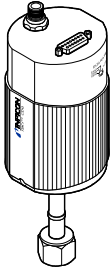


Capacitance Diaphragm Gauges

CDG045-SD



Operating Manual
Incl. Declaration of Conformity

tina02e1 (0010)

Validity

This document applies to products with the following part numbers:

CDG045-SD Temperature-controlled (+45 °C):

360-303	10 ¹ ... 1000 Torr	(flange Swagelok 8 VCR)
361-303	10 ² ... 100 Torr	(flange Swagelok 8 VCR)
362-303	10 ³ ... 10 Torr	(flange Swagelok 8 VCR)
364-303	10 ⁴ ... 1 Torr	(flange Swagelok 8 VCR)
365-303	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.

Intended Use

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

The gauges are operated via DeviceNet.

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⁾

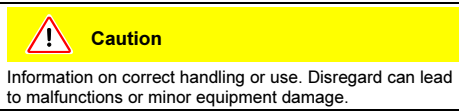
The analog output signal is converted into a digital value by an incorporated microprocessor. This value can be polled via DeviceNet.

Trademarks

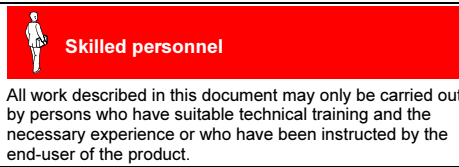
SKY™	INFICON
Swagelok®	Swagelok Marketing Co.
VCR®	Swagelok Marketing Co.
DeviceNet™	Open DeviceNet Vendor Association Inc.

Safety

Symbols Used



Personnel Qualifications



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.

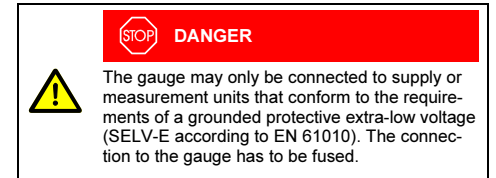
Technical Data

Measurement ranges	→ "Validity"
Accuracy	0.15 % of measurement value
Temperature effect on zero	≥1 Torr F.S. 0.0025 % F.S./°C 100 mTorr F.S. 0.0050 % F.S./°C
Temperature effect on range	0.01 % of measurement value / °C
Resolution	≥10 Torr F.S. 0.0015 % F.S. ≤1 Torr F.S. 0.0025 % F.S.
Gas type dependence	none ¹⁾

Analog output signal for diagnostics only; digital zero adjustment via DeviceNet has no effect on the analog value.

voltage range	0 V ... 10.0 V
relationship voltage-pressure	linear ¹⁾
Output impedance	200 Ω (short-circuit resistant)
Minimum loading impedance	10 kΩ
Response time	≥10 Torr F.S. 30 ms ≤1 Torr F.S. 100 ms

Supply



Supply voltage at the gauge (DeviceNet connector)	
Pin 2 voltage range	+24 V= +11 ... 25 V=
Power consumption max. (depending on supply voltage)	24 W
The gauge is protected against polarity change of the supply voltage.	

Connection 1 (electrical) Cable	MicroStyle, 5-pole, male according to DeviceNet specifications
Line length	according to DeviceNet specifications

Connection 2 (electrical) Cable	15-pole D-Sub, male 10 poles plus screening depending on conductor cross-section
Line length	depending on conductor cross-section
Conductor cross-section	depending on setpoint contact load

Setpoints (adjustable via potentiometers "SET POINT" "A" and "B")	2 (A, B)
Contacts voltage current	24 V-; 30 V= 1 A

DeviceNet data transfer rate (select via "DATA RATE" switch)	125 kB 250 kB 500 kB "PGM" position (125 kB, 250 kB, 500 kB, programmable via DeviceNet)
node address (select via "NODE ADDRESS" switch)	0 ... 63 "PGM" position (0 ... 63 programmable via DeviceNet)

Grounding concept	→ "Electrical Connection"
-------------------	---------------------------

¹⁾ For $p < 1$ mbar and $T_{\text{Gauge}} \neq T_{\text{Vacuum}}$ 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.

