Compact FullRange™ Gauge
All-metal
PKR 261
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For cross references to pages within this manual, the symbol (→ XY) is used, for references to other documents, the symbol (→ [Z]).
Product identification

In all communications with Pfeiffer Vacuum, please specify the information given on the product nameplate.

Validity

This manual applies to products with the following part numbers

- PT R26 250 (DN 25 ISO-KF)
- PT R26 251 (DN 40 ISO-KF)
- PT R26 252 (DN 40 CF-F)

The part number can be taken from the nameplate.

We reserve the right to make engineering changes without notice.

Intended use

The Compact FullRange™ Gauge PKR 261 has been designed for vacuum measurement in a pressure range of $5 \times 10^{-9}$ ... 1000 mbar.

The gauge can be used with a Pfeiffer Vacuum measurement unit for Compact Gauges or with another evaluation unit.

Functional principle

Over the whole measurement range, the measuring signal is output as logarithm of the pressure.

The PKR 261 gauge consists of two separate measurement systems (Pirani system and cold cathode system according to the inverted magnetron principle). They are combined in such a way that for the user, they normally behave as one uniform measurement system.
1 Safety

1.1 Symbols used

**DANGER**
Information on preventing any kind of physical injury.

**WARNING**
Information on preventing extensive equipment and environmental damage.

**Note**
Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

1.2 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 custodian of the product.

1.3 Safety information

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
  Consider possible reactions between the materials (→ 5) and the process media.
  Consider possible reactions 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 information in this document.
- Before you begin to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Pass on the safety information to other users.

1.4 Liability and warranty

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if the custodian 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 corresponding product documentation.

The custodian assumes the responsibility in conjunction with the process media used.
## 2 Technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admissible temperature</strong></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>-40 °C ... +65 °C</td>
</tr>
<tr>
<td>Operation</td>
<td>+5 °C ... +55 °C (up to 150 °C at the flange if mounted horizontally; without magnetic shielding)</td>
</tr>
<tr>
<td>Bakeout</td>
<td>+150 °C (without electronics and magnetic shielding)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>max. 80% up to +31 °C decreasing to 50% at +40 °C</td>
</tr>
<tr>
<td>Use</td>
<td>indoors only altitude up to 2000 m (6600 ft.)</td>
</tr>
<tr>
<td><strong>Measuring range (air, N₂)</strong></td>
<td>5×10⁻⁹ ... 1000 mbar</td>
</tr>
<tr>
<td>Accuracy</td>
<td>≈ ± 30% in the range 1×10⁻⁸ ... 100 mbar</td>
</tr>
<tr>
<td>Reproducibility</td>
<td>≈ ± 5% in the range 1×10⁻⁸ ... 100 mbar</td>
</tr>
<tr>
<td>Gas type dependence</td>
<td>→ Appendix B</td>
</tr>
<tr>
<td><strong>Adjustment</strong></td>
<td>(→ 14)</td>
</tr>
<tr>
<td>Pirani measurement circuit</td>
<td></td>
</tr>
<tr>
<td>Trimmer potentiometer &lt;HV&gt;</td>
<td>at &lt; 1×10⁻⁴ mbar (while depressing the tactile switch)</td>
</tr>
<tr>
<td>Trimmer potentiometer &lt;ATM&gt;</td>
<td>at atmospheric pressure</td>
</tr>
<tr>
<td>Cold cathode measurement circuit</td>
<td>no adjustment (the gauge is factory calibrated and requires no maintenance)</td>
</tr>
<tr>
<td><strong>Type of protection</strong></td>
<td>IP 40</td>
</tr>
<tr>
<td>Maximum pressure (absolute)</td>
<td>10 bar only for inert gases &lt; 55 °C</td>
</tr>
<tr>
<td><strong>Supply</strong></td>
<td></td>
</tr>
</tbody>
</table>

**DANGER**

The gauge may only be connected to supply or measurement 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 fused. ¹)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage at the gauge</td>
<td>15.0 ... 30.0 V= (ripple max. 1 V&lt;sub&gt;pp&lt;/sub&gt;)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 2 W</td>
</tr>
<tr>
<td>Fuse¹)</td>
<td>≤ 1 AT</td>
</tr>
</tbody>
</table>

