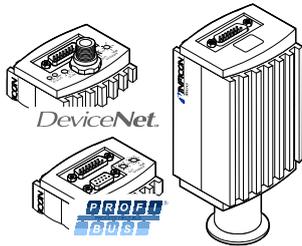


TripleGauge™

Bayard-Alpert Pirani Capacitance Diaphragm Gauge

BCG450
BCG450-SD
BCG450-SP

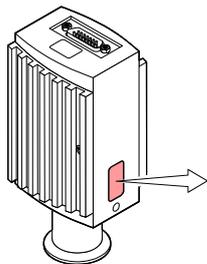


Instruction Sheet
Incl. EC Declaration of Conformity

tima40e1-b (2011-04)

Product Identification

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



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

Validity

This document applies to products with the following part numbers (PN):

BCG450 (without display)

- 353-550 (DN 25 ISO-KF)
- 353-551 (DN 40 CF-R)
- 353-561 (DN 25 ISO-KF, with baffle)

BCG450 (with display)

- 353-552 (DN 25 ISO-KF)
- 353-553 (DN 40 CF-R)

BCG450-SD (with DeviceNet interface and switching functions)

- 353-557 (DN 25 ISO-KF)
- 353-558 (DN 40 CF-R)
- 353-562 (DN 25 ISO-KF, with baffle)

BCG450-SP (with Profibus interface and switching functions)

- 353-554 (DN 25 ISO-KF)
- 353-556 (DN 40 CF-R)

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

If not indicated otherwise in the legends, the illustrations in this document correspond to the gauge with part number 353-550. They apply to the other gauges by analogy.

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

All dimensions in mm.

Intended Use

The BCG450, BCG450-SD and BCG450-SP gauges have been designed for vacuum measurement of gases in the pressure range 5×10^{-10} ... 1500 mbar.

They must not be used for measuring flammable or combustible gases in mixtures containing oxidants (e.g. atmospheric oxygen) within the explosion range.

Trademarks

DeviceNet™ Open DeviceNet Vendor Association, Inc.
TripleGauge™ INFICON AG, Balzers

Functional Principle

Due to the combination of three sensor technologies incorporated in the gauge (Capacitance diaphragm sensor, Pirani sensor and hot cathode ionisation sensor (BA)), a minimized gas type dependence is achieved.

Between 10 mbar and atmospheric pressure, the capacitance diaphragm sensor operates without any gas type dependence. Below 1 mbar, the Pirani sensor and the hot cathode ionisation sensor take over with only a small gas type dependence.

Between $1 \dots 10$ mbar and $5 \times 10^{-3} \dots 2 \times 10^{-2}$ mbar the gauges built in electronic circuits take care of continuous and smooth crossovers between the ranges. Over the whole measurement range, the measurement signal is output as a logarithm of the pressure.

The hot cathode is switched on by the Pirani measurement system only below the switching threshold of 2.4×10^{-2} mbar (to prevent filament burn-out). It is switched off when the pressure exceeds 3.2×10^{-2} mbar.

Gauge adjustment is carried out automatically, no manual adjustment is required.

A user programmable atmospheric pressure switching function is incorporated.

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.

Gauge failures due to contamination or wear and tear, as well as expendable parts (e.g. filament), are not covered by the warranty.

Technical Data



In some points, the technical data of BCG450-SD and BCG450-SP differ from those of BCG450, which are given below (→ "Technical Data" in [1] and [2]).

Measuring principle

10 ... 1500 mbar	capacitance diaphragm sensor
1 ... 10 mbar	crossover range
2×10^{-2} ... 1 mbar	Pirani sensor
5×10^{-3} ... 2×10^{-2} mbar	crossover range
5×10^{-10} ... 5×10^{-3} mbar	hot cathode ionization (BA)

Measuring range

(air, O₂, CO, N₂)

Accuracy

1×10^{-8} ... 50 mbar	±15% of reading
50 ... 950 mbar	±5% of reading
950 ... 1050 mbar	±2.5% of reading (after 10 min. stabilization)

Repeatability

(1×10^{-8} ... 10^{-2} mbar)	5% of reading (after 10 min. stabilization)
--	---

Emission

Switching on threshold	2.4×10^{-2} mbar
Switching off threshold	3.2×10^{-2} mbar

Emission current	5 mA
$p \leq 7.2 \times 10^{-6}$ mbar	
7.2×10^{-6} mbar < p < 3.2×10^{-2} mbar	25 µA

Emission current switching	
25 µA ⇒ 5 mA	7.2×10^{-6} mbar
5 mA ⇒ 25 µA	3.0×10^{-5} mbar

Degas

Current (p < 7.2×10^{-6} mbar) ≈ 20 mA (P_{degas} ≈ 4.0 W)

Control input signal 0 V/+24 V, active high

Duration < 3 min, followed by automatic stop. A new degas cycle can only be started after a waiting time of 30 minutes.

