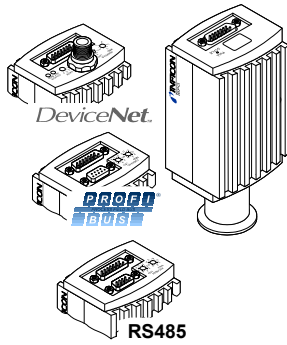


# Bayard-Alpert Pirani Gauge

BPG400  
BPG400-SD  
BPG400-SP  
BPG400-SR

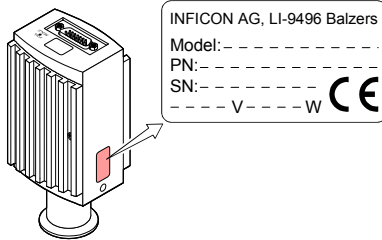


Instruction Sheet  
Incl. Declaration of Conformity

tima03e1-b (0309)

## 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.



## Validity

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

BPG400 (without display)  
353-500 (DN 25 ISO-KF)  
353-502 (DN 40 CF-R)

BPG400 (with display)  
353-501 (DN 25 ISO-KF)  
353-503 (DN 40 CF-R)

BPG400-SD (with DeviceNet interface and switching functions)  
353-507 (DN 25 ISO-KF)  
353-508 (DN 40 CF-R)

BPG400-SP (with Profibus interface and switching functions)  
353-505 (DN 25 ISO-KF)  
353-506 (DN 40 CF-R)

BPG400-SR (with RS485 interface and switching functions)  
353-509 (DN 25 ISO-KF)  
353-513 (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 353-500. 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 BPG400, BPG400-SD, BPG400-SP and BPG400-SR gauges have been designed for vacuum measurement of non-flammable gases and gas mixtures in a pressure range  $5 \times 10^{-10} \dots 1000$  mbar.

The gauges can be operated in connection with the VGC103 or VGC40x Vacuum Gauge Controller or with another instrument or control device.

## Functional Principle

Over the whole measuring range, the gauge has a continuous characteristic curve and its measuring signal is output as logarithm of the pressure.

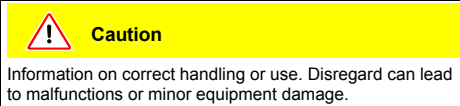
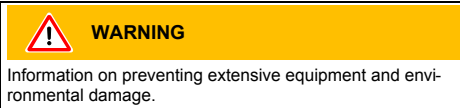
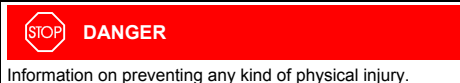
The gauge functions with a Bayard-Alpert hot cathode ionization measurement system (for  $p < 2.0 \times 10^{-2}$  mbar) and a Pirani measurement system (for  $p > 5.5 \times 10^{-3}$  mbar). In the overlapping pressure range of  $2.0 \times 10^{-2} \dots 5.5 \times 10^{-3}$  mbar, a mixed signal of the two measurement systems is output. The hot cathode is switched on by the Pirani measurement system only below the switching threshold of  $2.4 \times 10^{-2}$  mbar (to prevent filament burn-out). It is switched off when the pressure exceeds  $3.2 \times 10^{-2}$  mbar.

## Trademarks

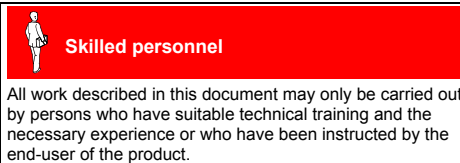
DeviceNet™ Open DeviceNet Vendor Association, Inc.

