING: Risk of breakage

Impacts can destroy the ceramic sensor.

Avoid harsh impacts and never allow the product to drop to the floor.

3.1 Vacuum connection

DANGER

DANGER: Overpressure in the vacuum system >100 kPa

Opening tensioning pieces with overpressure in the vacuum system can lead to injuries as a result of flying parts, and escaping process medium could prove harmful to health.

Never open tensioning pieces when overpressure is prevalent in the vacuum system. Use tensioning pieces suitable for overpressure.

DANGER

DANGER: Overpressure in the vacuum system >250 kPa

Elastomer seals (e.g. O-rings) are no longer capable of withstanding the pressure for KF-connections. This could prove harmful to health due to escaping process medium.

Use O-rings with an external centering ring.

DANGER

DANGER: Protective earth

Products that are not properly grounded can cause fatal injuries in the event of a fault.

The gauge must be galvanically connected with the earthed vacuum chamber. The connection must comply with the requirements of a protective bonding according to EN 61010:

- CF and VCR connections comply with this requirement.
- An electrically conductive circlip must be used for KF connections.
- Compliance with this requirement for ½"-tube can be achieved by applying suitable measures.

Caution

Caution: Vacuum components

Dirt and damage impair the function of the vacuum component.

When handling vacuum components, observe the rules relating to cleanliness and protection against damage.

Caution

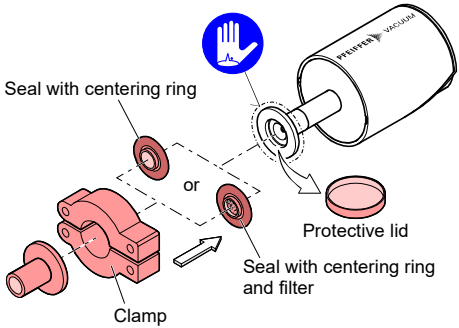
Caution: Area sensitive to contamination

Touching the product, or parts of the product with bare hands will increase the rate of desorption.

Wear clean, lint-free gloves and use clean tools.

Install the gauge vibration-free wherever possible. The installation position is arbitrary. To prevent condensate and particles accumulating in the measurement chamber, the installation position should be horizontal or upright, and a seal with centering ring and filter must be fitted where necessary. If calibration of the gauge is possible in the installed condition, you must ensure easy access to the buttons with a pin (→ 18).

Remove the protective cap and connect the product to the vacuum system.



Store the protective cap in a safe place.

3.2 Electrical connection

The gauge must be correctly connected to the vacuum equipment (→ 🗎 13).

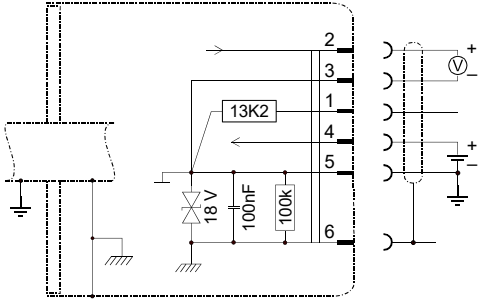
DANGER

The gauge may only be connected to supply devices or measurement instruments that comply with the requirements of the earthed protective extra low voltage (PELV). Protection must be provided for the cable leading to the gauge.

Earth loops, potential differences or EMC can influence the measuring signal. Please observe the following notes on installation to ensure optimum signal quality:

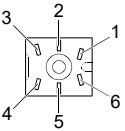
- Connect the cable shielding with the earth via the connector housing on one side only. Leave the other end of the shielding open.
- Connect the supply earth directly with protective earth for power supply pack.
- Use the differential measuring input (separate signal- and supply earth).
- Potential difference between supply earth and housing ≤18 V (overvoltage protection)

❶ If no measurement cable is present, a measurement cable can be fitted in accordance with the following diagram.



Electrical connection

Pin 1	Gauge identification
Pin 2	Signal output (measuring signal)
Pin 3	Signal common
Pin 4	Supply
Pin 5	Supply common
Pin 6	Chassis ground



Connector, soldering side

- The cable must be shielded and grounded as indicated in the above Illustration and the Grounding concept *).
- Connect the cable shield to ground on the gauge side via Pin 6. Do not connect the other side of the shield to prevent a ground circuit.

*) → "Technical Data"

❷ Connect the measurement cable to the gauge and secure the cable connector using the locking screw.

❸ Connect the measurement cable to the measurement instrument.

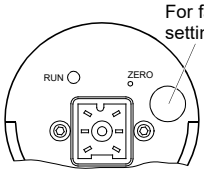
4 Operation

Start up the gauge.

Warm-up period

- for general pressure measurements (within the specifications) >¼ of an hour
- for precision measurements and zero point calibration >2 hours

4.1 Indicate (to)



LED	Condition	Meaning
<RUN>	lights up	Measuring mode
	is flashing	Other mode, error, outside of measuring range

4.2 Calibrating the gauge

The gauge is calibrated in the vertical upright position before leaving the factory (→ "Calibration Test Report").

