Bayard Alpert Pirani Gauge

With Fieldbus Interface

BPG400-SD, BPG400-SP, BPG400-SR

Intended Use

The Bayard Alpert Pirani Gauges of the type BPG400-SD, BPG400-SP and BPG400-SR have been designed for vacuum measurement of non-flammable gases and gas mixtures in a pressure range of 5×10⁻¹⁰ ... 1000 mbar.

Safety

Symbols Used

DANGER

Information on preventing any kind of physical injury.

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

All safety instructions given in [1] and [2] apply to the sensor types described in this document, too.

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.

Validity

This document applies to products with the following part numbers:

BPG400-SD (DeviceNet):
- 353-507 (DN 25 ISO-KF)
- 353-508 (DN 40 CF-R)

BPG400-SP (Profibus):
- 353-505 (DN 25 ISO-KF)
- 353-506 (DN 40 CF-R)

BPG400-SR (DeviceNet):
- 353-509 (DN 25 ISO-KF)
- 353-513 (DN 40 CF-R)

The part number (PN) can be taken from the product nameplate. For convenient reference copy that information into the space provided below.

Product Identification

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

Technical Data

Fieldbus Interface

Fieldbus name: DeviceNet
Standard applied: → [8]
Communication protocol, data format: → [3], [8]
Interface, physical: CAN bus

DeviceNet Parameters

<table>
<thead>
<tr>
<th>DeviceNet Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rate (adjustable via &quot;RATE&quot; switch)</td>
<td>125 kbps, 250 kbps, 500 kbps</td>
</tr>
<tr>
<td>Node address (MAC ID) (adjustable via &quot;ADDRESS, MSD, LSD&quot; switches)</td>
<td>0 … 63, &quot;P&quot; (programmable)</td>
</tr>
<tr>
<td>Power consumption (min, max)</td>
<td>24 VDC (20 … 28 V), 18 W</td>
</tr>
</tbody>
</table>

Supply Voltages

- Supply voltage at the sensor connector, Pin 8:
  - Min.: 24 VDC (20 … 28 V)
  - Max.: 18 W

- DeviceNet operation requires an additional, separate power supply.

Safety

DANGER

The gauge may only be connected to power supplies, instruments or control devices 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 DeviceNet connector, Pin 2:
- Min.: 24 VDC (11 … 25 V)
- Max.: 2 W

The gauge is protected from reversed polarity of the supply voltage.
Sensor Cable Connection

For reasons of compatibility, the expression "sensor cable" is used in this document, although the pressure reading of the SD-type gauge is normally transmitted via the DeviceNet interface.

Connector: D-Sub, 15 pins, male
Cable: Max. 15 conductors, shielded
Cable length, (conductor cross section per conductor): ≤35 m (0.25 mm²)
≤50 m (0.34 mm²)
≤100 m (1.0 mm²)

Switching functions:
- 2 Setpoints adjustable via potentiometers (Setpoints A and B), one floating, normally open contact per setpoint
- 1 Relay switching function A, COM contact
- 1 Relay switching function B, common
- 1 Relay switching function B, N.O. contact
- 1 Relay switching function A, N.O. contact
- 1 Signal output (measuring signal)
- 1 Gauge identification
- 1 Signal common GND
- 1 Supply common GND
- 1 Supply +24 VDC
- 1 Drain
- 1 Threshold (Setpoint) A 0 … +10 V
- 1 Threshold (Setpoint) B 0 … +10 V
- 1 Degas on, active high
- 1 Degas off, active low

Relay contact rating:
- Voltage ≤60 VDC
- Current ≤0.5 A

Gauge identification:
- 42 kΩ between Pin 10 (sensor cable) and GND

Grounding principle:
- → "Electrical Connection"

Dimensions [mm]
Housing and vacuum connection → [1], [2]

Weight
353-507 = 430 g
353-508 = 695 g

Electrical Connection

Sensor Cable Connection

Make sure the vacuum connection is properly made (→ [1], [2], "Vacuum Connection").

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

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

Operation

Caution:
- Data transmission errors
- If the gauge is operated via an RS232 interface, and the DeviceNet at the same time, data transmission errors may occur.
- The gauge must not be operated via an RS232 interface.

Adjusting the Gauge

→ Adjustment and settings.

Adjusting the Switching Functions

→ Adjustment and settings.

Status Lights

STATUS MOD

"STATUS MOD" (gauge status):

Light status Meaning
Dark No supply
Flash red/green Selftest
Green Normal operation
Red Non recoverable error

"STATUS NET" (network status):

Light status Meaning
Dark Gauge not online:
- Selftest not yet concluded
- No supply, → "STATUS MOD" light
Flash green Gauge online but no connection:
- Selftest concluded, but no connection to other nodes established
- Gauge not assigned to any master
Green Gauge online; necessary connections established
Flash red One or several input/output connections in "timed out" status
Red Communication error. The gauge has detected an error that impedes communication via the network (e.g. two identical node addresses (MAC ID) or "Bus-off")

Data Rate Setting

By means of the "RATE" switch, the data rate can be set to 125 ("1"), 250 ("2") or 500 kbaud ("5").

