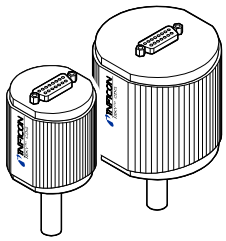
Capacitance Diaphragm Gauges

CDG025
CDG045
CDG045-H



Operating Manual
Incl. Declaration of Conformity

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Intended Use

The Capacitance Diaphragm Gauges of the CDG025, CDG045, and CDG045-H series are intended for absolute pressure measurement of gases in the pressure ranges specified in section "Validity".

The gauges belong to the SKY™ Smart Sensors family and can be operated in connection with the INFICON VGC032 Vacuum Gauge Controller or another appropriate measuring unit.

Functional Principle

The Capacitance Diaphragm Gauges consist of a capacitive sensor element made of aluminum oxide ceramic and electronics which convert the capacitance change into a DC voltage output signal.

The output signal is linear to the measured pressure and independent of the gas type.[1)]

Trademarks

SKY™	INFICON
Swagelok®	Swagelok Marketing Co.
VCR®	Swagelok Marketing Co.

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.

Liability and Warranty

INFICON 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.

Validity

This document applies to products with the following part numbers:

CDG025 Temperature-compensated:

360-000	10^{-1} ...	1000 Torr	(with ½" tube)
361-000	10^{-2} ...	100 Torr	(with ½" tube)
362-000	10^{-3} ...	10 Torr	(with ½" tube)
364-000	10^{-4} ...	1 Torr	(with ½" tube)
360-001	10^{-1} ...	1000 Torr	(with ½" tube)
361-001	10^{-2} ...	100 Torr	(flange DN 16 ISO-KF)
362-001	10^{-3} ...	10 Torr	(flange DN 16 ISO-KF)
364-001	10^{-4} ...	1 Torr	(flange DN 16 ISO-KF)
360-002	10^{-1} ...	1000 Torr	(flange DN 16 CF-R)
361-002	10^{-2} ...	100 Torr	(flange DN 16 CF-R)
362-002	10^{-3} ...	10 Torr	(flange DN 16 CF-R)
364-002	10^{-4} ...	1 Torr	(flange DN 16 CF-R)
360-003	10^{-1} ...	1000 Torr	(flange Swagelok 8 VCR)
361-003	10^{-2} ...	100 Torr	(flange Swagelok 8 VCR)
362-003	10^{-3} ...	10 Torr	(flange Swagelok 8 VCR)
364-003	10^{-4} ...	1 Torr	(flange Swagelok 8 VCR)

CDG045 Temperature-controlled (+45 °C):

360-010	10^{-1} ...	1000 Torr	(with ½" tube)
361-010	10^{-2} ...	100 Torr	(with ½" tube)
362-010	10^{-3} ...	10 Torr	(with ½" tube)
364-010	10^{-4} ...	1 Torr	(with ½" tube)
365-010	10^{-5} ...	100 mTorr	(with ½" tube)
360-011	10^{-1} ...	1000 Torr	(flange DN 16 ISO-KF)
361-011	10^{-2} ...	100 Torr	(flange DN 16 ISO-KF)
362-011	10^{-3} ...	10 Torr	(flange DN 16 ISO-KF)
364-011	10^{-4} ...	1 Torr	(flange DN 16 ISO-KF)
365-011	10^{-5} ...	100 mTorr	(flange DN 16 ISO-KF)
360-012	10^{-1} ...	1000 Torr	(flange DN 16 CF-R)
361-012	10^{-2} ...	100 Torr	(flange DN 16 CF-R)
362-012	10^{-3} ...	10 Torr	(flange DN 16 CF-R)
364-012	10^{-4} ...	1 Torr	(flange DN 16 CF-R)
365-012	10^{-5} ...	100 mTorr	(flange DN 16 CF-R)
360-013	10^{-1} ...	1000 Torr	(flange Swagelok 8 VCR)
361-013	10^{-2} ...	100 Torr	(flange Swagelok 8 VCR)
362-013	10^{-3} ...	10 Torr	(flange Swagelok 8 VCR)
364-013	10^{-4} ...	1 Torr	(flange Swagelok 8 VCR)
365-013	10^{-5} ...	100 mTorr	(flange Swagelok 8 VCR)

