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Bayard-Alpert Pirani Gauge
BPG400
BPG400-SD
BPG400-SP
BPG400-SR

Function 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 \( p > 2.0 \times 10^{-12} \) mbar) and a Pirani measurement system (for \( p > 5.5 \times 10^{-12} \) mbar). In the overlapping pressure range of \( 2.0 \times 10^{-12} \rightarrow 5.5 \times 10^{-12} \) 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 \( 2.4 \times 10^{-12} \) mbar (to prevent filament burn-out). It is switched off when the pressure exceeds \( 3.2 \times 10^{-12} \) mbar.

Trademark
DeviceNet™ Open DeviceNet Vendor Association, Inc.

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
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.

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 (filament), are not covered by the warranty.

### Technical Data

#### Measuring range
(air, \( O_2, NO, N_2 \))
- \( 5 \times 10^{-10} \ldots 10^{-2} \) mbar continuous

#### Accuracy
- 15% of reading in the range of \( 1 \times 10^{-4} \ldots 10^{-3} \) mbar (after 5 min. stabilization)

#### Repeatability
- 5% of reading in the range of \( 1 \times 10^{-4} \ldots 10^{-3} \) mbar (after 5 min. stabilization)

### Degas
- Current (p <7.2×10^{-6} mbar)
  - \( +16 \) 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 tolerance of which can be higher than during normal operation.

### Output signal
- Measuring range 0.774 ... 10 V
- Voltage vs. pressure logarithmic, 0.75 V/decade
- Error signal (\( \rightarrow \) [1])
  - \( +0.3 \) V (hot cathode error)
  - \( -0.5 \) V (Pirani error)
- Minimum load impedance 10 kΩ

### Gauge identification
- 42 kΩ between Pin 10 and Pin 5 (gauge cable)

#### RS232C interface
- Data rate 9600 Baud
- Data format binary
- 8 data bits
- one stop bit
- no parity bit
- no handshake
- Connector \( \rightarrow \) "Power Connection"

Further information on the RS232C interface \( \rightarrow \) [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 \( \rightarrow \) [1])

### Supply

- **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 [3].

- **DANGER** Voltage at gauge 24 VDC (20 ... 28 VDC) (ripple 52 Vpp [2])
- **DANGER** Power consumption
  - Standard \( \leq 0.5 \) A
  - Degas \( \leq 0.8 \) A
  - Emissions start (200 ms) \( \leq 1.4 \) A
  - Fuse required \( \leq 1.25 \) AT
  - Power consumption \( \leq 16 \) W

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[1] INFICON controllers fulfill these requirements.
[2] Consider the voltage drop on the sensor cable.

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**Electrical connection**
D-Sub, 15-pin, 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 mm²)
≤50 m (4/5/7x0.34 mm²)
≤100 m (4/5/7x1.0 mm²)

For operation with RS232C interface ≤30 m

**Weight**

- 353-500, 353-501: 285 g
- 353-502, 353-503: 350 g
- 353-505, 353-507: 430 g
- 353-509, 353-508: 695 g
- 353-513: 795 g

**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:

\[
p_{\text{eff}} = C \times p\text{ [mbar]}
\]

Where:
- \( p \) is the pressure
- \( C \) is a constant (pressure unit dependent)

**Pressure p [mbar]**
- Ne: 0.5
- Ar: 0.8
- Kr: 0.5
- He: 4.1
- \( \text{Ar}, \text{CO}, \text{N}_2 \): 1.0
- \( \text{O}_2 \): 2.4
- \( \text{Xe} \): 0.4

**Gas type**
- Ne: 0.5
- Ar: 0.8
- \( \text{Ar}, \text{CO}, \text{N}_2 \): 1.0
- \( \text{O}_2 \): 2.4
- \( \text{Xe} \): 0.4

**DANGER**

- overpressure in the vacuum system
- 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.

**Installation**

**Voltage Connection**

- Dangers: 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 CF flange, use a conductive metallic clamping ring

**Clamp**

- Seal with centering ring
- Protect the protective lid.

**Power 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.

**Measuring Signal vs. Pressure**

**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: 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.

**Measuring signal U[V]**

- 0 to 10 V

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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 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 ≈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, O₂, CO, and N₂. 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 V or the display reading is <atmosphere
- when venting the vacuum system, the output voltage reaches 10 V before the measured pressure has reached atmosphere (Gauges with display will show the error "5" at atmosphere (Pirani sensor warning)).

**Display**

(BPG400 with part numbers 353-501 and 353-503)

<table>
<thead>
<tr>
<th>Display</th>
<th>Pressure reading</th>
<th>Pressure unit</th>
<th>Function display</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.20E-5 mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(none)</td>
<td>Pirani operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Emission 25 µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Emission 5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Degas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1000 mbar adjustment (Pirani)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Error display**

<table>
<thead>
<tr>
<th>Error display</th>
</tr>
</thead>
<tbody>
<tr>
<td>no error</td>
</tr>
<tr>
<td>(green background illumination)</td>
</tr>
<tr>
<td>5 Pirani sensor warning (red background illumination)</td>
</tr>
<tr>
<td>3 Pirani sensor error (red background illumination)</td>
</tr>
<tr>
<td>3 BA sensor error (red background illumination)</td>
</tr>
</tbody>
</table>

**Deinstallation**

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**

- 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**

- 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.

Put the gauge out of operation.

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 or wear and tear, as well as expendable parts (filament), are not covered by the warranty.

Returning the Product

![WARNING]

WARNING: 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]

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


Operating Manual
Bayard-Alpert Pirani Gauge BPG400, BPG400-SD, BPG400-SP, BPG400-SR

tna03d1 (German)
tna01e1 (English)

INFICON AG, LI–9496 Balzers, Liechtenstein


Instruction Sheet
Bayard-Alpert Pirani Gauge BPG400-SD, BPG400-SP, BPG400-SR

tma36b1 (German)
tma36e1 (English)

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.

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.

Products

Bayard-Alpert Pirani Gauge

BPG400
BPG400-SD
BPG400-SP
BPG400-SR

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic emission standard)
- EN 61000-6-3:2007 (EMC: generic immunity standard)
- EN 61010-1:2001 (Safety requirements for electrical equip-

ment for measurement, control and laboratory use)
- EN 61326-1:2006 (EMC requirements for electrical equip-
ment for measurement, control and laboratory use)

Manufacturer / Signatures

INFICON AG, Alle Landstrasse 6, LI-9496 Balzers

12 April 2010

Dr. Urs Wälchi
Managing Director

Claudio Christoffel
Product Manager

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