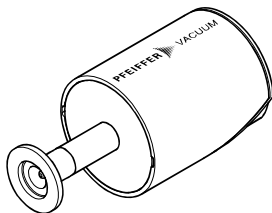


Ceramic Capacitance Gauge

CMR 361 ... CMR 365





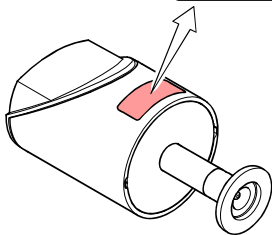
CE

Operating Instructions
Incl. Declaration of Conformity

Product Identification

In all communications with Pfeiffer Vacuum, please specify the information given on the product nameplate. For convenient reference copy that information into the space provided below.

Pfeiffer Vacuum, D-35614 Asslar		
Typ:		
Range:		
No:		
F-No:		
..... V W		



Validity


This document applies to products with the following part numbers:

Type	Part number	Flange	Measurement range		
			min. (0 V) [mbar] [Pascal]	F.S. (9 V) [mbar] [Pascal]	max. (9.8 V) [mbar] [Pascal]
CMR 361	PT R24 600	½" tube	10 ⁻¹ 10 ¹	1000 100'000	1100 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 (No) can be taken from the product nameplate. If not indicated otherwise in the legends, the illustrations in this document correspond to CMR 361 gauges with the DN 16 ISO-KF vacuum connection. They apply to other vacuum connections by analogy.

We reserve the right to make technical changes without prior notice. All dimensions in mm.

Intended Use

The Ceramic Capacitance Gauges of the CMR 36X series are intended for absolute pressure measurement of gases in their respective pressure ranges (→  3).

Function

The Ceramic Capacitance Gauge consists of a capacitive sensor element made of aluminum oxide ceramics and electronics which convert the capacitance into a DC voltage output signal.

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

Trademark

VCR[®] Swagelok Marketing Co.

Patents

EP 1070239, 1040333


US Patents 6528008, 6591687, 7107855, 7140085

Scope of Delivery

- 1× gauge CMR 36X
- 1× pin
- 1× Calibration Test Report
- 1× Operating Instructions
- 1× Betriebsanleitung

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For cross-references within this document, the symbol (→  XY) is used.

1 Safety

1.1 Symbols Used



DANGER

Information on preventing any kind of physical injury.



WARNING

Information on preventing extensive equipment and environmental damage.



Caution

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.



Notice

1.2 Personnel Qualifications



Skilled personnel

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

1.3 General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
Consider possible reactions with the product materials.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

1.4 Liability and Warranty

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

Gauge failures due to contamination are not covered by the warranty.

2 Technical Data


Measurement range	→ "Validity"
Accuracy ¹⁾	
PT R24 600 ... PT R24 633	0.20% of reading
PT R24 640 ... PT R24 643	0.50% of reading
Temperature effect on zero	
PT R24 600 ... PT R24 623	0.0050% F.S./ °C
PT R24 630 ... PT R24 633	0.015% F.S./ °C
PT R24 640 ... PT R24 643	0.020% F.S./ °C
Temperature effect on span	
PT R24 600 ... PT R24 633	0.01% of reading / °C
PT R24 640 ... PT R24 643	0.03% of reading / °C
Resolution	0.003% F.S.
Gas type dependence	none
<hr/>	
Output signal analog (measuring signal)	
Voltage range	0 ... +11 V
Measuring range	+1.0 ... +9.8 V
Relationship voltage-pressure	linear
Error signal	<0.4 V (no supply, sensor error)
	>9.8 V ("overrange")
Output impedance	<10 Ω (short-circuit proof)
Loaded impedance	10 kΩ
Response time	
PT R24 600 ... PT R24 633	30 ms
PT R24 640 ... PT R24 640	130 ms


¹⁾ Non-linearity, hysteresis, repeatability in the calibrated range at 25 °C ambient operating temperature without temperature effects after operation of 2 h.

Gauge identification

Resistance 13.2 k Ω referenced to supply common

Supply

 **DANGER**



The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective low voltage (SELV). The connection to the gauge has to be fused.

Supply voltage
at the gauge
ripple

+14 ... +30 VDC
 $\leq 1 V_{pp}$

Current consumption

<500 mA
(max. starting current)

Power consumption
(depending on supply voltage)

$\leq 1 W$

Internal fuse

1 AT (slow), automatic reset
(Polyfuse)

The gauge is protected against reverse polarity of the supply voltage.

Electrical connection

Hirschmann compact
connector, type GO 6,
6 poles, pins

Sensor cable

5 poles plus shielding

Cable length

$\leq 120 m$ (0.25 mm² conductor)

For longer cables, larger conductor cross-sections are required
($R_{cable} \leq 1.0 \Omega$).