The minimum voltage of the power supply must be increased proportionally to the length of the measuring cable.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage of the supply unit at maximum cable length</td>
<td>16.0 ... 30.0 V= (ripple max. 1 V&lt;sub&gt;pp&lt;/sub&gt;)</td>
</tr>
<tr>
<td><strong>Electrical connection</strong></td>
<td>Hirschmann compact connector type GO 6, 6 poles, male</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>5 poles plus screening</td>
</tr>
<tr>
<td>maximum cable length</td>
<td>75 m (0.25 mm² conductor)</td>
</tr>
<tr>
<td></td>
<td>100 m (0.34 mm² conductor)</td>
</tr>
<tr>
<td></td>
<td>300 m (1.0 mm² conductor)</td>
</tr>
</tbody>
</table>

¹) Pfeiffer Vacuum measurement and control units for Compact Gauges fulfill these requirements.
### Operating voltage
(in the measuring chamber) ≤ 3.3 kV

### Operating current
(in the measuring chamber) ≤ 500 µA

### Output signal (measuring signal)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>0 V ... +10.5 V</td>
</tr>
<tr>
<td>Voltage/pressure relationship</td>
<td>logarithmic, increase 0.6 V / decade</td>
</tr>
<tr>
<td></td>
<td>(→ Appendix A)</td>
</tr>
<tr>
<td>Error signal</td>
<td>&lt;0.5 V (no supply)</td>
</tr>
<tr>
<td></td>
<td>&gt;9.5 V (Pirani measurement element</td>
</tr>
<tr>
<td></td>
<td>defective, filament break)</td>
</tr>
<tr>
<td>Output impedance</td>
<td>2×10 Ω</td>
</tr>
<tr>
<td>Minimum load</td>
<td>10 kΩ, short-circuit proof</td>
</tr>
<tr>
<td>Response time</td>
<td>pressure dependent</td>
</tr>
<tr>
<td>p &gt; 10^-6 mbar</td>
<td>≤ 10 ms</td>
</tr>
<tr>
<td>p = 10^-8 mbar</td>
<td>≥ 1 s</td>
</tr>
</tbody>
</table>

### Gauge identification

- Pirani-only mode: 11.1 kΩ resistor referenced to supply common
- Combined Pirani/cold cathode mode: 9.1 kΩ resistor referenced to supply common

### The following conditions must be fulfilled:

- **Polarity**: The polarity of pin 1 referenced to supply common is always positive.
- **Measurement with constant current**: measurement current within range 0.2 ... 0.3 mA
- **Measurement with constant voltage**: measurement voltage within range 2 ... 3 V

### Grounding concept

- Vacuum flange–measuring common connected via 10 kΩ (max. voltage differential with respect to safety ±50 V with respect to accuracy ±10 V)
- Supply common–signal common conducted separately; differential measurement recommended for cable lengths (≥6 m)
### PT R26 250 (DN 25 ISO-KF)

<table>
<thead>
<tr>
<th>Materials exposed to the vacuum</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange</td>
<td>stainless steel (1.4104)</td>
</tr>
<tr>
<td>Measuring chamber</td>
<td>stainless steel (1.4104)</td>
</tr>
<tr>
<td>Feedthrough isolation</td>
<td>ceramic (Al₂O₃), glass</td>
</tr>
<tr>
<td>Internal seals</td>
<td>Ag, Cu, soft solder (Sn, Ag)</td>
</tr>
<tr>
<td>Anode</td>
<td>Mo</td>
</tr>
<tr>
<td>Ignition aid</td>
<td>stainless steel (1.4310 / AISI 301)</td>
</tr>
<tr>
<td>Pirani measuring tube</td>
<td>Ni, Au</td>
</tr>
<tr>
<td>Pirani filament</td>
<td>W</td>
</tr>
</tbody>
</table>