We recommend setting the zero point for initial operation.

Long-term operation and contamination can lead to a zero point shift, and may also necessitate a periodic zero adjustment.

Perform a zero adjustment for identical and constant ambient conditions and with the same installation position in which the gauge is normally used.

The output signal is dependent upon the installation position. Shifting from a vertical upright position to a horizontal position constitutes:

F.S.	ΔU / 90°
1000 hPa	≈2 mV
100 hPa	≈10 mV
10 hPa	≈50 mV
1 hPa	≈300 mV
0.1 hPa	≈1.8 V

If the gauge is operated with a measurement instrument, the zero adjustment must be performed at the measurement instrument for the entire measuring system: Calibrate the gauge first, and then the measurement instrument.

4.2.1 <ZERO> Adjust

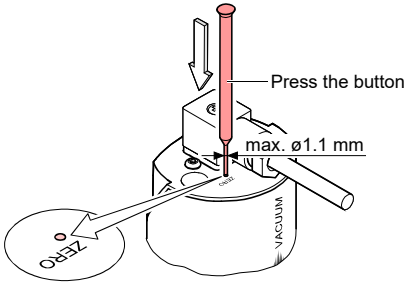
❶ Evacuate the gauge up to the pressure stipulated in the following table:

	Recommended ultimate pressure for zero adjustment		
1,100 hPa	<4×10^{-2} Torr	<5×10^{-2} hPa	<5×10^{-2} mbar
110 hPa	<4×10^{-3} Torr	<5×10^{-3} hPa	<5×10^{-3} mbar
11 hPa	<4×10^{-4} Torr	<5×10^{-4} hPa	<5×10^{-4} mbar
1.1 hPa	<4×10^{-5} Torr	<5×10^{-5} hPa	<5×10^{-5} mbar
0.11 hPa	<1×10^{-5} Torr	<1×10^{-5} hPa	<1×10^{-5} mbar

If the ultimate pressure is too high during zero adjustment (>25% of F.S.), zero is no longer achievable and the LED <RUN> starts flashing. In this case, first activate the factory settings and then calibrate the zero point again (→ 🗎 22).

❷ Operate the gauge for at least 2 hours (until the measured value stabilizes).

❸ Push the <ZERO> button briefly with a pin (max. ø1.1 mm). The zero point is calibrated automatically. The LED <RUN> continues to flash until calibration is complete (duration ≤8 s).



Following calibration of the zero point, the gauge returns automatically to measuring mode. The LED <RUN> lights up.

The LED <RUN> flashes

- if the transmitter is indicating a negative output signal (> 22 mV) with ultimate pressure, or
- if calibration of the zero point has failed.

4.2.2 <ZERO> Adjust with ramp function

The ramp allows the zero point to be set with an established reference pressure that is within the measuring range of the gauge.

Furthermore, an offset of the characteristic can be set with the ramp in order to

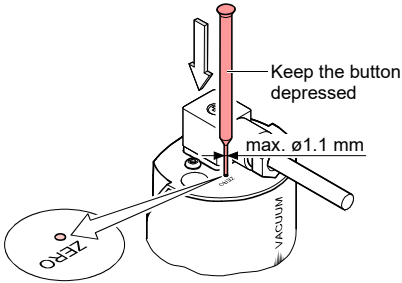
- compensate an offset from the measurement system, or
- to generate a slightly positive zero point for a 0 … 10 V AD-converter.

The offset should not be greater than 2% of the F.S. (+160 mV). A greater positive offset will exceed the upper measuring range limit.

Recommended procedure for offset adjustment for measurement systems: → Note 19.

1. Operate the gauge for at least ¼ of an hour (until the measured value stabilizes).

2. Push the <ZERO> button with a pin (max. ø1.1 mm), and hold pressed. The LED <RUN> starts to flash. After 5 s, the zero-adjust value is continuously (ramp) changed from the current output value until the button is released or the setting limit (max. 25% F.S.) is reached. The signal is issued with a delay of approx. 1 s at the signal output.



❸ Press the <ZERO> button again:

Fine adjustment within 0...3 s:	Zero-adjust value changes by one unit (press button approx. 1 x every second)
Direction change within 3...5 s:	Zero-adjust setting changes the direction (flash frequency of the LED <RUN> changes briefly)

If the <ZERO> button is not pressed again within a period of 5 s, the gauge returns to measuring mode.

The LED <RUN> starts to flash when the gauge indicates a negative output signal.

4.3 Factory reset

All parameters set/changed by the user (e.g. zero point, filter) are reset to the standard values (factory settings).

A reset of the standard values cannot be undone.

Load factory settings:

❶ Shutting down the gauge.

❷ Hold the <ZERO> button pressed ≥5 s during commissioning of the gauge.