Grounding concept

Vacuum flange - signal common

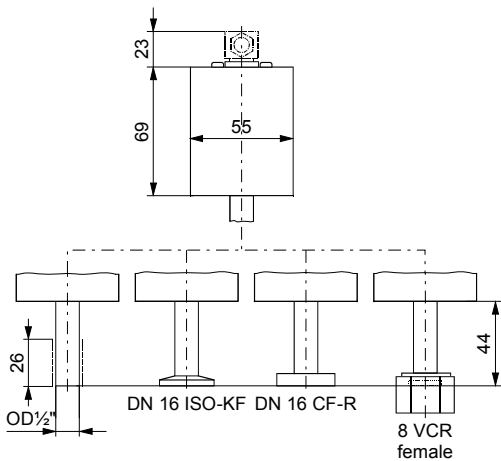
→ "Electrical Connection"

Supply common - signal common

conducted separately; for differential measurement (10 Ω)

Materials exposed to vacuum	
Flange, tube	stainless steel AISI 316L
Sensor and diaphragm	ceramics ($\text{Al}_2\text{O}_3 \geq 99.5\%$)
Sensor–diaphragm connection	glass ceramics solder
Ceramics–metal connection	AgTiCu hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
Internal volume	$\leq 6 \text{ cm}^3$
Admissible pressure (absolute)	
PT R24 600 ... PT R24 603	3 bar
PT R24 610 ... PT R24 633	2 bar
PT R24 640 ... PT R24 643	1.3 bar
Bursting pressure (absolute)	5 bar
Admissible temperatures	
Storage	$-40 \text{ }^\circ\text{C} \dots +65 \text{ }^\circ\text{C}$
Operation	$+5 \text{ }^\circ\text{C} \dots +50 \text{ }^\circ\text{C}$
Bakeout (not in operation)	$\leq 110 \text{ }^\circ\text{C}$ at the flange
Relative humidity	$\leq 80\%$ at temperatures $\leq +31 \text{ }^\circ\text{C}$ decreasing to 50% at $+40 \text{ }^\circ\text{C}$
Use	indoors only, altitude up to 2000 m NN
Type of protection	IP 30

Dimensions [mm]

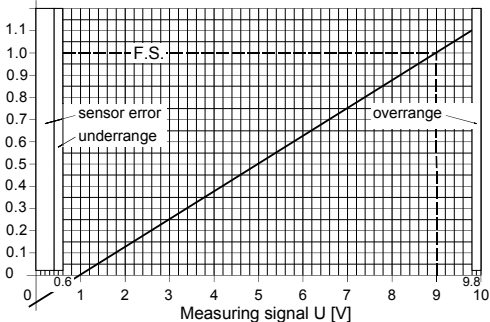


Weight

≤370 g

Analog Measuring Signal vs. Pressure

Pressure p [mbar]



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

	mbar	Pa	Torr
c	0.125	12.5	0.094

Example: Gauge CMR 361 with 1000 mbar F.S.
Measuring signal $U_{\text{out}} = 6 \text{ V}$

$$p = (6 \text{ V} - 1 \text{ V}) \times 0.125 \times 1000 \text{ mbar} \\ = \mathbf{625 \text{ mbar}}$$

3 Installation



WARNING



WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

3.1 Vacuum Connection



DANGER



DANGER: overpressure in the vacuum system
>1 bar

Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.

Do not open any clamps while the vacuum system is pressurized. Use the type clamps which are suited to overpressure.



DANGER



DANGER: overpressure in the vacuum system
>2.5 bar

KF flange connections with elastomer seals (e.g. O-rings) cannot withstand such pressures. Process media can thus leak and possibly damage your health.

Use O-rings provided with an outer centering ring.

**DANGER**

DANGER: protective ground

Products that are not correctly connected to ground can be extremely hazardous in the event of a fault.

Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF and VCR flanges fulfill this requirement.
- For gauges with a KF flange, use a conductive metallic clamping ring.
- For gauges with a 1/2" tube, take appropriate measures to fulfill this requirement.

**Caution**

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.


**Caution**

Caution: dirt sensitive area

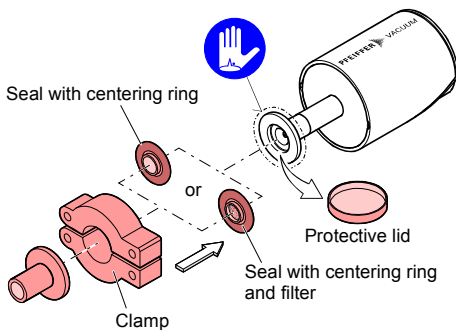
Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.