If the switch is in any of the "P" positions, the data rate is programmable via the DeviceNet (→[3]).

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If the switch is in any of the "P" positions, the data rate is programmable via the DeviceNet (→[3]).
BPG400-SP (Profibus)

General Information
The BPG400-SP gauge has a fieldbus interface that conforms to the Profibus DP/V1 standard (→ [9]).

Via this interface, the following and further data are exchanged in the standardized Profibus protocol (→ [1], [2]):
- Pressure reading
- Pressure unit (Torr, mbar, Pa)
- Degas function
- Gauge adjustment
- Status and error messages

Two adjustable switching functions are integrated in the gauge. The corresponding relay contacts are available at the sensor cable connector.

The basic sensor and sensor electronics of the BPG400-SP type are the same as in the standard BPG400 (→ [1], [2]).

Technical Data BPG400-SP

Fieldbus Interface

<table>
<thead>
<tr>
<th>Fieldbus name</th>
<th>Profibus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard applied</td>
<td>→ [9]</td>
</tr>
<tr>
<td>Communication protocol, data format</td>
<td>→ [4], [9]</td>
</tr>
<tr>
<td>Interface, physical</td>
<td>RS485</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profibus Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rate</td>
</tr>
<tr>
<td>Node address</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profibus connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable connection</td>
</tr>
<tr>
<td>Cable length, system wiring</td>
</tr>
</tbody>
</table>

Supply Voltages

The power consumption of the BPG400-SP is higher than that of the standard BPG400.

Supply voltage at sensor cable connector, Pin 8: +24 VDC (+20 … 28 V)
Power consumption: <18 W

Sensor Cable Connection

→ "Technical Data, Sensor Cable Connection" of the gauge BPG400-SD (identical).

Dimensions

Housing and vacuum connection: → [1], [2]

Weight
353-505: 425 g
353-506: 685 g

Electrical Connection

Make sure the pressure connection is properly made (→ [1], [2], "Vacuum Connection").

Sensor Cable Connection

1. If no sensor cable is available, make one according to the diagram shown in the BPG400-SD section (identical).
2. Connect the sensor cable to the gauge and secure the sensor cable connector using the lock screws.

BPG400-SR (RS485)

General Information
The BPG400-SR gauge has a RS485 fieldbus interface.

Via this interface, the following and further data are exchanged (→ [1], [2]):
- Pressure reading
- Pressure unit (Torr, mbar, Pa)
- Degas function
- Gauge adjustment
- Status and error messages
- Threshold values of switching functions

Two adjustable switching functions are integrated in the gauge. The corresponding relay contacts are available at the sensor cable connector. Additionally, the Relay contact of switchingfunction A is also available at the interface connector.

The basic sensor and sensor electronics of the BPG400-SR type are the same as in the standard BPG400 (→ [1], [2]).

Technical Data BPG400-SR

Fieldbus Interface

<table>
<thead>
<tr>
<th>Fieldbus name</th>
<th>RS485</th>
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<tbody>
<tr>
<td>Communication protocol, data format</td>
<td>→ [2]</td>
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<thead>
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<th>RS485 parameters</th>
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<tbody>
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<td>Device address</td>
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<table>
<thead>
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<th>RS485 connection</th>
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</thead>
<tbody>
<tr>
<td>Cable</td>
</tr>
<tr>
<td>Cable length, system wiring</td>
</tr>
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</table>

Supply Voltages

The power consumption of the BPG400-SR is higher than that of the standard BPG400.

Supply voltage at sensor cable connector, Pin 8: +24 VDC (+20 … 28 V)
Power consumption: <18 W

Sensor Cable Connection

→ "Technical Data, Sensor Cable Connection" of the gauge BPG400-SD (identical).

Dimensions

Housing and vacuum connection: → [1], [2]

Weight
353-509: 425 g
353-513: 685 g

Electrical Connection

Make sure the pressure connection is properly made (→ [1], [2], "Vacuum Connection").

Sensor Cable Connection

1. If no sensor cable is available, make one according to the diagram shown in the BPG400-SD section (identical).
2. Connect the sensor cable to the gauge and secure the sensor cable connector using the lock screws.

RS485 Cable Connection

1. If no RS485 cable is available, make one according to the following indications:

BPG400-SP

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Supply Voltages

The power consumption of the BPG400-SP is higher than that of the standard BPG400.

Supply voltage at sensor cable connector, Pin 8: +24 VDC (+20 … 28 V)
Power consumption: <18 W

Sensor Cable Connection

→ "Technical Data, Sensor Cable Connection" of the gauge BPG400-SD (identical).