CDG045-H High Speed, Temperature-controlled (+45 °C):

371-030	10^{-4} ...	1 Torr	(flange DN 16 ISO-KF)
371-031	10^{-5} ...	100 mTorr	(flange DN 16 ISO-KF)
371-032	10^{-4} ...	1 Torr	(flange Swagelok 8 VCR)
371-033	10^{-5} ...	100 mTorr	(flange Swagelok 8 VCR)

The part number can be taken from the product nameplate.

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

Safety

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.

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.

Technical Data

Measurement range		→ "Validity"
Accuracy		
CDG025		0.20% of reading
CDG045		0.15% of reading
CDG045-H		0.15% of reading
Temperature effect on zero		
CDG025	≥10 Torr F.S.	0.0050% F.S./ °C
CDG025	1 Torr F.S.	0.0150% F.S./ °C
CDG045	≥1 Torr F.S.	0.0025% F.S./ °C
CDG045	100 mTorr F.S.	0.0050% F.S./ °C
CDG045-H	≥1 Torr F.S.	0.0025% F.S./ °C
CDG045-H	100 mTorr F.S.	0.0050% F.S./ °C
Temperature effect on span		
CDG025		0.01% of reading / °C
CDG045		0.01% of reading / °C
CDG045-H		0.01% of reading / °C
Resolution		
CDG025	≥10 Torr F.S.	0.0015% F.S.
CDG025	1 Torr F.S.	0.0025% F.S.
CDG045	≥10 Torr F.S.	0.0015% F.S.
CDG045	≤1 Torr F.S.	0.0025% F.S.
CDG045-H	all F.S. values	0.0025% F.S.
Gas type dependence		none[1)]

Output signal (measuring signal)		
Voltage range		0 V ... 10.0 V
Relationship voltage-pressure		linear[1)]
Output impedance		200 Ω (short-circuit proof)
Minimum loaded impedance		10 kΩ
Response time		
CDG025	≥10 Torr F.S.	30 ms
CDG025	1 Torr F.S.	100 ms
CDG045	≥10 Torr F.S.	30 ms
CDG045	≤1 Torr F.S.	100 ms
CDG045-H	all F.S. values	30 ms

Gauge identification	Resistance 13.2 kΩ referenced to supply common

[1)] For p < 1 mbar and $T_{Gauge} \neq T_{Vacuum}$ the linearity of a temperature-controlled gauge is influenced by the thermal transpiration (gas type dependent) at the maximum in the same order of magnitude as the zero point stability.
See K. F. Poulter, et al., Vacuum 33, 331 (1983); W. Jitschin and P. Röhl, J. Vac. Sci. Technol. A, Vol. 5, No. 3, 1987.

Supply

DANGER

The gauge may only be connected to supply or measurement units that conform to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010). The connection to the gauge has to be fused.

Supply voltage at the gauge	
at pin 7	15 V= ±5%
or pin 11	18.0 … 26.4 V=
Power consumption (depending on supply voltage)	
CDG025	1 … 1.6 W
CDG045, CDG045-H	
during heat-up	9 … 19 W
at operating temperature	4 … 5 W
Internal fuse	1 AT, slow, automatic reset (Polifuse)

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

Electrical connection	15-pole D-Sub, male
Cable	5 poles plus shielding
Cable length	
CDG025	≤120 m (0.25 mm² conductor)
CDG045, CDG045-H	≤50 m (0.50 mm² conductor)

For longer cables, bigger conductor cross-sections are required ($R_{conductor}$ ≤1.0 Ω).