Mount the gauge so that no vibrations occur. The gauge may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber preferably choose a horizontal to upright position and possibly use a seal with a centering ring and filter. If adjustment should be possible after the gauge has been installed, be sure to install it so that the buttons can be accessed with a pin (→  18).


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



Keep the protective lid.

3.2 Electrical Connection



Make sure the vacuum connection is properly made (→  13).



DANGER

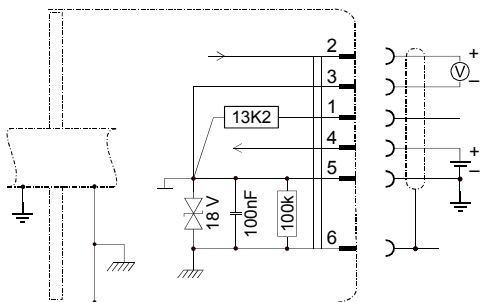
The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (SELV). The connection to the gauge has to be fused.



Ground loops, differences of potential, or EMC problems may affect the measurement signal. For optimum signal quality, please do observe the following notes:

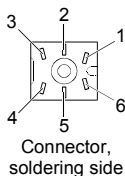
- Connect the cable shield to ground on one side via the chassis ground. Do not connect the other side of the shield.
- Connect the supply common with protective ground directly at the power supply.
- Use differential measurement input (signal common and supply common conducted separately).
- Potential difference between supply common and housing ≤ 18 V (overvoltage protection).

- 1** If no sensor cable is available, make one according to the following diagram.



Power connection

- Pin 1 identification
- Pin 2 signal output (measuring signal)
- Pin 3 signal common
- Pin 4 supply
- Pin 5 supply common
- Pin 6 screening



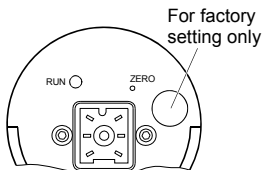
- 2** Connect the sensor cable to the gauge and secure it using the lock screw.
- 3** Connect the sensor cable to the controller.

4 Operation

Put the gauge into operation.

A warm-up time of at least 15 minutes should be allowed; for exact pressure measurements a warm-up time of at least 2 hours is required.

4.1 Displays



LED	State	Meaning
<RUN>	lit	Measurement mode
	flashing	Other mode, error

4.2 Zeroing the Gauge

The gauge is factory calibrated while "standing upright" (→ "Calibration Test Report").



We recommend performing a zero adjustment, when the gauge is operated for the first time.

Due to long time operation or contamination, a zero drift could occur and zero adjustment may become necessary.

For adjusting the zero, operate the gauge under the same constant ambient conditions and in the same mounting orientation as normally.

The output signal (measuring signal) is depending on the mounting orientation. The signal difference between the vertical and horizontal mounting orientation is:

F.S.	$\Delta U / 90^\circ$
1000 mbar	≈ 2 mV
100 mbar	≈ 10 mV
10 mbar	≈ 50 mV
1 mbar	≈ 300 mV




If the gauge is operated via a controller, the zero of the whole measuring system has to be adjusted on the controller: first, adjust the zero of the gauge and then, the zero of the controller.

4.2.1 <ZERO> Adjustment

1

Evacuate the gauge to a pressure according to the table below:

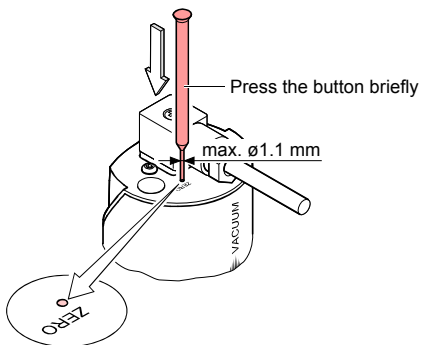
F.S.	Recommended final pressure for zero adjustment	
1100 mbar	$< 5 \times 10^{-2}$ mbar	$< 6.65 \times 10^0$ Pa
110 mbar	$< 5 \times 10^{-3}$ mbar	$< 6.65 \times 10^{-1}$ Pa
11 mbar	$< 5 \times 10^{-4}$ mbar	$< 6.65 \times 10^{-2}$ Pa
1.1 mbar	$< 5 \times 10^{-5}$ mbar	$< 6.65 \times 10^{-3}$ Pa
0.11 mbar	$< 5 \times 10^{-6}$ mbar	$< 6.65 \times 10^{-4}$ Pa


If the final pressure in the gauge is too high for zero adjustment ($> 50\%$ of the F.S.), the zero cannot be reached and the <RUN> LED flashes. If this is the case, activate the factory setting and adjust the zero again (\rightarrow  22).

