

### Intended Use

The Capacitance Diaphragm Gauges of the CDG100 and CDG160 series are intended for absolute pressure measurement of gases in the pressure ranges specified in section "Validity".

The gauges can be operated in connection with an appropriate controller.

### 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 <sup>1)</sup>.

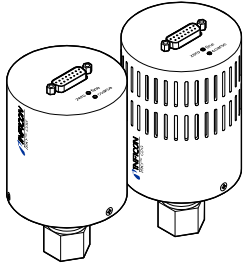
The sensor is heated and its temperature kept constant at 100 °C (160 °C) to avoid contamination by process and process by-products.

### Trademarks

SKY™ Inficon  
VCR® Swagelok Marketing Co.

## SKY™ Capacitance Diaphragm Gauge

CDG100  
CDG160  
CDG100-H

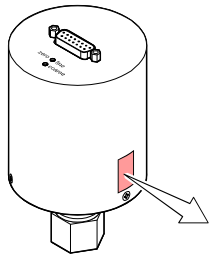


Operating Manual  
Incl. Declaration of Conformity

tina05e1-b (0108)

### Product Identification

In all communications with Inficon, please specify the information given on the product nameplate. For convenient reference copy that information into the diagram below.



INFICON AG, LI-9496 Balzers  
Model: \_\_\_\_\_  
PN: \_\_\_\_\_  
SN: \_\_\_\_\_  
\_\_\_\_\_ V \_\_\_\_\_ W

### Validity

This document applies to products with the following part numbers:

CDG100, CDG160:

- 360-033
- 0 ⇒ Torr  
1 ⇒ Pa
  - 3 ⇒ 100 °C  
6 ⇒ 160 °C
  - 0 ⇒ 10<sup>-1</sup> ... 1000 Torr (F.S.)  
1 ⇒ 10<sup>-2</sup> ... 100 Torr (F.S.)  
2 ⇒ 10<sup>-3</sup> ... 10 Torr (F.S.)  
4 ⇒ 10<sup>-4</sup> ... 1 Torr (F.S.)  
5 ⇒ 10<sup>-5</sup> ... 100 mTorr (F.S.)
  - 0 ⇒ 1.33×10<sup>1</sup> ... 133322 Pa (F.S.)  
1 ⇒ 1.33×10<sup>0</sup> ... 13332.2 Pa (F.S.)  
2 ⇒ 1.33×10<sup>-1</sup> ... 1333.22 Pa (F.S.)  
4 ⇒ 1.33×10<sup>-2</sup> ... 133.322 Pa (F.S.)  
5 ⇒ 1.33×10<sup>-3</sup> ... 13.3322 Pa (F.S.)

CDG100-H High Speed:

- 371-034 (10<sup>-4</sup> ... 1 Torr (F.S.))
- 371-035 (10<sup>-5</sup> ... 100 mTorr (F.S.))

The part number (PN) can be taken from the product nameplate.

The illustrations in this document correspond to the CDG100. They apply to the CDG100-H and CDG160 by analogy.

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

All dimensions in mm.

### 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.

#### 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.  
Consider possible reactions of the process media due to the heat generated by the product.
- 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.

<sup>1)</sup> For  $p < 1 \text{ mbar}$  and  $T_{\text{Gauge}} \neq T_{\text{Vacuum}}$  the linearity of temperature-controlled gauges 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.

## Technical Data

Measurement ranges	→ "Validity"
Accuracy	0.5% of reading
Resolution	0.005% F.S.
Temperature effect on zero	
360-XX3 ... 364-XX3	0.005% F.S. /°C
371-034	0.005% F.S. /°C
365-X33, 371-035	0.01% F.S. /°C
Temperature effect on span	0.02% of reading /°C
Gas type dependence	none <sup>1)</sup>

Output signal (measurement signal)	
measurement range	0 ... +10.0 V
voltage range	-11.0 ... +11.0 V
voltage vs. pressure	linear <sup>1)</sup>
Output impedance	200 Ω (short-circuit proof)
Minimum loaded impedance	10 kΩ
Response time	
360-XX3 ... 364-XX3	50 ms
365-X33	100 ms
371-03X	30 ms