5 Dismantling

WARNING

WARNING: Risk of breakage

Impacts can destroy the ceramic sensor.

Avoid harsh impacts and never allow the product to drop to the floor.

DANGER

DANGER: Contaminated parts

Contaminated parts can be harmful to health and to the environment.

Inform yourself about any contamination before starting work. Observe the applicable guidelines when handling contaminated parts and make sure the safety measures are adhered to.

Caution

Caution: Vacuum components

Dirt and damage impair the function of the vacuum component.

When handling vacuum components, observe the rules relating to cleanliness and protection against damage.

Caution

Caution: Area sensitive to contamination

Touching the product, or parts of the product with bare hands will increase the rate of desorption.

Wear clean, lint-free gloves and use clean tools.

1. Vent the vacuum system.
2. Shut down the gauge.
3. Loosen the locking screw and remove the measurement cable.
4. Dismantle the gauge from the vacuum system and fit the protective cap.

6 Maintenance, repair

The product is maintenance-free, provided that orderly operating conditions are upheld.

Malfunctioning of the gauge as a direct result of contamination is not covered by the warranty. We recommend that you check the zero point periodically (→ 19).

Pfeiffer Vacuum shall assume no responsibility nor provide any warranty if the operating company or a third party performs the repair work.

7 Returning the product

WARNING

WARNING: Shipping of contaminated products

Contaminated products (e.g. by radioactive, toxic, corrosive or microbiological means) can be harmful to health and to the environment.

Products should be free of contaminants during delivery wherever possible. Observe the shipping guidelines of the respective countries and transport companies. Completed Declaration of Contamination *) to be included.

*) Form available at www.pfeiffer-vacuum.de

Products not clearly declared "Free of contamination" will be decontaminated at your cost.

If you do not include a completed Declaration of Contamination, all delivered products will be immediately returned with costs.

8 Disposal of the product

DANGER

DANGER: Contaminated parts

Contaminated parts can be harmful to health and to the environment.

Inform yourself about any contamination before starting work. Observe the applicable guidelines when handling contaminated parts and make sure the safety measures are adhered to.

WARNING

WARNING: Environmentally hazardous substances

Products or parts thereof (mechanical and electrical components, operating fluid, etc.) can cause environmental damage.

Dispose of the environmentally hazardous substances in accordance with local regulations.

Breaking down the components

After the product has been dismantled, the components must be separated into the following categories for disposal:

- Contaminated components

  Contaminated components (radioactive, toxic, corrosive, microbiological etc.) must be decontaminated in accordance with the regulations of the respective country, separated by material type and disposed of accordingly.

- Non-contaminated components

  These components must be separated by material type and recycled.

Conversion table

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	1×10^{-3}	100	1	0.1	0.75
bar	1×10^{3}	1	1×10^{5}	1×10^{3}	100	750
Pa	0.01	1×10^{-5}	1	0.01	1×10^{-3}	7.5×10^{-3}
hPa	1	1×10^{-3}	100	1	0.1	0.75
kPa	10	0.01	1×10^{3}	10	1	7.5
Torr mm Hg	1,332	$1,332\times10^{-3}$	133.32	1.3332	0.1332	1

1 Pa = 1 N/m^2

ETL-Certification

C ETL US LISTED

Intertek

3103457

ETL LISTED

The products CMR 361 … CMR 365

- conform to the UL Standard UL 61010-1
- are certified to the CSA Standard CSA C22.2 # 61010-1

EU-Declaration of Conformity

CE

Pfeiffer Vacuum, hereby confirms that the following product conforms to EMC Directive 2014/30/EU and RoHS Directive 2011/65/EU.

Ceramic Capacitance Gauge

CMR 361 … CMR 365

Standards

Harmonized standards and applied national standards and specifications:

- EN 61000-6-2:2005 (EMC immunity to interference)
- EN 61000-6-3:2007 + A1:2011 (EMC immunity to interference)
- EN 61010-1:2010 (Safety regulations for electrical measuring and control equipment)
- EN 61326-1:2013 (EMC requirements for electrical measuring and control equipment)

Manufacturer/Signatures

Pfeiffer Vacuum GmbH, Berliner Straße 43, D-35614 Aßlar

Aßlar, April 18, 2016

Dr. Ulrich von Hülsen
Managing Director

Notes

Notes

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A PASSION FOR PERFECTION

PFEIFFER VACUUM

Vacuum solutions from a single source

Worldwide, Pfeiffer Vacuum stands for innovative and customized vacuum solutions, technological perfection, competent consultation and reliable service.

Complete range of products

From an individual component through to complex systems: We are the only vacuum technology provider to offer a complete range of products.

Competence in theory and practices

Take advantage of our know-how and our training offer! We will support you in system planning, and we offer first-class-on-site service worldwide.

Are you looking for a perfect vacuum solution? Then contact us at:

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