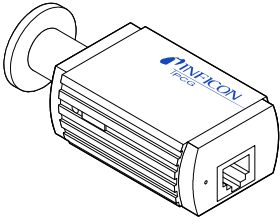


Pirani Capacitance Diaphragm Gauge

PCG400
PCG400-S



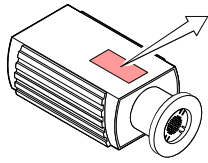
Operating Manual
Incl. Declaration of Conformity

tina28e1-c (2004-05)

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:

PCG400 (without switching function)

- 355-000 (DN 16 ISO-KF)
- 355-001 (1/8" NPT)
- 355-002 (DN 16 CF-F)
- 355-004 (8 VCR[®])
- 355-005 (4 VCR[®])

PCG400-S (2 switching functions)

- 355-010 (DN 16 ISO-KF)
- 355-011 (1/8" NPT)
- 355-012 (DN 16 CF-F)
- 355-014 (8 VCR[®])
- 355-015 (4 VCR[®])

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

If not indicated otherwise in the legends, the illustrations in this document correspond to 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 are indicated in mm.

Intended Use

The Pirani Capacitance Diaphragm Gauges PCG400 and PCG400-S have been designed for vacuum measurement of gases in the pressure range of 5×10^{-4} ... 1500 mbar.

They must not be used for measuring flammable or combustible gases which react in air.

The gauge is intended to be operated in connection with a INFICON Vacuum Gauge Controller VCG401, 402, 403 or with another suitable controller.

Functional Principle

The PCG gauge is a combination gauge consisting of a Pirani sensor and a capacitive diaphragm sensor. Both sensors are constantly active.

At low pressures, only the signal of the Pirani sensor is used for pressure measurement; at high pressures, only the signal of the capacitive diaphragm sensor. To determine the output signal in the intermediate range, both signals are used proportional to the pressure.

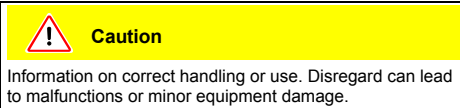
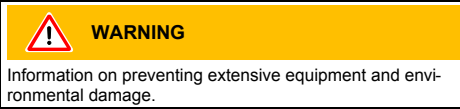
Additionally, the PCG400-S features two switching functions with adjustable setpoints. A floating relay contact is provided for each switching function.

Trademarks

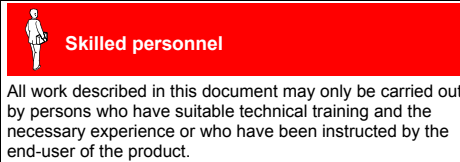
VCR[®] Swagelok Marketing Co.

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 between the product materials and the process media.
Consider possible reactions (e.g. explosion) 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 changes (modifications, alterations etc.) to 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 principle	100 mbar ¹⁾ ... 1500 mbar	capacitance diaphragm sensor
	5×10^{-4} ... 1 mbar	thermal conductance according to Pirani crossover range
	1 ... 100 mbar ¹⁾	
Measurement range		5×10^{-4} ... 1500 mbar
Accuracy (N ₂)		
	1×10^{-3} ... 50 mbar	±15% of reading
	50 ... 950 mbar	±5% of reading
	Atmospheric pressure (950 ... 1050 mbar)	±2.5% of reading
Repeatability (N ₂)		±2% of reading (1 × 10 ⁻³ ... 1100 mbar)
Output signal (measurement signal)		
Voltage range		0 ... +10.3 V
Measurement range		+1.9 ... +10.23 V
Voltage vs. pressure		1.286 V/decade, logarithmic
Output impedance		2 × 4.7 Ω, short circuit-proof
Minimum load impedance		10 kΩ
Response time		10 ms
Gauge Identification		resistor 71.5 kΩ from pin 4 to pin 2 of electrical connector (→ "Electrical Connection")
HV Adjustment		at <<10 ⁻⁴ mbar (with potentiometer <HV>)
Switching functions (PCG400-S)		
Setting range		
Voltage range		2.51 ... 10.19 V with potentiometer <SP1/2> 1.5×10^{-3} ... 1400 mbar with potentiometer <SP1/2>
Pressure range (N ₂)		
Hysteresis		10% of threshold
Relay contact		
Type		1 floating contact (n.o.) per switching function
Contact rating		30 VDC, 1 A, resistive
Operation		Relay energizes if the pressure drops below the set threshold (On).
Status indicator		Green lamp lights up if the pressure drops below the set threshold (On).
Supply		
<p>The gauge may only be connected to supply and evaluation 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 fused²⁾.</p>		
Supply voltage at gauge		+15 ... +30 VDC (ripple ≤1 V _{pp})
Power consumption		≤2.5 W
Fuse to be connected ²⁾		1 AT
Electrical connection		FCC 68
Sensor cable		screened, 0.14 mm ² /conductor
Cable length		≤100 m
Grounding concept		→ "Electrical Connection"
Vacuum connection to signal common		connected via 1 MΩ
Materials exposed to vacuum		
Vacuum connection		stainless steel
Pirani filament		tungsten
Feedthrough		glass
Orifice ³⁾		stainless steel
Other materials		Ni, Cu, NiFe, SnAg, glass, Al ₂ O ₃ (>99.5%)