In degas mode, the BCG450 keeps supplying pressure readings, the tolerances of which can be higher than during normal operation.

Output signal

(measuring signal) 0 ... +10.13 V

Measuring range

0.774 ... 10.13 V (5×10^{-10} ... 1500 mbar)

Relationship voltage-pressure

logarithmic, 0.75 V/decade

Error signal (→ [1])

+0.1 V	diaphragm sensor error or EEPROM error
+0.3 V	BA sensor error
+0.5 V	Pirani sensor error

Minimum load impedance

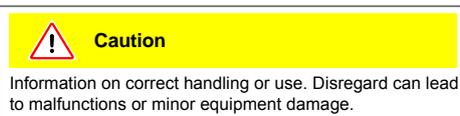
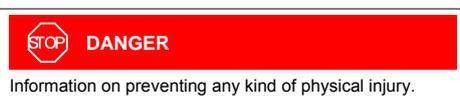
10 kΩ

Gauge identification

42 kΩ between Pin 10 and Pin 5 (gauge cable connector)

Safety

Symbols Used



Personnel Qualifications



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 (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.

Atmosphere switching function (relay "Atmosphere reached")	Atmospheric pressure threshold programmable via serial interfaces (→ [1])
BCG450	threshold value programmable via RS232 (default value 99%)
BCG450-SD/-SP	threshold value programmable via fieldbus interfaces (→ corresponding communication protocols).

RS232C interface (BCG450)	
Data rate	9600 Baud
Data format	binary
	8 data bits
	one stop bit
	no parity bit
	no handshake
Connector	→ "Power Connection"
Further information on the RS232C interface → [1]	

Display (353-552, 353-553)	LCD matrix, 32×16 pixels
Background illumination	two colors red/green
Dimensions	16.0 mm × 11.2 mm
Pressure units	mbar (default), Torr, Pa (Selecting the pressure unit → [1])

Supply

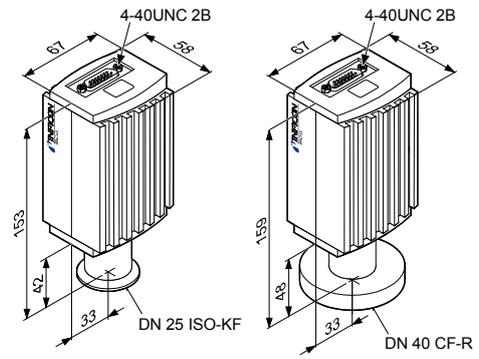
STOP DANGER

The gauge must 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 ¹⁾.

Voltage at gauge	+24 VDC (+20 ... +28 VDC) (ripple ≤ 2 V _{pp}) ²⁾
Power consumption	Standard ≤ 0.5 A
	Degas ≤ 0.9 A
	Emissions start (200 ms) ≤ 1.4 A
Fuse required ¹⁾	1.25 AT
Power consumption	≤ 18 W (BPG450)
Electrical connection	D-Sub, 15-pin, male
Sensor cable	shielded, number of conductors depending on the functions used (max. 15 conductors plus shielding).
Cable length (24 VDC (conductor cross-section))	≤ 35 m (0.25 mm ²) ≤ 50 m (0.34 mm ²) ≤ 100 m (1.0 mm ²)
For operation with RS232C interface	≤ 30 m

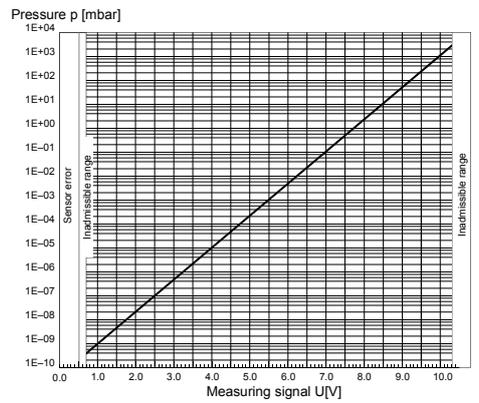
Materials on the vacuum side	
Housing, supports, screens	stainless steel
Feedthroughs	NiFe nickel plated
Insulator	glass
Cathode	iridium, yttrium oxide (Y ₂ O ₃)
Cathode holder	molybdenum
Pirani element	tungsten, copper
Diaphragm	ceramic (Al ₂ O ₃)
Sensor electrodes	SnAg
Internal volume	
DN 25 ISO-KF	≈ 24 cm ³
DN 40 CF-R	≈ 34 cm ³
Maximum admissible pressure	5 bar (absolute)
Admissible temperatures	
Storage	-20 ... +70 °C
Operation	0 ... +50 °C
Bakeout	+80 °C (at vacuum connection, without electronics unit, horizontally mounted)
Relative humidity	
Year's mean	≤ 65% (not condensable)
During 60 days	≤ 85% (not condensable)
Use	
	indoors only
	altitude up to 2000 m NN
Mounting orientation	
	any
Type of protection	IP 30