2

Operate the gauge for at least 15 minutes (until the signal is stable).

- 3** Press the <ZERO> button briefly with a pin (max. $\varnothing 1.1$ mm). The zero adjustment runs automatically. The <STATUS> LED flashes until the adjustment (duration ≤ 8 s) is completed.



 After zero adjustment the gauge automatically returns to measurement mode. The <RUN> LED lit.

The <STATUS> LED flashes if



- the signal output is negative (>0.5 mV) when the final pressure has been attained
- the zero adjustment has failed.

4.2.2 <ZERO> Adjustment with Ramp Function

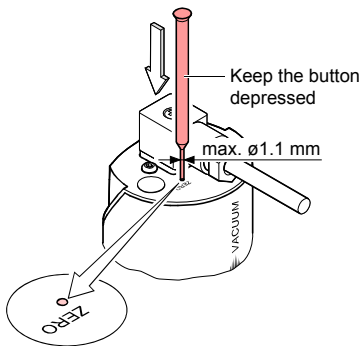
The ramp function allows to adjust the zero at a known reference pressure within the measurement range of the gauge.

It also permits to adjust an offset of the characteristic curve in order to compensate for the offset of the measuring system.

The offset should not exceed 2% of the F.S. (+200 mV). At a higher positive offset, the upper limit of the measurement range is exceeded.

 Recommended procedure for adjusting the offset of a measuring system: → Notice  19.

- 1** Operate the gauge for at least 15 minutes (until the signal is stable).
- 2** Push the <ZERO> button with a pin (max. $\varnothing 1.1$ mm) and keep it depressed. The <RUN> LED starts flashing. After 5 s, the zero adjustment value, starting at the current output value, keeps continually changing (ramp) until the button is released or until the setting limit (min. 50% F.S.) is reached.



- 3** Push the <ZERO> button again:

Fine adjustment within 0...3 s:	the zero adjustment value changes by one unit
Change of direction within 3...5 s:	the zero adjustment changes its direction (the flashing frequency of the <STATUS> LED changes briefly)



If the <ZERO> button is released for more than 5 s, the gauge returns to the measurement mode.

The <RUN> LED flashes if the signal output is negative.

4.3 Activating the Factory Setting (Factory Reset)

All user defined parameters (e.g. zero, filter) are restored to their default values.



Loading of the default parameters is irreversible.

Loading the default parameters:

- 1** Put the gauge out of operation.
- 2** Keep the <ZERO> button depressed for at least 5 s while the gauge is being put into operation (Power ON).

5 Deinstallation



WARNING



WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.



DANGER



DANGER: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.



Caution



Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

**Caution**

Caution: dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.


- 1** Vent the vacuum system.
- 2** Turn the gauge off.
- 3** Unfasten the lock screw and disconnect the sensor cable.
- 4** Remove the gauge from the vacuum system and install the protective lid.

6 Maintenance, Repair

Under clean operating conditions, the product requires no maintenance.



Gauge failures due to contamination are not covered by the warranty.

We recommend checking the zero at regular intervals (→  19).

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

7 Returning the Product



WARNING



WARNING: forwarding contaminated products
Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment.

Products returned to Pfeiffer Vacuum should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination ²⁾.

Products that are not clearly declared as "free of harmful substances" are decontaminated at the expense of the customer. Products not accompanied by a duly completed declaration of contamination are returned to the sender at his own expense.

²⁾ Forms under www.pfeiffer-vacuum.net

8 Disposal



DANGER



Caution: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.



WARNING



Caution: substances detrimental to the environment

Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment.

Dispose of such substances in accordance with the relevant local regulations.

Separating the components

After disassembling the product, separate its components according to the following criteria:

- Contaminated components
Contaminated components (radioactive, toxic, caustic or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.
- Other components
Such components must be separated according to their materials and recycled.

EC Declaration of Conformity



We, Pfeiffer Vacuum, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 2006/95/EC and the Directive relating to electromagnetic compatibility 2004/108/EC.

Ceramic Capacitance Gauge

CMR 361 ... CMR 365

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2001 (Electromagnetic compatibility: generic immunity standard)
- EN 61000-6-3:2001 + A11:2004 (Electromagnetic compatibility: generic emission standard)
- EN 61010-1:2001 (Safety requirements for electrical equipment for measurement, control and laboratory use)

Signatures

Pfeiffer Vacuum GmbH, Asslar

31 March 2009

Manfred Bender
Managing director

31 March 2009

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bg5136be/ a

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