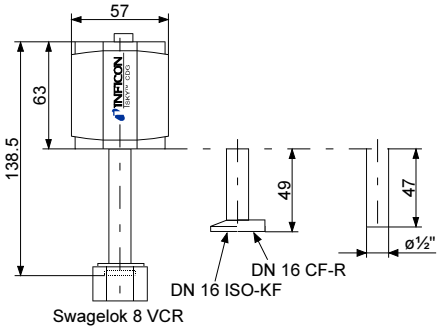
Grounding concept	
Vacuum flange-measurement common	→ "Electrical Connection"
Signal common	conducted separately; for differential measurement

Materials exposed to the vacuum	
Flange, tube, protective chamber, plasma shield	stainless steel 316L
Sensor and diaphragm	ceramic (Al_2O_3 ≥99.5%)
Sensor–diaphragm connection	glass ceramics solder
Ceramic-metal connection	AgCu hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
Internal volume	
CDG025	6 cm³
CDG045	7 cm³
CDG045-H	7 cm³
Pressure max.	
CDG025 1000 Torr F.S.	≤3000 Torr (absolute)
CDG025 ≤100 Torr F.S.	≤2000 Torr (absolute)
CDG045 1000 Torr F.S.	≤3000 Torr (absolute)
CDG045 1…100 Torr F.S.	≤2000 Torr (absolute)
CDG045 100 mTorr F.S.	≤1000 Torr (absolute)
CDG045-H 1… Torr F.S.	≤2000 Torr (absolute)
CDG045-H 100 mTorr F.S.	≤1000 Torr (absolute)

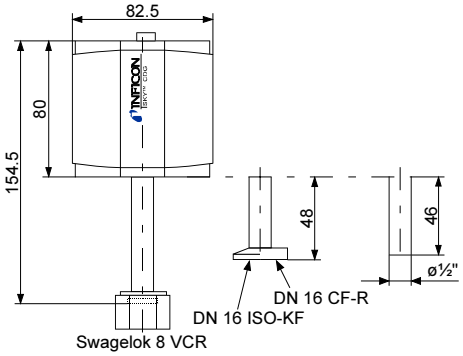
Admissible temperatures	
Storage	–40 °C … +65 °C
Operation	
CDG025	+ 5 °C … +50 °C
CDG045, CDG045-H	+15 °C … +40 °C
Bakeout (out of operation)	
CDG025	≤110 °C at the flange
CDG045, CDG045-H	≤ 90 °C at the flange
Relative humidity	≤80% at temperatures ≤+31 °C decreasing to 50% at +40°C
Use	indoors only, altitude up to 2000 m NN
Degree of protection	IP 30

Dimensions [mm]

CDG025



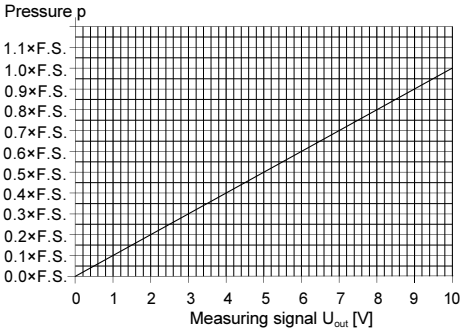
CDG045, CDG045-H



Weight

CDG025	260 … 290 g (depending on flange)
CDG045	485 … 515 g (depending on flange)
CDG045-H	485 … 515 g (depending on flange)

Relationship Measuring Signal – Pressure



$p = (U_{out} / 10\ V) \times p(F.S.)$

Conversion Torr ↔ Pascal

	Torr	mbar[2)]	Pa[2)]
c	1.00	1013.25 / 760 = 1.3332…	101325 / 760 = 133.3224…

Example: Gauge with 10 Torr F.S.
Measuring signal U_{out} = 6 V

$p = (6\ V / 10\ V) \times 10\ Torr$
$= 0.6 \times 10\ Torr =$ **6 Torr**

Installation

Vacuum Connection

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.