Dimensions [mm]



Weight	353-550 / -552 / -561	≈ 305 g
	353-551 / -553	≈ 565 g
	353-554 / -557 / -562	≈ 445 g
	353-556 / -558	≈ 710 g

Measuring Signal vs. Pressure

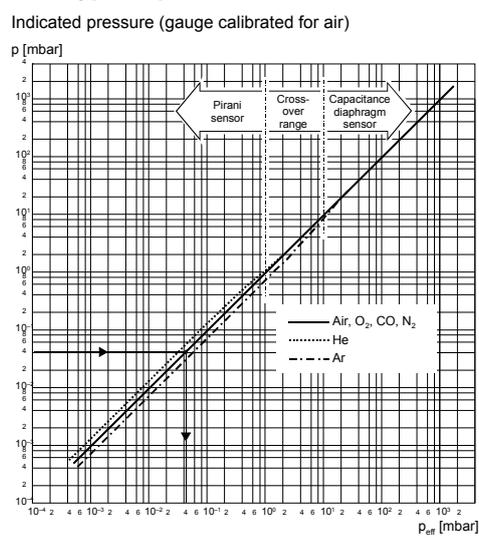


$$p = 10^{(U-7.75) \cdot 0.75^c}$$

U	p	c
[V]	[mbar]	0
[V]	[Pa]	2
[V]	[Torr]	-0.125

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

Gas Type Dependence



Calibration factors

(Gauge calibrated for air)

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

Valid for Pirani pressure range 2×10⁻² ... 1 mbar:

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	H ₂ O vapor	0.5
Xe	3.0	freon 12	0.7

Valid for BA pressure range ≤ 5×10⁻³ mbar:

Gas type	Calibration factor C	Gas type	Calibration factor C
He	5.9	H ₂	2.4
Ne	4.1	air, O ₂ , CO, N ₂	1.0
Ar	0.8		
Kr	0.5		
Xe	0.4		

(Indicated factors are average values.)

Installation

Vacuum Connection

STOP 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.

STOP 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.

STOP DANGER

DANGER: 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 connection fulfill this requirement
- For gauges with a KF flange, use a conductive metallic clamping ring

¹⁾ INFICON gauge controllers fulfill these requirements.
²⁾ Measured at the sensor cable connector (consider the voltage drop on the sensor cable).



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.

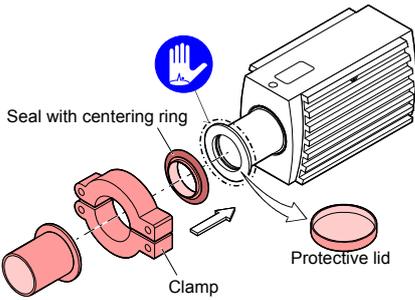
Caution

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.

- 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.
- The gauge is supplied with a built-in grid. For potentially contaminating applications and to protect the electrodes against light and fast particles, installation of
- the optional baffle or
 - the optional centering ring with baffle is recommended (→ [1]).

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

We recommend to install the gauge without applying vacuum grease.



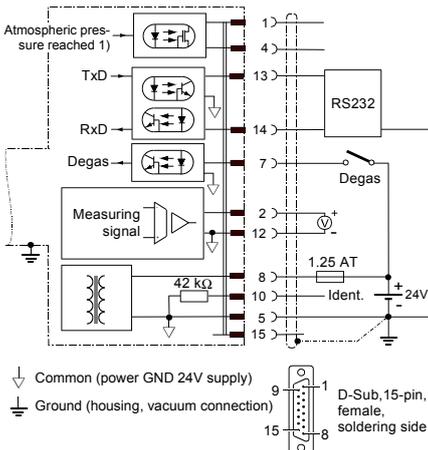
Keep the protective lid.

Power Connection (BCG450)

The following information on the electrical connection as well as the wiring diagram applies to BCG450 only (→ [1] and [2] for details on the electrical connection and additional functions of BCG450-SD and -SP).