## 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. 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

In some points, the technical data of BPG400-SD, BPG400-SP and BPG400-SR differ from those of BPG400, which are given below (→ "Technical Data" in [1] and [2]).

|  |  |
|--|--|
| Measuring range<br>(air, O <sub>2</sub> , CO, N <sub>2</sub> ) | $5 \times 10^{-10} \dots 1000$ mbar<br>continuous  |
| Accuracy   | 15% of reading in the range of $1 \times 10^{-8} \dots 10^{-2}$ mbar<br>(after 5 min. stabilization) |
| Repeatability  | 5% of reading in the range of $1 \times 10^{-8} \dots 10^{-2}$ mbar<br>(after 5 min. stabilization)  |

|   |                           |
|---|---------------------------|
| Emission  |                           |
| Switching on threshold                                    | $2.4 \times 10^{-2}$ mbar |
| Switching off threshold                                   | $3.2 \times 10^{-2}$ mbar |
| Emission current  |                           |
| $p \leq 7.2 \times 10^{-6}$ mbar                          | 5 mA                      |
| $7.2 \times 10^{-6}$ mbar $< p < 3.2 \times 10^{-2}$ mbar | 25 $\mu$ A                |
| Emission current switching                                |                           |
| 25 $\mu$ A $\Rightarrow$ 5 mA                             | $7.2 \times 10^{-6}$ mbar |
| 5 mA $\Rightarrow$ 25 $\mu$ A                             | $3.2 \times 10^{-5}$ mbar |

|  |   |
|--|---|
| Degas  |   |
| Current ( $p < 7.2 \times 10^{-6}$ mbar)   | $\approx 16$ mA ( $P_{\text{degas}} \approx 4.0$ W) |
| Control input signal   | 0 V/24 V, high active                               |
| Duration   | $< 3$ min, followed by automatic stop               |
| In degas mode, the BPG400 keeps supplying pressure readings, the tolerances of which can be higher than during normal operation. |   |

|                                     |   |
|-------------------------------------|---|
| Output signal<br>(measuring signal) | 0 ... +10 V   |
| Measuring range                     | $0.774$ V $\pm 5 \times 10^{-10}$ mbar<br>... 10 V $\pm 1000$ mbar    |
| Relationship voltage-pressure       | logarithmic,<br>0.75 V/decade   |
| Error signal (→ [1])                | $\approx 0.3$ V (hot cathode error)<br>$\approx 0.5$ V (Pirani error) |
| Minimum load impedance              | 10 k $\Omega$   |

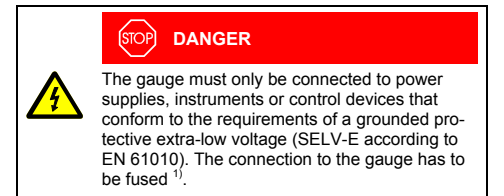
|                      |  |
|----------------------|--|
| Gauge identification | 42 k $\Omega$ between Pin 10 and Pin 5 (gauge cable) |
|----------------------|--|

|                  |  |
|------------------|--|
| RS232C interface |  |
| Data rate        | 9600 Baud  |
| Data format      | binary<br>8 data bits<br>one stop bit<br>no parity bit<br>no handshake |
| Connector        | → "Electrical Connection"  |

Further information on the RS232C interface → [1]

|                                  |  |
|----------------------------------|--|
| Display panel (353-501, 353-503) | LCD matrix, 32×16 pixels, with background illumination       |
| Dimensions                       | 16.0 mm × 11.2 mm  |
| Pressure units                   | mbar (default), Torr, Pa (Selecting the pressure unit → [1]) |

## Supply



|                             |  |
|-----------------------------|--|
| Voltage at gauge            | 24 VDC (20 ... 28 VDC)<br>(ripple $\leq 2$ V <sub>pp</sub> ) <sup>2)</sup> |
| Power consumption           |  |
| Standard                    | $\leq 0.5$ A   |
| Degas                       | $\leq 0.8$ A   |
| Emissions start (200 ms)    | $\leq 1.4$ A   |
| Fuse required <sup>1)</sup> | $\leq 1.25$ AT   |
| Power consumption           | $\leq 16$ W  |

<sup>1)</sup> INFICON controllers fulfill these requirements.