DANGER

Caution: overpressure in the vacuum system >750 Torr

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

Caution: 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 Swagelok 8 VCR flanges fulfill this requirement.
- For gauges with a KF flange, use a conductive metallic clamping ring.
- For gauges with a ½" tube, take appropriate measures to fulfill this requirement.

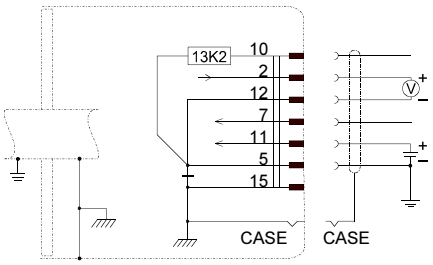
The gauge may be mounted in any orientation. However, it should be mounted so that no vibrations occur and that no particles and condensates can penetrate into the measuring chamber.

[2)] Source: NPL (National Physical Laboratory)
Guide to the Measurement of Pressure and Vacuum
ISBN 0904457x / 1998

Electrical Connection

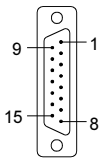
❶ Make sure the vacuum connection is properly made (→ "Vacuum Connection").

❷ If no connection cable is available, make one according to the following diagram.



Pin assignment

Pin 1	not assigned
Pin 2	**signal output (measuring signal)**
Pin 3	not assigned
Pin 4	not assigned
Pin 5	**supply common**
Pin 6	not assigned
Pin 7	**supply (15 V)**
Pin 8	not assigned
Pin 9	not assigned
Pin 10	**identification**
Pin 11	**supply (18 ... 26.4 V)**
Pin 12	**signal common**
Pin 13	not assigned
Pin 14	not assigned
Pin 15	**housing**
CASE	**connector housing**



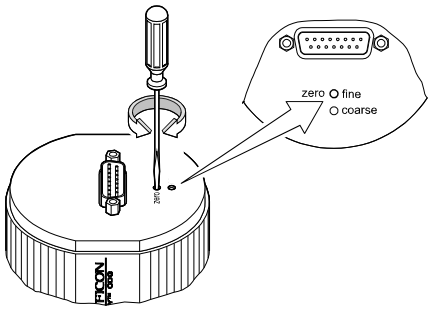
15-pole D-Sub
female
soldering side

Connect only one supply voltage.

❸ Connect the gauge to the controller.

❹ Secure the cable socket to the gauge connector with the lock screws.

❺ CDG045, CDG045-H:
Using a screwdriver (1.5 mm), adjust the <zero fine> potentiometer to the center position (i.e. 5½ turns from either stop position).



Operation

Activate the gauge. If you are operating the gauge with the VGC032 Vacuum Gauge Controller, adjust the measurement range (→ 🕮 [1]).

warm-up time:

CDG025	½ hour
CDG045	1 hour
CDG045-H	1 hour

warm-up time for high precision measurement:

CDG045	≤1 Torr F.S.	2 hours
CDG045-H		2 hours

Initial Operation

CDG025
The influence of the mounting orientation on the output signal is compensated by adjusting the output signal to 0.000 V= ±0.200 V= via the <zero> potentiometer.

CDG045, CDG045-H:
The influence of the mounting orientation on the output signal is compensated by adjusting the output signal to 0.000 V= ±0.200 V= via the <zero coarse> potentiometer.

Gas type dependence

The measured value is independent of the gas type.[1)]

Zeroing the Gauge

Periodically check the zero and adjust it if necessary. Due to long time operation or contamination, a zero drift could occur and zero adjustment may become necessary.

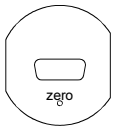
❶ Evacuate the gauge to a pressure in accordance with the table below:

Full scale (F.S.)	Recommended maximum pressure for zero adjustment
100 mTorr	$<5 \times 10^{-6}$ Torr
1 Torr	$<5 \times 10^{-5}$ Torr
10 Torr	$<5 \times 10^{-4}$ Torr
100 Torr	$<5 \times 10^{-3}$ Torr
1000 Torr	$<5 \times 10^{-2}$ Torr

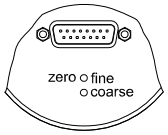
❷ Operate the gauge for at least 1 hour, or for high precision measurement, for at least 2 hours.