**Internal volume**: \( \approx 20 \text{ cm}^3 \)

### Dimensions [mm]

```
\| Compact | Full RangeTM | Gauge |
\|---------|--------------|-------|
\| VACUUM  |              |       |
\| 122.5   | 128.5        | 123   |
\| ø 18.5  | ø 24         | ø 24  |
\| 63.5    | 63.5         | 63.5  |
```

### Weight

- **700 g**

---

### PT R26 251 (DN 40 ISO-KF)

**Materials exposed to the vacuum**

- Flange: stainless steel (1.4306/AISI 304L)
- Measuring chamber: stainless steel (1.4104)
- Feedthrough isolation: ceramic (Al₂O₃), glass
- Internal seals: Ag, Cu, soft solder (Sn, Ag)
- Anode: Mo
- Ignition aid: stainless steel (1.4310 / AISI 301)
- Pirani measuring tube: Ni, Au
- Pirani filament: W

**Internal volume**: \( \approx 20 \text{ cm}^3 \)

### Dimensions [mm]

```
\| Compact | Full RangeTM | Gauge |
\|---------|--------------|-------|
\| VACUUM  |              |       |
\| 123     | 128.5        | 123   |
\| ø 18.5  | ø 24         | ø 24  |
\| 63.5    | 63.5         | 63.5  |
```

### Weight

- **750 g** (DN 40 ISO-KF flange)
- **995 g** (DN 40 CF-F flange)
3 Installation

3.1 Vacuum connection

**Note**

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.

The gauge can be mounted in any orientation. However, it should be mounted so that any particles present cannot enter the measuring chamber (→ 13). If it should be possible to operate the gauge with a maximum temperature of 150 °C at the flange, mount the gauge horizontally.

See the dimensional drawings for space requirements (→ 7).

**Procedure**

1. Remove the protective cap.

   The protective cap will be needed for maintenance.

2. Make the flange connection.
   When making CF flange connections, it can be advantageous to temporarily remove the magnet (→ section 3.1.1).

   If it should be possible to adjust the gauge while it is connected to the vacuum system, make sure the two <HV> and <ATM> trimmer potentiometers are accessible for a screw driver.

**DANGER**

Caution: overpressure in the vacuum system > 4 bar
KF flange connections with elastomer sealing rings (e.g. O-rings) cannot withstand such pressures. Process media can thus leak and possibly damage your health.
Use sealing rings provided with an outer centering ring.

**DANGER**

Caution: overpressure in the vacuum system > 1 bar
If clamps are opened unintentionally injury can be caused by catapulted parts.
Use the type of clamps which can only be opened and closed by means of a tool (e.g. hose clip clamping ring).
3.1.1 Removing the magnet unit (only for gauges with CF flanges)

Tools required

- Allen wrench 1.5 mm
- Open-end wrench 7.0 mm

Procedure

a) Unfasten the socket head set screw (1) on the side of the electronics unit (2).

b) Remove the electronics unit without twisting it.

c) Unfasten the hexagon head screw (3) on the magnet unit (4) and remove the magnet unit.

Note

The magnetic force and the tendency to tilt make it more difficult to separate the magnet unit and the measuring chamber (7).

d) Make the flange connection between the gauge and the vacuum system.

e) Remount the magnet unit and lock it with the hexagon head screw (3).

f) Carefully mount the electronics unit (2). (Make sure the pin of the Pirani element is properly plugged into the corresponding hole of the electronics unit.)

g) Push the electronics unit until the mechanical stop is reached and lock it with the socket head set screw (1).
3.2 Electrical connection

3.2.1 Use with a Pfeiffer Vacuum-measurement unit

If the gauge is used with a Pfeiffer Vacuum measurement unit for Compact Gauges, a corresponding connection cable is required (→ 20).

- Secure the connection socket on the gauge with the screw.

3.2.2 Use with another evaluation unit

The gauge can also be operated with other evaluation units. In this case, an individual connection cable must be made.

For cable lengths up to 10 m (0.34 mm² conductor cross-section), the measuring signal can be read directly between the positive signal output (pin 2) and the supply common (pin 5) without the degree of accuracy being reduced. For longer measuring cable lengths, we recommend a differential measurement between the signal output and signal common (pin 3) (as a result of the voltage drop along the supply cable ground lead, the common mode signal is approx. 1.0 V at the max. permissible cable length).