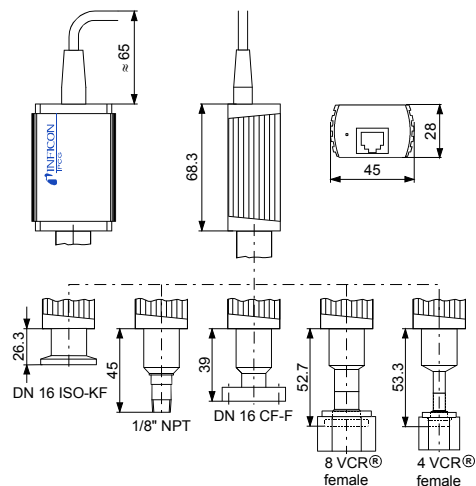
¹⁾ Crossover range for air, O₂, CO and N₂ 10 mbar, 100 mbar in heavy gases.

²⁾ INFICON controllers fulfill these requirements.

³⁾ Only versions DN 16 ISO-KF and DN 16 CF-F.

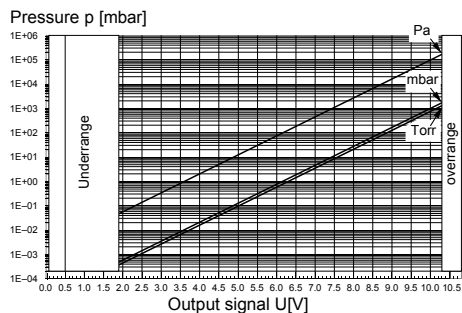
Internal volume	
DN 16 ISO-KF	6 cm ³
1/8" NPT	8 cm ³
DN 16 CF-F	8 cm ³
8 VCR®	10 cm ³
4 VCR®	8 cm ³
Admissible pressure	≤5 bar (absolute)
Admissible Temperatures	
Storage	-20 ... +65 °C
Operation (ambient)	+10 ... +50 °C
Bake-out ⁴⁾	≤80 °C
Filament temperature	<160 °C
Relative humidity	≤80% at temperatures ≤+31 °C, decreasing to 50% at +40 °C
Mounting orientation	any
Use	indoors only altitudes up to 2000 m NN
Protection category	IP 40

Dimensions [mm]



Weight	
DN 16 ISO-KF	90 g
1/8" NPT	90 g
DN 16 CF-F	120 g
8 VCR®	145 g
4 VCR®	130 g

Output Signal vs. Pressure



$$p = 10^{0.778(U-c)} \Leftrightarrow U = c + 1.286 \log_{10} p$$

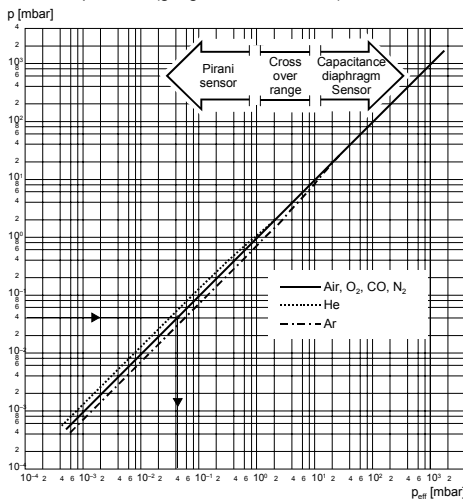
valid in the range 5×10^{-4} mbar < p < 1500 mbar

U	p	c	U	p	c
[V]	[mbar]	6.143	[V]	[micron]	2.448
[V]	[µbar]	2.287	[V]	[Pa]	3.572
[V]	[Torr]	6.304	[V]	[kPa]	7.429
[V]	[mTorr]	2.448			

where p pressure
U output signal
c constant (pressure unit dependent)