Dimensions

Housing and vacuum connection: → [1], [2]

Weight
353-505: 425 g
353-506: 685 g

Electrical Connection

Make sure the pressure connection is properly made (→ [1], [2], "Vacuum Connection").

Sensor Cable Connection

1. If no sensor cable is available, make one according to the diagram shown in the BPG400-SD section (identical).
2. Connect the sensor cable to the gauge and secure the sensor cable connector using the lock screws.

RS485 Cable Connection

1. If no RS485 cable is available, make one according to the following indications:
### Operation

**Warning**

Caution: data transmission errors

If the gauge is operated via RS485 and RS232C interface at the same time, data transmission errors may occur.

The gauge must not be operated via RS485 and RS232C interface at the same time.

### Communication Protocol

The controlling host sends its commands to the individually addressed devices (gauges) connected to the bus. In replay the device returns the data requested via bus to the host.

A maximum of 127 devices can be connected to a RS485 bus system.

The device address (base address) setting is primarily made on the gauge. Via RS485 communication, an address offset can be added from the host:

\[
\text{Operating device address} = \text{base address} + \text{Offset}
\]

where:

- Operating device address: \(00 \ldots 7F_{\text{hex}}\)
- Base address (Switches): \(00 \ldots 7F_{\text{hex}}\)
- Offset (from host address): \(00 \ldots 7F_{\text{hex}}\)

**1)** Sum of base address and offset must not exceed \(7F_{\text{hex}}\).

The base address (\(0 \ldots 127_{\text{hex}}\)) is set in hexadecimal form (\(00 \ldots 7F_{\text{hex}}\)) via the "ADDRESS", "MSD", and "LSD" switches. The address is polled by the firmware when the gauge is switched on only. If the address set by the switches is above the allowed range, all parameters are set to the factory default values. Communication is not possible in this case.

### Adjusting the Gauge

→ “Adjustment and settings”.

### Adjusting the Switching Functions

→ “Adjustment and settings”.

On the BPG400-SR, lower and upper thresholds can be set individually (only via the RS485), if certain conditions are met (→ [2]).

#### Adjusting the Sets

For BPG400-SD, BPG400-SP and BPG400-SR gauges.

### Adjusting the Gauge

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.

If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ [1], [2], "Deinstallation").

**2)** Connect the RS485 cable to the gauge and secure the RS485 cable connector using the lock screws.

The gauge can now be put into operation.

#### The gauge is now automatically adjusted. The adjustment takes \(\approx 4\) s.

The gauge is now adjusted.

### Setting the Switching Functions

The threshold values of switching functions A and B can be set within the pressure range \(1 \times 10^{-9} \text{ mbar} \ldots 100 \text{ mbar}\) via potentiometers "SETPOINT A" and "SETPOINT B". For the corresponding threshold voltages \(U_{\text{threshold}}\) the following equation applies:

For BPG400-SD, -SR:

\[
U_{\text{threshold}} = 0.5 \times (\log P_{\text{threshold}} – c) + 7.75
\]

For BPG400-SP:

\[
U_{\text{threshold}} = 0.6129401 \times (\log P_{\text{threshold}} – c + 9.30102999)
\]

Constant \(c\) depends on the pressure unit (→ [1], [2]).

#### Measuring Signal

The hysteresis of the switching function is 10% of the threshold setting.

1) Put the gauge into operation.

2) Connect the + lead of a voltmeter to the threshold measurement point of the selected switching function ("SETPOINT A" Pin 3, "SETPOINT B" Pin 6) and its – lead to Pin 5.

3) Using a screwdriver (max. \(\approx 0.5\) mm), set the threshold of the selected switching function (Setpoint A, B) to the desired value \(U_{\text{threshold}}\).

A functional check of the switching functions (On/Off) is only possible via fieldbus interface (→ [3] for BPG400-SD, -SR) or (→ [4] for BPG400-SP) and (→ [2] for BPG400-SR) or by measuring the relay contacts with a continuity checker/ohmmeter (→ "Electrical Connection", sensor cable connector).

### Further Information

1. www.inficon.com
   Instruction sheet
   Bayard Alpert Pirani Gauge BPG400
   tma03e1

2. www.inficon.com
   Instruction manual
   Bayard Alpert Pirani Gauge BPG400, BPG400-SP, BPG400-SR
   tma03e1

3. www.inficon.com
   Communication protocol
   DeviceNet™ BPG400-SP
   tma03e1

4. www.inficon.com
   Communication protocol
   Probus BPG400-SP
   tma03e1

5. www.inficon.com
   (“Semiconductor and Vacuum coating processes, Vacuum Gauges”)
   Product descriptions and downloads
   INFICON AG, LI–9496 Balzers, Liechtenstein

6. www.odva.org
   Open DeviceNet Vendor Association, Inc.
   "DeviceNet™ Specifications"

7. www.proibus.com
   Probus user organisation

8. European Standard for DeviceNet EN 50325

9. European Standard for Probus EN 50170