1 Prepare the connection socket (ordering number → 20).

2 Solder the connection cable according to the diagram.

**Figure 1: Electrical connection**

- Pin 1: identification
- Pin 2: signal output (measuring signal)
- Pin 3: signal common
- Pin 4: supply
- Pin 5: supply common
- Pin 6: screen

Connection socket soldering side
3 Reassemble the connection socket.

4 Plug in the connection socket.
   Secure the connection socket on the gauge with the screw.

---

**WARNING**

The supply common (pin 5) and screen (pin 6) must be connected to the supply unit with protective ground.
Incorrect connection, incorrect polarity, or inadmissible supply voltages can damage the gauge.
4 Operation

As soon as the required voltage is applied, the measuring signal is available between pins 2 and 3 (see Appendix A for the relationship between the measuring signal and the pressure).

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

4.1 Measurement principle, measurement behavior

The PKR 261 gauge consists of two separate measurement systems (Pirani system and cold cathode system according to the inverted magnetron principle). They are combined in such a way that for the user, they normally behave as one uniform measurement system.

The optimum measurement configuration for the particular pressure range, in which measurement is performed, is used:

<table>
<thead>
<tr>
<th>Pressure Range</th>
<th>Cold Cathode</th>
<th>Pirani</th>
</tr>
</thead>
<tbody>
<tr>
<td>10⁻⁴ mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10⁻⁵ mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10⁻⁷ mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10⁻⁹ mbar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The Pirani measurement circuit is always on.
- The cold cathode measurement circuit is controlled by the Pirani circuit and is activated only at pressures p < 1x10⁻² mbar.

The identification output (pin 1) indicates the current status of the gauge:

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Green lamp on the gauge</th>
<th>Operating mode</th>
<th>Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>p &gt; 1x10⁻² mbar</td>
<td></td>
<td>Pirani-only mode</td>
<td>11.1 kΩ (Pirani)</td>
</tr>
<tr>
<td>p &lt; 1x10⁻² mbar</td>
<td></td>
<td>Pirani-only mode (cold cathode measurement circuit not ignited)</td>
<td>11.1 kΩ (Pirani)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combined operation</td>
<td>9.1 kΩ (combined)</td>
</tr>
</tbody>
</table>

As long as the cold cathode measurement circuit has not yet ignited, the measurement value of the Pirani is output as measuring signal. ("Pirani underrange" is displayed for pressures p < 5x10⁻⁴ mbar).

Gas type dependence

The measuring signal depends on the type of gas being measured. The curves are accurate for dry air, N₂, O₂, and CO. They can be mathematically converted for other gases (→ Appendix B).

If you are using a Pfeiffer Vacuum measurement unit for Pfeiffer Vacuum Compact Gauges, you can enter a calibration factor to correct the measurement value displayed (→ ☐ of that measurement unit).

Ignition delay

An ignition delay occurs when cold cathode gauges are switched on. The delay time increases at low pressures and is typically:

<table>
<thead>
<tr>
<th>Pressure Range</th>
<th>Delay Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10⁻⁵ mbar</td>
<td>1 second</td>
</tr>
<tr>
<td>10⁻⁷ mbar</td>
<td>20 seconds</td>
</tr>
<tr>
<td>5x10⁻⁹ mbar</td>
<td>2 minutes</td>
</tr>
</tbody>
</table>

As long as the cold cathode measurement circuit has not yet ignited, the measurement value of the Pirani is output as measuring signal ("Pirani underrange" is displayed for pressures p < 5x10⁻⁷ mbar). The identification output (pin 1) indicates the Pirani-only mode.
Note

If the gauge is activated at a pressure \( p < 3\times10^{-9} \), the gauge cannot recognize whether the cold cathode system has ignited. It indicates "Pirani underrange".

Note

Once flanged on, permanently leave the PKR 261 gauge in the operating mode irrespective of the pressure range. This ensures that the ignition delay of the cold cathode measurement circuit is always negligible (<1 s) and that thermal stabilizing effects are minimized.