Materials exposed to the vacuum

flange, tube, protective chamber, plasma shield	stainless steel 316L
sensor and diaphragm	ceramic (Al ₂ O 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	7 cm ³
Pressure max.	
100 mTorr F.S.	1000 Torr (absolute)
1...100 Torr F.S.	2000 Torr (absolute)
1000 Torr F.S.	3000 Torr (absolute)

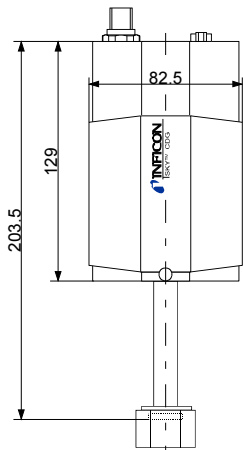
Admissible temperatures	
storage	-40 °C ... +65 °C
operation	+15 °C ... +40 °C
bakeout (out of operation)	≤90 °C at flange

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
----------------------	-------

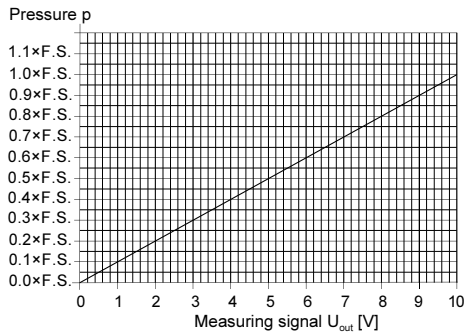
Dimensions [mm]



Swagelok 8 VCR

Weight	1000 g
--------	--------

Relationship Measuring Signal – Pressure (Analog Output)



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

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

$$p = (6 V / 10 V) \times 10 \text{ Torr} = 0.6 \times 10 \text{ Torr} = 6 \text{ Torr}$$

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.

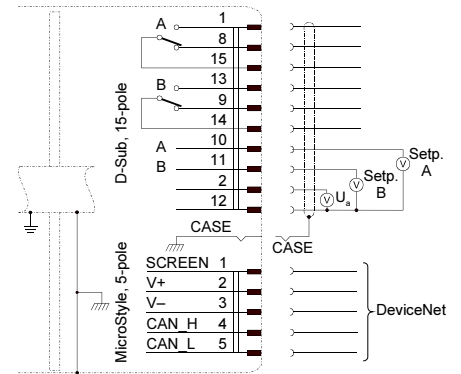
DANGER

Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:
• Swagelok 8 VCR flanges 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.

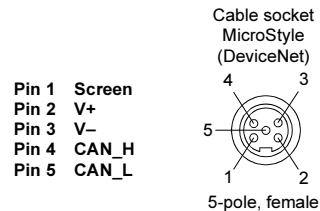
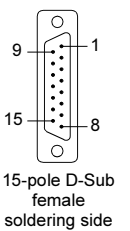
Electrical Connection

- Make sure the vacuum connection is properly made (→ "Vacuum Connection").
- If no connection cable is available, make one according to the following diagram.



Pin assignment

- Pin 1 setpoint A, normally open
- Pin 2 signal output (0 ... 10 V) (analog measuring signal)
- Pin 3 not assigned
- Pin 4 not assigned
- Pin 5 not assigned
- Pin 6 not assigned
- Pin 7 not assigned
- Pin 8 setpoint A, normally closed
- Pin 9 setpoint B, normally closed
- Pin 10 setpoint A, threshold (referenced to Pin 12)
- Pin 11 setpoint B, threshold (referenced to Pin 12)
- Pin 12 signal common
- Pin 13 setpoint B, normally open
- Pin 14 setpoint B, common
- Pin 15 setpoint A, common
- CASE connector housing



- Connect the gauge to the controller.
- Secure the cable socket to the gauge connector with the lock screws.

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

Operation

Defining the node address

NODE ADDRESS The node address (valid values: 0 ... 63) is defined by using the switches "NODE ADDRESS", "MSD", and "LSD". The firmware polls this value whenever the gauge is initialized. If this value is not identical with the stored value, the new value is saved in the NVRAM. If an address higher than 63 is defined, the stored value is considered as address.

In the "PGM" position, the node address can be programmed via DeviceNet (→ [1]).

Setting the data transmission rate

DATA RATE The data transmission rate "DATA RATE" can be set to 125, 250, or 500 kBaud. In the "PGM" position, the data transmission rate can be programmed via DeviceNet (→ [1]).