❸ Adjust the gauge using a reliable, accurate, and correctly calibrated instrument.

CDG025:
Using a screwdriver (1.5 mm), adjust the <zero> so that the output signal is 0.000 V=.



CDG045, CDG045-H:
Using a screwdriver (1.5 mm), adjust the <zero fine> so that the output signal is 0.000 V=.



If you are using the INFICON VGC032 Vacuum Gauge Controller, you can adjust the zero on the controller (→ 🕮 [1]).

Maintenance/Repair

Caution

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

We recommend returning the product to your local INFICON service center for repair.

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

Returning the Product

WARNING

Caution: forwarding contaminated products

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

Products returned to INFICON 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.

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.

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.

Further information

🕮 [1] www.inficon.com
Operating Manual
VGC032
Vacuum Gauge Controller
tinb02e1
Inficon AG, FL–9496 Balzers, Liechtenstein

Declaration of Contamination

The service, repair, and/or disposal of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.
This declaration may only be completed (in block letters) and signed by authorized and qualified staff.

1 Description of product
Type
Article Number
Serial Number

2 Reason for return

3 Operating fluid(s) used (Must be drained before shipping.)

4 Process related contamination of product:

toxic	no ❑ 1)	yes ❑
caustic	no ❑ 1)	yes ❑
biological hazard	no ❑	yes ❑ 2)
explosive	no ❑	yes ❑ 2)
radioactive	no ❑	yes ❑ 2)
other harmful substances	no ❑ 1)	yes ❑

The product is free of any substances which are damaging to health yes ❑

1) or not containing any amount of hazardous residues that exceed the permissible exposure limits

2) Products thus contaminated will not be accepted without written evidence of decontamination!

5 Harmful substances, gases and/or by-products
Please list all substances, gases, and by-products which the product may have come into contact with:

Trade/product name	Chemical name (or symbol)	Precautions associated with substance	Action if human contact

6 Legally binding declaration:
I/we hereby declare that the information on this form is complete and accurate and that I/we will assume any further costs that may arise. The contaminated product will be dispatched in accordance with the applicable regulations.

Organization/company
Address — Post code, place
Phone — Fax
Email
Name

Date and legally binding signature

Company stamp

This form can be downloaded from our website.

Copies:
Original for addressee - 1 copy for accompanying documents - 1 copy for file of sender

Declaration of Conformity

as defined by the Directive relating to machinery 98/37/EC, Appendix IIb

CE

We, INFICON, hereby declare that putting the incomplete equipment mentioned below into operation is not permitted until evidence is given that the system into which that incomplete shall be installed is in conformity with the provisions of the EU Directive relating to machinery.

We also declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 73/23/EEC and the Directive relating to electromagnetic compatibility 89/336/EEC.

Capacitance Diaphragm Gauges

CDG025
CDG045
CDG045-H

Part numbers

360-000	361-000	362-000	364-000	
360-001	361-001	362-001	364-001	
360-002	361-002	362-002	364-002	
360-003	361-003	362-003	364-003	
360-010	361-010	362-010	364-010	365-010
360-011	361-011	362-011	364-011	365-011
360-012	361-012	362-012	364-012	365-012
360-013	361-013	362-013	364-013	365-013

371-030
371-031
371-032
371-033

Standards

Harmonized and international/national standards and specifications:

- EN 61010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 50081-1 (Electromagnetic compatibility generic emission standard)
- EN 50082-2 (Electromagnetic compatibility generic immunity standard)

Signatures

INFICON AG, 9496 Balzers

25. October 2000
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Product management

25. October 2000
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