Contamination

Note

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

Gauge contamination is influenced by the process media used as well as any existing or new contaminants and their respective partial pressures. Continuous operation in the range of \( 10^{-5} \) mbar ... \( 10^{-2} \) mbar can cause severe contamination as well as reduced up-time and maintenance cycles. With constantly low pressures (< \( 1\times10^{-6} \) mbar), the gauge can be operated for more than one year without cleaning (cleaning the gauge \( \rightarrow \) 17).

In general, contamination of the gauge leads to deviations of the measured values:

- In the high pressure range \( (1\times10^{-3} \text{ mbar} ... 0.1 \text{ mbar}) \), the pressure indication is too high (contamination of the Pirani element). Readjustment of the Pirani measurement system \( \rightarrow \) 14.

- In the low pressure range \( (p < 1\times10^{-3} \text{ mbar}) \), the pressure indication is usually too low (as a consequence of the contamination of the cold cathode system). In case of severe contamination, instabilities can occur (as layers in the measuring chamber peel off). Contamination due to isolating layers can even lead to a complete failure of the discharge ("Underrange" is displayed).

Contamination can to a certain extent be reduced by:

- geometric protections (e.g. screenings, elbows) against particles that spread rectilinearly
- mounting the flange of the gauge at a place where the partial pressure of the pollutants is particularly low.

Special precautions are required for vapors deposited under plasma (e.g. of the cold cathode measurement system). It may even be necessary to temporarily switch off the gauge while vapors occur.
5 Maintenance

5.1 Adjusting the gauge

The gauge is factory-calibrated. Readjusting the gauge can become necessary due to use under different climatic conditions, aging, or contamination (→ 13).

The cold cathode measurement circuit, which is dominant for low pressures (<1×10⁻³ mbar), is factory-calibrated and cannot be adjusted. By way of contrast, the Pirani measurement circuit can be adjusted. Any adjustment has a negligible effect on the pressure range between approx. 10⁻² mbar and 10² mbar.

**Tools required**

- Screw driver 1.5 mm
- Cylindrical pin ø 3 mm

**Procedure**

1. Put the gauge into operation (if possible, in the position, in which it will be used later on).
2. Evacuate the vacuum system to p << 10⁻⁴ mbar, and then wait 10 min.
3. Turn the nameplate counter-clockwise until the mechanical stop is reached.

4. While depressing the tactile switch with the cylindrical pin, adjust the <HV> potentiometer ...
   ... to 5×10⁻⁵ mbar ... or ... to 4.2 V.

   Then turn the potentiometer counter-clockwise by ≈ 120°.

5. Vent with air or nitrogen to atmospheric pressure and then wait 10 minutes.
6. Turn the nameplate clockwise until the mechanical stop is reached.
7 Adjust the <ATM> potentiometer ...
... to $1 \times 10^3$ mbar ... or ... to 8.6 V.

8 Turn the nameplate back to its original position (it will catch).

5.2 Cleaning the gauge / replacing parts

**DANGER**

Caution: cleaning agents
Cleaning agents can be detrimental to health and environment.
Adhere to the relevant regulations and take the necessary precautions when handling and disposing of cleaning agents.

**Note**

For cleaning the measuring chamber, the Pirani element must be removed and replaced.

**Tools / material required**

- Allen wrench 1.5 mm
- Allen wrench 3.0 mm
- Open-end wrench 6.0 mm
- Open-end wrench 7.0 mm
- Pliers for circlip
- Polishing cloth (400 grain) or Scotch-Brite
- Tweezers
- Cleaning alcohol
- Mounting tool for ignition aid
- Ignition aid
- Metal seal (11) for anode feedthrough
- Pirani element (13) incl. set of seals (13a, 13b)
5.2.1 Disassembling the gauge

Procedure

a) Remove the gauge from the vacuum system (→ 19).

b) Unfasten the hexagon socket set screw (1) on the side of the electronics unit (2) (→ Figure 2).

c) Remove the electronics unit without twisting it.

![Note]

The cover of the electronics unit cannot be removed.