Gauge identification	Resistance 13.2 kΩ referenced to supply common
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### Supply

**STOP 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	
Pin 6	-15 VDC ±5% (ripple ≤0.3 V <sub>pp</sub> )
Pin 7	+15 VDC ±5% (ripple ≤0.3 V <sub>pp</sub> )
Pin 11	+24 VDC ±10% (ripple ≤1 V <sub>pp</sub> )
Current	≤0.7 A
Power consumption	
while being heated	≤24 W
at operating temperature	≤15 W (The power consumption strongly depends on the temperature of the vacuum connection.)
Internal fuse	900 mA, slow reaction, automatic reset (Polifuse)
The gauge is protected against polarity change of the supply voltage.	

Electrical connection	15-pole D-Sub, male
Sensor cable	5 poles plus shielding
Cable length	≤50 m (5×0.5 mm <sup>2</sup> )
For longer cables, bigger conductor cross-sections are required (R <sub>conductor</sub> ≤1.0 Ω).	

Grounding concept	→ "Electrical Connection" supply common-signal common
supply common-signal common	conducted separately; for differential measurement

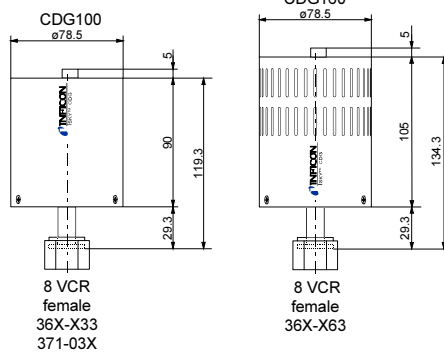
Materials exposed to vacuum	
vacuum connection, tube, protective chamber, plasma shield	stainless steel AISI 316L
sensor housing, diaphragm	ceramic (Al <sub>2</sub> O <sub>3</sub> ≥99.5%)
connection	
sensor housing - diaphragm	glass ceramic solder
diaphragm	AgCu hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
ceramic - metal	

Internal volume	6 cm <sup>3</sup>
Admissible pressure	
365-X33	1000 Torr (absolute) 133322 Pa (absolute)
361-XX3 ... 364-XX3	2000 Torr (absolute) 266644 Pa (absolute)
371-034	266644 Pa (absolute)
360-XX3, 371-035	3000 Torr (absolute) 399966 Pa (absolute)

### Admissible temperatures

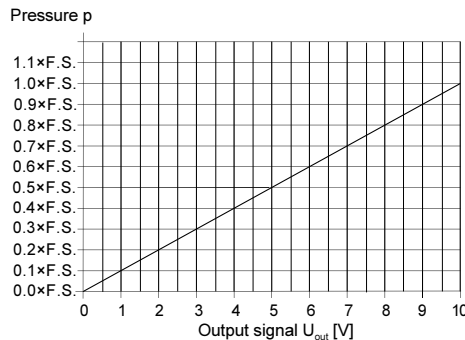
operation	
36X-X3X, 371-03X	+15 °C ... +40 °C
36X-X6X	+15 °C ... +50 °C
vacuum connection	
36X-X3X, 371-03X	≤100 °C
36X-X6X	≤160 °C
storage	-40 °C ... +65 °C
Relative humidity	≤80% at temperatures ≤+31 °C, decreasing to 50% at +40 °C
Mounting orientation	any, → "Installation"
Use	indoors only altitude up to 2000 m NN
Protection category	IP 30

### Dimensions [mm]



Weight	
36X-X33, 371-03X	550 g
36X-X63	600 g

### Output Signal vs. Pressure



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

Example: Gauge with 10 Torr F.S.  
Output signal U<sub>out</sub> = 6 V

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

### Conversion Torr ↔ mbar

Torr	mbar <sup>2)</sup>
1.00	1013.25 / 760 = 1.3332...

### Conversion Pascal ↔ mbar

Pa	mbar <sup>2)</sup>
1.00	0.01

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

## Installation

### Vacuum Connection

**STOP DANGER**

Caution: overpressure in the vacuum system >750 Torr, 100000 Pa  
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.

**STOP DANGER**

Caution: protective ground  
Incorrectly grounded products 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:  
8 VCR connections fulfill this requirement.