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

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



Electrical connection

Pin 1	Relay "Atmosphere reached", n. o. contact	1)
Pin 2	Measuring signal output	0 ... +10.13 V
Pin 4	Relay "Atmosphere reached", com contact	1)
Pin 5	Supply common	0 V
Pin 7	Degas on, active high	0 V/+24 V
Pin 8	Supply	+24 V
Pin 10	Gauge identification	
Pin 12	Measuring signal common	
Pin 13	RS232, TxD	
Pin 14	RS232, RxD	
Pin 15	Do not connect	

Pins , 3, 6, 9 and 11 are not connected internally.

1) Detailed information on the atmosphere switching function and the "Atmosphere reached" relay → [1].

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

Operation

When the supply voltage is applied, the measuring signal is available between pins 2 (+) and 12 (-) (Relationship Measuring Signal – Pressure → "Technical Data" and [1]).

BCG450-SD and -SP can also be operated via the corresponding fieldbus interface (DeviceNet or Profibus, → [1] and [2] for further details and functions).

Allow for a stabilizing time of ≈10 minutes. Once the gauge has been switched on, permanently leave it on irrespective of the pressure.

Gas Type Dependence

Pressure range	Measuring principle	Gas type dependence
10 ... 1500 mbar	capacitance diaphragm sensor	independent of gas type, no correction required
1 ... 10 mbar	capacitance diaphragm sensor and Pirani sensor	crossover range
2×10^{-2} ... 1 mbar	Pirani sensor	1)
5×10^{-3} ... 2×10^{-2} mbar	Pirani sensor and hot cathode ionisation sensor (BA)	crossover range
5×10^{-10} ... 5×10^{-3} mbar	hot cathode ionisation sensor (BA)	1)

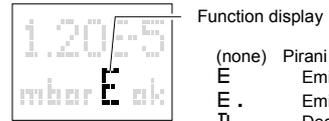
1) → Table "Technical Data, Calibration factors"

Adjusting the Gauge

The gauge is adjusted automatically (adjustment of the atmosphere switching function (atmosphere sensor) → [1]).

Display

(BCG450 with part numbers 353-552 and 353-553)



(none) Pirani operation
E Emission 25 µA
E . Emission 5 mA
D Degas

Error display:



No error (green background illumination)



Pirani sensor error (red background illumination)



BA sensor error (red background illumination)



Diaphragm sensor error (red background illumination)



EEPROM error (red background illumination)



Internal data connection failure (red background illumination)

Deinstallation

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.

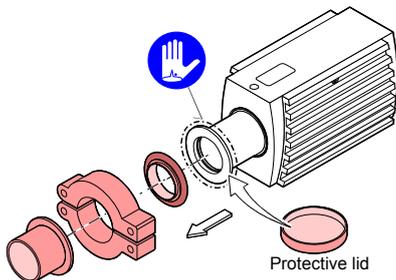
Caution

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 Put the gauge out of operation, switch off power supply.
- 3 Unfasten the lock screws and unplug the sensor cable. (If you are using BCG450-SD or -SP, unfasten and unplug the interface cable too (→ [1] and [2]).
- 4 Remove the gauge from the vacuum system and replace the protective lid.



Maintenance, Troubleshooting

In case of severe contamination or a malfunction, the sensor can be replaced (→ [1]).

Adjustment of the atmosphere sensor is described in detail in [1].

- Gauge failures due to contamination or wear and tear, as well as expendable parts (e. g. filament), are not covered by the warranty.

Returning the Product



WARNING

WARNING: forwarding contaminated products
Contaminated products (e.g. radioactive, toxic, caustic or biological 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 ¹⁾

¹⁾ Form under www.inficon.com

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



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.

WARNING



WARNING: substances detrimental to the environment

Products or parts thereof (mechanical and electrical 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 recycled.
- Other components
Such components must be separated according to their materials and recycled.

Further Information

[1] www.inficon.com
Operating Manual
TripleGauge™ BCG450, BCG450-SD, BCG450-SP
tina40d1 German
tina40e1 English
INFICON AG, LI-9496 Balzers, Liechtenstein

[2] www.inficon.com
Instruction Sheet
TripleGauge™ BCG450-SD, BCG450-SP
tima41d1 German
tima41e1 English
INFICON AG, LI-9496 Balzers, Liechtenstein

EC Declaration of Conformity



We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electromagnetic compatibility 2004/108/EC.

TripleGauge™

BCG450
BCG450-SD
BCG450-SP

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2001 (EMC: generic emission standard)
- EN 61010-1:2001 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326:1997 + A1:1998 + A2:2001 + A3:2003 (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signatures

INFICON AG, Alte Landstraße 6, LI-9496 Balzers

18 April 2011

18 April 2011

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