![Tip]

The magnetic force and the tendency to tilt make it more difficult to separate the magnet unit and the measuring chamber (7).

d) Unfasten the hexagon head screw (3) on the magnet unit (4) and remove the magnet unit.

e) Remove the circlip (5) and the polarity insert (6) from the measuring chamber.

f) Unfasten the hexagon socket set screw (9c) and remove the insulator (9b) without twisting it.

g) Remove the four hexagon socket screws (8) incl. lock washers (8a) on the back of the measuring chamber.

h) Carefully remove the following parts in this order (without exerting stress on the Pirani element (13)): pressure piece (9), anode extension piece (9a), complete anode (10), metal seal (11) incl. centering ring (12).

i) Unfasten the screw fitting (13a) of the Pirani element and remove Pirani element together with the copper seal (13b).

The parts can now be cleaned or replaced individually.
5.2.2 Cleaning the gauge

Procedure

Cleaning the measuring chamber and the polarity insert:

a) Using a polishing cloth rub the inside walls of the measuring chamber and the polarity insert to a bright finish.

Note

The sealing surfaces must only be worked concentrically.

b) Rinse the measuring chamber and the polarity insert with cleaning alcohol.

c) Allow both to dry.

Cleaning or replacing the anode:

a) Remove the used ignition aid (10a) with pliers (Figure 2).

b) Using a polishing cloth rub the anode pin to a bright finish.

Note

Do not bend the anode. Do not carry out mechanical work on the ceramic part.

c) Rinse the anode with cleaning alcohol.

d) Allow the anode to dry.

e) Insert a new ignition aid (10a) into the mounting tool.

f) Carefully press the anode (clean or new) centered and parallel to the tool axis into the ignition aid and insert it to a depth of approx. 15 mm. The final positioning is established after the anode is installed.

5.2.3 Reassembling the gauge

Procedure

a) Slide the screw fitting (13a) and the copper seal (13b) on the tube of the Pirani element (13) (Figure 2).

b) Insert this combination (13, 13a, 13b) into the corresponding conic bore hole (7) of the measuring chamber.

c) Tighten the screw fitting (13a) with your fingers while slightly pushing the Pirani element against the mechanical stop. Then tighten the screw fitting by one turn with the open-end wrench.

d) Insert a new metal seal (11) incl. the centering ring (12) centered into the measuring chamber (7).

e) Carefully insert the anode (10) with the ignition aid (10a) and extension piece (9a) slid onto it into the measuring chamber.

f) Carefully place the pressure piece (9) on the measuring chamber.

g) Insert the four hexagon socket screws (8) incl. lock washers (8a) and tighten them uniformly until the mechanical stop is reached.

h) Carefully slide the insulator (9b) onto the pressure piece (9) and lock it with the hexagon socket set screw (9c).
i) Position the ignition aid (10a) by pushing the mounting tool over the anode pin until the mechanical stop is reached.

j) Blow the particles in the measuring chamber with dry nitrogen (be careful to hold the measuring chamber with the flange pointing downwards).

k) Slide the polarity insert (6) into the measuring chamber until the mechanical stop is reached.

l) Place the circlip (5) snugly fitting on the polarity insert.

Note: Visually check that the anode pin is centered over the middle hole of the polarity insert (max. eccentricity = 0.5 mm).

m) If possible perform a leak test (leak rate <10⁻⁶ mbar l/s). If necessary slightly retighten the screw fitting (13a).

n) Mount the magnet unit (4) and lock it with the hexagon head screw (3).

o) Carefully mount the electronics unit (2). (Make sure the pin of the Pirani element is properly plugged into the corresponding hole of the electronics unit.)

p) Push the electronics unit up to the mechanical stop and lock it with the hexagon socket set screw (1).

q) Adjust the gauge (→ 14).