**Caution**

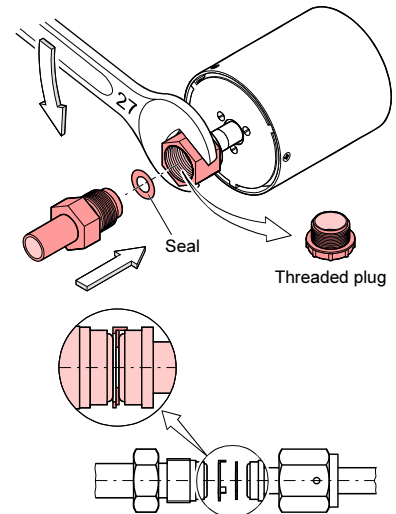
Caution: vacuum component  
Dirt and damages impair the function of the vacuum component.  
When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

**Caution**


Caution: dirt sensitive area  
Touching the product or parts thereof with one's bare hands increases the desorption rate.  
Always wear clean, lint-free gloves and use clean tools when working in this area.

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. If it should be possible to adjust the gauge while it is mounted, make sure its two trimmer potentiometers <zero coarse> and <zero fine> are accessible with a screw driver. The vacuum connection may be heated at the maximum to the controlled sensor temperature of 100 °C (160 °C).

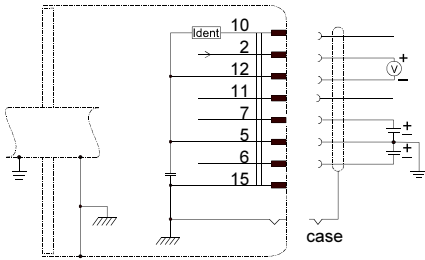
Remove the threaded plug or protective lid and connect the product to the vacuum system.



## Electrical Connection

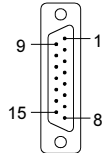
 Make sure the vacuum connection is properly made (→ "Vacuum Connection").

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



### Electrical connection

Pin 2	Signal output (measuring signal)
Pin 5	Supply common
Pin 6	Supply (-15 V)
Pin 7	Supply (+15 V)
Pin 10	Identification
Pin 11	Supply (+24 V)
Pin 12	Signal common
Pin 15	Housing case

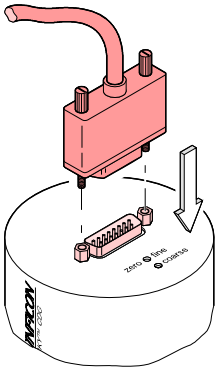


D-Sub, 15-pole female soldering side



- Connect only one supply voltage ( $\pm 15$  V or +24 V).
- Pins 1, 3, 4, 8, 9, 13 and 14 are not assigned in the gauge.

**2** Connect the cable to the gauge



**3** Secure the cable socket to the gauge connector with the lock screws.

**4** Connect the sensor cable to the controller.

## Operation

Turn the gauge on. The sensor is heated and its temperature kept constant at 100 °C or 160 °C depending on the gauge type.

If the vacuum connection is not heated, it takes up to 2 hours until the output signal of the gauge reaches a stability of 5 mV. If the vacuum connection is heated, the warm-up time is reduced accordingly.

## Gas Type Dependence

The measured value is independent of the gas type <sup>1)</sup>.

## Zeroing the Gauge <zero>

When the gauge is put into operation for the first time, its zero should be adjusted.

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

Adjust the zero at the ambient temperature at which the gauge is normally operated. The gauge should be adjusted in the position in which it will be operated.

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

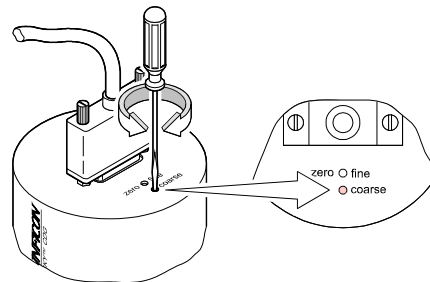
	Recommended final pressure for zero adjustment	
360-XXX	$<5 \times 10^{-2}$ Torr	$<6.65 \times 10^0$ Pa
361-XXX	$<5 \times 10^{-3}$ Torr	$<6.65 \times 10^{-1}$ Pa
362-XXX	$<5 \times 10^{-4}$ Torr	$<6.65 \times 10^{-2}$ Pa
364-XXX	$<5 \times 10^{-5}$ Torr	$<6.65 \times 10^{-3}$ Pa
365-X3X	$<5 \times 10^{-6}$ Torr	$<6.65 \times 10^{-4}$ Pa
371-034	$<5 \times 10^{-5}$ Torr	
371-035	$<5 \times 10^{-6}$ Torr	