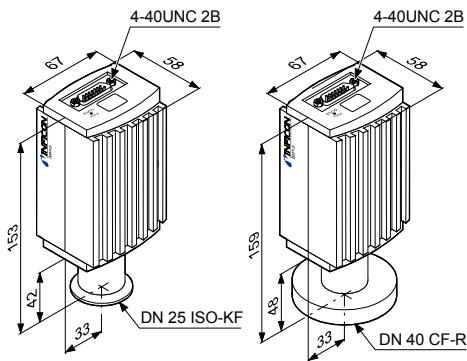
<sup>2)</sup> Consider the voltage drop on the sensor cable.

|  |   |
|--|---|
| Electrical connection                          | D-Sub, 15 pins, male  |
| Sensor cable                                   |   |
| For analog values only, without degas function | 4 conductors, shielded  |
| For analog values, with degas function         | 5 conductors, shielded  |
| All functions, incl. RS232C interface          | 7 conductors, shielded  |
| Cable length (24 VDC)                          | ≤35 m (4/5/7x0.25 mm <sup>2</sup> )<br>≤50 m (4/5/7x0.34 mm <sup>2</sup> )<br>≤100 m (4/5/7x1.0 mm <sup>2</sup> ) |
| 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 <sub>2</sub> O <sub>3</sub> ) |
| Cathode holder               | molybdenum  |
| Pirani element               | tungsten, copper  |
| Internal volume              |   |
| DN 25 ISO-KF                 | ≈24 cm <sup>3</sup>                                     |
| DN 40 CF-R                   | ≈34 cm <sup>3</sup>                                     |
| Maximum admissible Pressure  |   |
|                              | 2 bar (absolute)  |

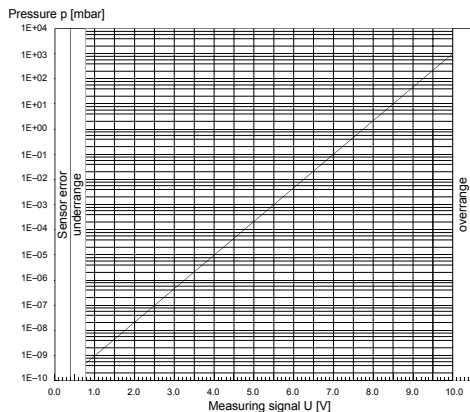
|                         |  |
|-------------------------|--|
| Admissible temperatures |  |
| Storage                 | -20 ... +70 °C                           |
| Operation               | 0 ... +50 °C                             |
| Bakeout                 | 150 °C (without electronics unit)        |
| Relative humidity       |  |
| Year's mean             | ≤65% (not condensable)                   |
| During 60 days          | ≤85% (not condensable)                   |
| Use                     |  |
|                         | indoors only<br>altitude up to 2000 m NN |
| Type of protection      |  |
|                         | IP 30                                    |

#### Dimensions [mm]



|                  |        |
|------------------|--------|
| Weight           |        |
| 353-500, 353-501 | ≈285 g |
| 353-502, 353-503 | ≈550 g |
| 353-505, 353-507 |        |
| 353-509          | ≈430 g |
| 353-506, 353-508 |        |
| 353-513          | ≈695 g |

#### Relationship Measuring Signal – Pressure



$$p = 10^{(U-7.75)/0.75+c}$$

| 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

For gases other than air, the pressure in the indication range  $p < 10^{-3}$  mbar can be determined by a simple conversion:

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

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

#### 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 clamps which are suited to overpressure.

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

**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

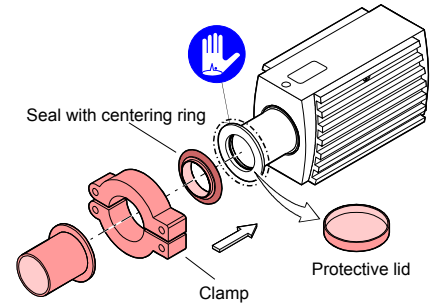
Touching the product or parts thereof with bare hands increases the desorption rate.

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 is recommended (→ [1]).

Remove the protective lid and install the product to the vacuum system, preferably without applying vacuum grease.