Start-up

The gauge is put into operation as soon as it is connected to the DeviceNet fieldbus.

warm-up time:

≥10 Torr F.S. 1 hour

warm-up time for high precision measurement:

≤1 Torr F.S. 2 hours

The measurement signal is evaluated via DeviceNet fieldbus (→ [1]). The analog output is used for diagnostics only; digital zero adjustment via DeviceNet has no effect on the analog value.

Gas type dependence

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

Zeroing the gauge

When operating the gauge for the first time, 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.

The zero can only be adjusted digitally via DeviceNet. This adjustment has no effect on the analog value.

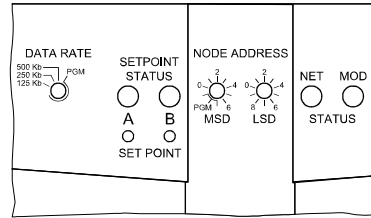
① Evacuate the gauge to a pressure according to the following table:

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

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

③ Adjust the zero of the gauge via DeviceNet (→ [1]).

LEDs and operating elements



Adjusting the setpoint functions

SETPOINT STATUS The gauge has two setpoint functions, A and B. The thresholds are adjusted with the two potentiometers "SET POINT A" and "SET POINT B". The setpoint status of the relays is indicated by the "SETPOINT STATUS" LEDs. If an LED is lit, the corresponding switching function is activated. The relay contacts and the threshold values are available at the 15-pole D-Sub connector (→ wiring diagram or pin assignment).

Status LEDs



"MOD STATUS" (gauge status):

LED	Comment
dark	no supply
flashing red-green	self-test
green	normal operation
red	unrecoverable fault

"NET STATUS" (network status):

LED	Comment
off	Gauge is not online: – self-test not yet completed – no supply, → "MOD STATUS" LED
flashing green	Gauge is online but has no connections in the established state: – gauge has completed self-test and is online, however, it has no contact to other nodes – gauge is not allocated to a master
green	Gauge is online and has connections in the established state.
flashing red	One or more I/O connections in "Timed-Out" state.
red	Communication error. The gauge has detected an error which has rendered it incapable of communicating on the network (e.g. duplicate node address (MAC ID) or "Bus-off").
flashing red-green	The gauge has detected a network access error and is in the "Communication Faulted" state. Subsequently it received and acknowledged the "Identify Communication Faulted Request - Long protocol message".

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

STOP 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
Communication Protocol
DeviceNet Interface
tira02e1

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:																									
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">toxic</td> <td style="width: 10%;">no <input type="checkbox"/> 1)</td> <td style="width: 10%;">yes <input type="checkbox"/></td> <td style="width: 25%;"></td> </tr> <tr> <td>caustic</td> <td>no <input type="checkbox"/> 1)</td> <td>yes <input type="checkbox"/></td> <td></td> </tr> <tr> <td>biological hazard</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>explosive</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>radioactive</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>other harmful substances</td> <td>no <input type="checkbox"/> 1)</td> <td>yes <input type="checkbox"/></td> <td></td> </tr> </table>		toxic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>		caustic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>		biological hazard	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)		explosive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)		radioactive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)		other harmful substances	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>	
toxic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>																							
caustic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>																							
biological hazard	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)																							
explosive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)																							
radioactive	no <input type="checkbox"/>	yes <input type="checkbox"/> 2)																							
other harmful substances	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>																							
↓																									
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> The product is free of any substances which are damaging to health yes <input type="checkbox"/> </div>																									
↓																									
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:																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Trade/product name</th> <th style="width: 25%;">Chemical name (or symbol)</th> <th style="width: 25%;">Precautions associated with substance</th> <th style="width: 25%;">Action if human contact</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>		Trade/product name	Chemical name (or symbol)	Precautions associated with substance	Action if human contact																				
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



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 equipment shall be installed is in conformity with the provisions of the EC 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 CDG045-SD

Part numbers

360-303
361-303
362-303
364-303
365-303

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)
- DeviceNet Specifications, Volume 1+2, Release 2

Signatures

INFICON AG, 9496 Balzers

25. Oktober 2000

25. Oktober 2000

Hannes Fischer
Product management

Urs Wälchli
Product development



FL-9496 Balzers
Liechtenstein
Tel +423 / 388 3237
Fax +423 / 388 3728
reach.liechtenstein@inficon.com
www.inficon.com