Gas Type Dependence

Indicated pressure (gauge calibrated for air)



Calibration factors

valid for Pirani pressure range below 1 mbar

$$p_{\text{eff}} = C \times \text{indicated pressure}$$

Gas type	Calibration factor C	Gas type	Calibration factor C
He	0.8	H ₂	0.5
Ne	1.4	air, O ₂ , CO, N ₂	1.0
Ar	1.7	CO ₂	0.9
Kr	2.4	water vapour	0.5
Xe	3.0	Freon 12	0.7

Installation

Vacuum Connection

STOP DANGER



Caution: 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 of clamps which are suited to overpressure.

STOP DANGER



Caution: 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.

STOP DANGER



Caution: protective ground

Incorrectly grounded products can be extremely hazardous in the event of a fault.

The gauge must be electrically connected to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF, NPT and VCR® connections fulfill this requirement
- For gauges with a KF connection, use a conductive metallic clamping ring.

! Caution



Caution: vacuum component

Dirty 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

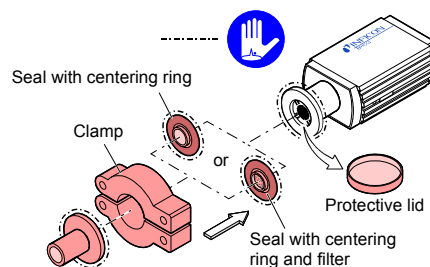
Touching the product or parts thereof with one's bare hands increases the desorption rate.

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



The gauge may be mounted in any orientation. 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 potentiometers can be accessed (→ "Adjustment" and "Switching functions").

Remove the protective lid and install the product at the vacuum system.




Keep the protective lid.

⁴⁾ Temperature at vacuum connection with horizontal mounting orientation. During bake-out, measurement range, accuracy, and repeatability may deviate from specifications.



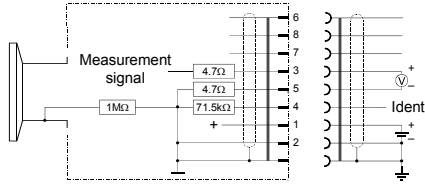
(2004-05)

Electrical Connection

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

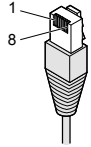
1 If no sensor cable is available, make one according to the following diagram.

PCG400 (without switching function)



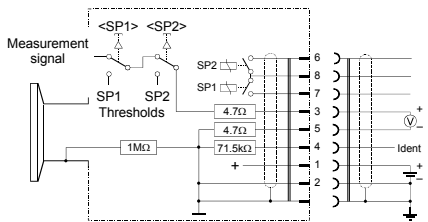
Electrical Connection

Pin 1 Supply
Pin 2 Supply common, GND
Pin 3 Measurement signal
Pin 4 Gauge identification
Pin 5 Signal common
Pin 6, 7, 8 Not connected



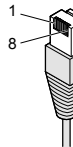
FCC 68, 8 pin

PCG400-S (2 switching functions)



Electrical Connection

Pin 1 Supply
Pin 2 Supply common, GND
Pin 3 Measurement signal/
Thresholds SP1/2
Pin 4 Gauge identification
Pin 5 Signal common
Pin 6, 8 Relay SP2, n.o. contact
Pin 7, 8 Relay SP1, n.o. contact



FCC 68, 8 pin

2 Connect the sensor cable to the controller.

Operation

When the supply voltage is being applied, the measurement signal is available at the connector (→ "Electrical Connection").



Allow a stabilization period of ≈10 minutes after power has been applied.

It is advisable to operate the gauge continuously, irrespective of the pressure.

Gas Type Dependence

Pressure Range	Measurement Principle	Gas Type Dependence
100 ¹⁾ ... 1500 mbar	capacitance diaphragm sensor	independent of gas type, no correction required
1 ... 100 ¹⁾ mbar	capacitance diaphragm sensor and Pirani sensor	crossover range
5×10 ⁻⁴ ... 1 mbar	Pirani sensor	proportional to pressure ⁵⁾

⁵⁾ The pressure reading applies to dry air, O₂, CO and N₂. For other gases, it has to be converted (→ "Technical Data").

Adjustment

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

The zero must be adjusted at the ambient temperature at which the gauge is normally operated.