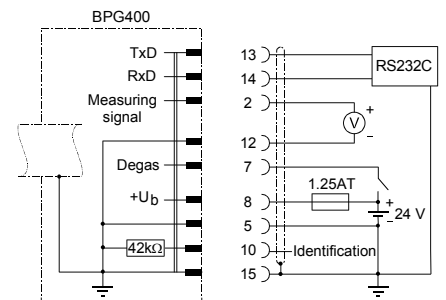
Keep the protective lid.

##### Electrical Connection (BPG400)

The following information on the electrical connection as well as the wiring diagram applies to BPG400 only (→ [1] and [2] for details on the electrical connection and additional functions of BPG400-SD, -SP and -SR).

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

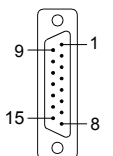
If no connection cable is available, make one according to the following diagram.



##### Electrical connection

|        |                                  |             |
|--------|----------------------------------|-------------|
| Pin 2  | Signal output (measuring signal) | 0 ... +10 V |
| Pin 5  | Supply common, GND               |             |
| Pin 7  | Degas on, active high            | +24 VDC     |
| Pin 8  | Supply                           | +24 VDC     |
| Pin 10 | Gauge identification             |             |
| Pin 12 | Signal common, GND               |             |
| Pin 13 | RS232C, TxD                      |             |
| Pin 14 | RS232C, RxD                      |             |
| Pin 15 | Shielding, housing, GND          |             |

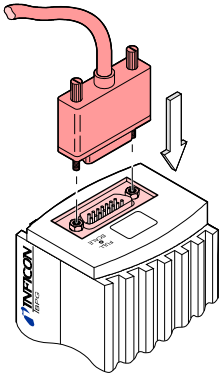
Pins 1, 3, 4, 6, 9 and 11 are not connected internally.



D-Sub, 15 pins female, soldering side



- Connect the sensor cable to the gauge.



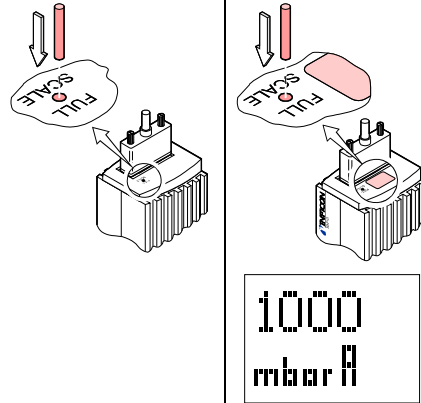
- Secure the cable connector with the lock screws.

- Connect the sensor cable to the controller.

- Adjusting the gauge

BPG400 without display | BPG400 with display  
353-500 353-502 | 353-501 353-503

Insert a pin ( $\approx \varnothing 1.3 \times 50 \text{ mm}$ ) through the opening marked <FULL SCALE> and push the button inside for at least 5 seconds.



$\approx 10 \text{ s}$

Automatic adjustment



Adjustment completed



## Operation

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

BPG400-SD, -SP and -SR can also be operated via the corresponding fieldbus interface (DeviceNet, Profibus or RS485 → [1] and [2] for further details and functions).

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

## Gas Type Dependence (BPG400)

The measurement value is gas dependent. The displayed reading applies to dry air,  $\text{O}_2$ , CO, and  $\text{N}_2$ . For other gases, it has to be converted (→ "Technical Data" and [1]).

## Adjusting the Gauge

The adjustment of BPG400-SD, -SP and -SR (→ [1] and [2]) is slightly different from the procedure for BPG400, which is described below.

The gauge is factory calibrated. If used under different climatic conditions, at extreme temperatures, through aging or contamination and after exchanging the sensor, the characteristic curve can be offset and readjustment can become necessary. Only the Pirani element can be adjusted and only at atmosphere.

Readjustment becomes necessary if

- at atmosphere the output voltage is  $< 10 \text{ V}$  or the display reading is  $< \text{atmosphere}$
- when venting the vacuum system, the output voltage reaches  $10 \text{ V}$  before the measured pressure has reached atmosphere (Gauges with display will show the error "5" at atmosphere (Pirani sensor warning)).

- Activate the gauge.