**2** Operate the gauge for at least two hours.

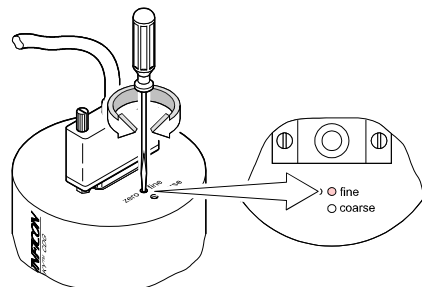
**3** Adjust the gauge measuring the output signal (measurement signal) with a reliable, correctly calibrated (at least) 4-digit instrument.

**4** Only when operating the gauge for the first time:

The influence of the mounting orientation on the output signal can be compensated by adjusting the output signal to  $-0.2 \dots +0.2$  VDC via the <zero coarse> potentiometer by means of a screwdriver (1.5 mm).



**5** Using a screwdriver (1.5 mm), adjust the <zero fine> potentiometer so that the output signal is 0.000 VDC.



## Deinstallation

 **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.

 **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**

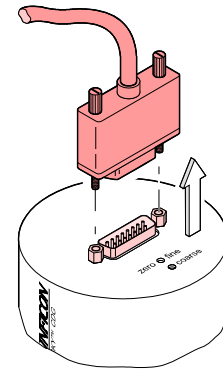


**Caution: dirt sensitive area**  
Touching the product or parts thereof with one's bare hands increases the desorption rate.  
Always wear clean, lint-free gloves and use clean tools when working in this area.

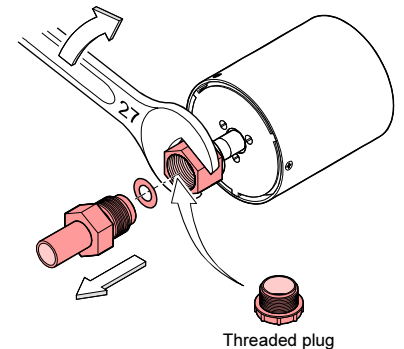
**1** Vent the vacuum system.

**2** Turn the gauge off.

**3** Loosen the lock screws and unplug the sensor cable.



**4** Remove the gauge from the vacuum system.



Threaded plug

## Maintenance, Repair

Under clean operating conditions, the product requires no maintenance.

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

## 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.

- Description of product**  
Type \_\_\_\_\_  
Part number \_\_\_\_\_  
Serial number \_\_\_\_\_
- Reason for return**  
\_\_\_\_\_
- Operating fluid(s) used**  
(Must be drained before shipping.)  
\_\_\_\_\_
- Process related contamination of product:**

toxic	no <input type="checkbox"/> 1)	yes <input type="checkbox"/>	
corrosive	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"/>	

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!

The product is free of any substances which are damaging to health
- 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 manufacturer	Chemical name (or symbol)

Precautions associated with substance	Action if human contact

- 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 \_\_\_\_\_  
Company stamp \_\_\_\_\_  
Date and legally binding signature \_\_\_\_\_

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



We, Inficon, 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 73/23/EEC and the Directive relating to electromagnetic compatibility 89/336/EEC.

## SKY™ Capacitance Diaphragm Gauge

CDG100  
CDG160  
CDG100-H

### Part numbers

360-033	360-063	360-133	360-163
361-033	361-063	361-133	361-163
362-033	362-063	362-133	362-163
364-033	364-063	364-133	364-163
365-033		365-133	
371-034			
371-035			

### 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

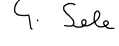
INFICON AG, Balzers

9 August 2001



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Product Manager

9 August 2001



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Quality Representative



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