1 If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ "Deinstallation").

2 Activate the gauge.

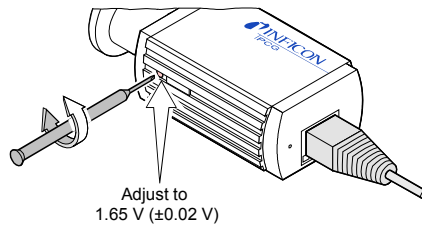
3 Connect a DC voltmeter to output signal (→ "Electrical Connection").

4 Evacuate vacuum system to p <<10⁻⁴ mbar.



Wait 10 minutes (stabilization period).

5 Carry out adjustment with potentiometer <HV> by means of the enclosed screwdriver.



Adjust to 1.65 V (±0.02 V)

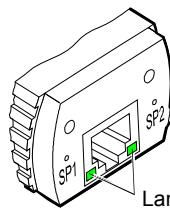
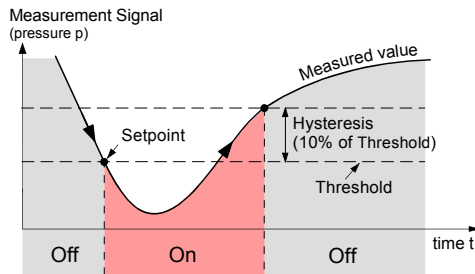


PCG400/400-S gauges do not require adjustment at atmospheric pressure.

Switching Functions (PCG400-S)

The setpoints are adjustable in a voltage range of 2.51 ... 10.19 V. Each switching function provides a floating relay contact (→ "Electrical Connection").

The status is indicated by a lamp.



Lamps

Status	Lamp	Relay
Off	dark	deenergized
On	lit	energized

Adjustment of Switching Function

DANGER



Caution: malfunction

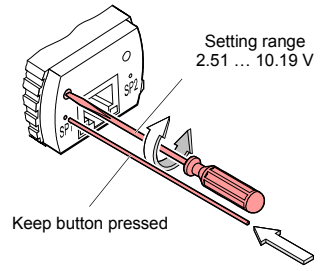
If processes are controlled via the signal output, it should be borne in mind that by pressing the <SP> button the measurement signal is suppressed and the threshold is output instead. This may lead to malfunctions.

Press the <SP> button only when you are sure that no damages can arise from a malfunction.



Status of relay and lamp is not affected while the button is being pressed.

1 Press button <SP1> with a pin (ø<1mm) and adjust threshold by means of the enclosed screwdriver.



Keep button pressed



2 Turns (cw) will rise the threshold by one pressure decade. The upper threshold is 10% higher (hysteresis).

2 Release the button. The gauge resumes normal operation. The controller connected to the gauge shows the current pressure value again.

The adjustment procedure for <SP2> is identical to the one described for <SP1>.

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 vacuum system.


2 Turn the gauge off.

3 Unplug sensor cable.

4 Remove the gauge from the vacuum system and cover the vacuum connection with the protective lid.

Maintenance, Repair

The product requires no maintenance.


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

Accessories

	Part number
Centering ring with fine filter DN 16 ISO-KF	211-097

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.

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 _____
Part number _____
Serial number _____
- 2 Reason for return**

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

- 4 Used in copper process**
no yes  Seal product in plastic bag and mark it with a corresponding label.
- 5 Process related contamination of product:**

toxic	no <input type="checkbox"/>	1) yes <input type="checkbox"/>	yes <input type="checkbox"/>
corrosive	no <input type="checkbox"/>	1) yes <input type="checkbox"/>	yes <input type="checkbox"/>
biological hazard	no <input type="checkbox"/>	yes <input type="checkbox"/>	2) yes <input type="checkbox"/>
explosive	no <input type="checkbox"/>	yes <input type="checkbox"/>	2) yes <input type="checkbox"/>
radioactive	no <input type="checkbox"/>	yes <input type="checkbox"/>	2) yes <input type="checkbox"/>
other harmful substances	no <input type="checkbox"/>	1) yes <input type="checkbox"/>	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. yes
- 6 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
- 7 Legally binding declaration:**
We hereby declare that the information on this form is complete and accurate and that 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 _____

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.

Pirani Capacitance Diaphragm Gauge

PCG400
PCG400-S

Part numbers

355-000
355-001
355-002
355-004
355-005

355-010
355-011
355-012
355-014
355-015

Standards

Harmonized and international/national standards and specifications:

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

Signatures

INFICON AG, Balzers

18 May 2004

18 May 2004

Markus Baffy
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Quality Representative



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