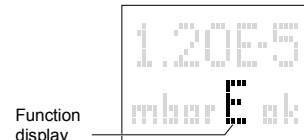


Operate the gauge for  $\approx 10$  minutes at atmospheric pressure. If the gauge was operated within the BA range, a cooling-down time of  $\approx 30$  minutes is to be expected (gauge temperature = environmental temperature).



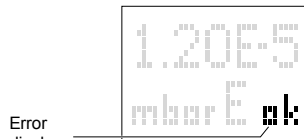
Pressure reading

Pressure unit



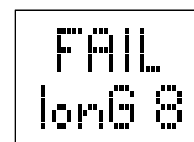
Function display

(none) Pirani operation  
E Emission  $25 \mu\text{A}$   
E Emission  $5 \text{ mA}$   
D Degas  
A 1000 mbar adjustment (Pirani)

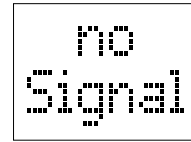


Error display

ak no error (green background illumination)  
5 Pirani sensor warning (red background illumination)  
3 Pirani sensor error (red background illumination)



3 BA sensor error (red background illumination)



Internal data connection failure (red background illumination)

## Deinstallation

**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.



**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**

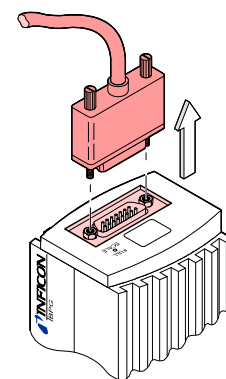


Caution: dirt sensitive area

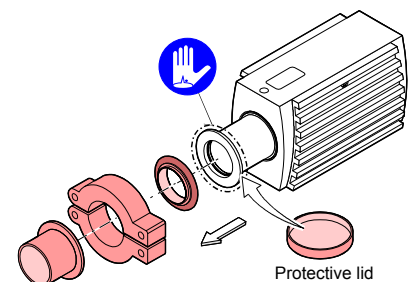
Touching the product or parts thereof with bare hands increases the desorption rate.

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

- Vent the vacuum system.
- Turn the gauge off.
- Unfasten the lock screws and unplug the sensor cable. (If you are using BPG400-SD, -SP or -SR, unfasten and unplug the interface cable too (→ [1] and [2]).




- Remove the gauge from the vacuum system.



Protective lid


## Maintenance, Troubleshooting

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

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

## 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 recycled.
- Other components  
Such components must be separated according to their materials and recycled.


## Further Information


[1] [www.inficon.com](http://www.inficon.com)  
Operating Manual  
Bayard-Alpert Pirani Gauge BPG400, BPG400-SD, BPG400-SP, BPG400-SR  
tina03e1  
INFICON AG, LI-9496 Balzers, Liechtenstein

[2] [www.inficon.com](http://www.inficon.com)  
Instruction Sheet  
Bayard-Alpert Pirani Gauge BPG400-SD, BPG400-SP, BPG400-SR  
tima36e1  
INFICON AG, LI-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 \_\_\_\_\_  
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"/> |  |
| 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. 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<br>manufacturer | Chemical name<br>(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.

## Bayard-Alpert Pirani Gauge

BPG400  
BPG400-SD  
BPG400-SP  
BPG400-SR

### Part numbers

353-500  
353-501  
353-502  
353-503  
353-505  
353-506  
353-507  
353-508  
353-509  
353-513

### Standards

Harmonized and international/national standards and specifications:

- EN 61010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61000-6-2 (Electromagnetic compatibility generic emission standard)
- EN 61000-6-3 (Electromagnetic compatibility generic immunity standard)
- EN 50325 (DeviceNet standard)
- EN 50170 (Profibus standard)

### Signatures

INFICON AG, Balzers

06 October 2003

06 October 2003

Michael Schöch  
Product Marketing Manager

Dr. Georg Sele  
Technical Support Manager  
Quality Representative



LI-9496 Balzers  
Liechtenstein  
Tel +423 / 388 3111  
Fax +423 / 388 3700  
reach.liechtenstein@inficon.com  
www.inficon.com