5.3 What to do in case of problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring signal continually &lt; 0.5 V &quot;Error low&quot;.</td>
<td>No supply voltage.</td>
<td>Turn on the power supply.</td>
</tr>
<tr>
<td>Measuring signal continually &gt; 9.5 V &quot;Error high&quot;.</td>
<td>Pirani measurement element defective (filament rupture).</td>
<td>Replace the Pirani element (→ 17).</td>
</tr>
<tr>
<td>Measuring signal continually &gt; 5 V or display &gt; 10⁻⁵ mbar although vacuum pressure is OK.</td>
<td>Pirani measurement circuit not adjusted, e.g. due to severe contamination.</td>
<td>Readjust the Pirani measurement circuit (→ 14). If adjustment is impossible, replace the Pirani element.</td>
</tr>
<tr>
<td>The green lamp is ON and the identification indicates Pirani-only mode (measuring signal continually &gt; 4.0 V) &quot;Pirani underrange&quot;.</td>
<td>The cold cathode discharge has not ignited.</td>
<td>Wait until the gas discharge ignites (in case of contamination with insulation layers, the cold cathode may completely fail to ignite). (Cleaning → 17.)</td>
</tr>
<tr>
<td>The PKR has only been activated with p &lt; 3×10⁻⁹ mbar.</td>
<td></td>
<td>Slightly increase the pressure.</td>
</tr>
<tr>
<td>Measurement of heavy gases.</td>
<td></td>
<td>Convert with the corresponding formula (→ 24).</td>
</tr>
<tr>
<td>Severe outgassing in the cold cathode measuring chamber.</td>
<td></td>
<td>Clean the measuring chamber.</td>
</tr>
<tr>
<td>Measuring signal unstable.</td>
<td>Gauge contaminated.</td>
<td>Clean the gauge. (Cleaning → 17).</td>
</tr>
</tbody>
</table>
6 Removing the gauge from the vacuum system

**DANGER**

Caution: contaminated parts
Contaminated parts can be detrimental to health.
Before you begin to work, find out whether any parts are contaminated.
Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

**Note**

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.

**Procedure**

1. Deactivate the gauge.

2. Unplug the connection socket.

3. Remove the gauge from the vacuum system.

4. Place the protective cap.
7 Returning the product

**WARNING**

Caution: forwarding contaminated products

Products returned to Pfeiffer Vacuum for service or repair should, if possible, be free of harmful substances (e.g. radioactive, toxic, caustic or microbiological). Otherwise, the type of contamination must be declared.

Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a completed contamination declaration.

Products that are not clearly declared as “free of harmful substances” are de-contaminated at the expense of the customer.

8 Accessories

<table>
<thead>
<tr>
<th>Connection cable for Pfeiffer Vacuum measurement unit for Compact Gauges</th>
<th>Ordering number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 m</td>
<td>BG 448 250 -T</td>
</tr>
<tr>
<td>6 m</td>
<td>BG 448 251 -T</td>
</tr>
<tr>
<td>10 m</td>
<td>BG 448 252 -T</td>
</tr>
<tr>
<td>Connection socket Hirschmann GO 6 WF 6 contacts, angled, female</td>
<td>B 4707 283 MA</td>
</tr>
<tr>
<td>Magnetic shielding</td>
<td>PT 443 155 -X</td>
</tr>
</tbody>
</table>
When ordering spare parts, always indicate:
- the type of product
- the manufacturing number given on the product nameplate
- the position, description, and ordering number according to the spare parts list

The following parts are available as spare parts sets:

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Ordering number</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Maintenance set, consisting of:</td>
<td>BN 846 241 -T</td>
</tr>
<tr>
<td>12</td>
<td>1× seal HNV 100 (9×1.6)</td>
<td></td>
</tr>
<tr>
<td>10a</td>
<td>1× centering ring</td>
<td></td>
</tr>
<tr>
<td>10a</td>
<td>3× ignition aid</td>
<td></td>
</tr>
<tr>
<td>10a</td>
<td>1× washer (not used with PKR)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Repair set, consisting of:</td>
<td>BN 846 242 -T</td>
</tr>
<tr>
<td>13</td>
<td>1× Pirani element with glass feedthrough</td>
<td></td>
</tr>
<tr>
<td>13a</td>
<td>1× screw fitting</td>
<td></td>
</tr>
<tr>
<td>13b</td>
<td>1× copper seal</td>
<td></td>
</tr>
<tr>
<td>9a</td>
<td>1× anode extension piece</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1× anode, complete</td>
<td></td>
</tr>
<tr>
<td>10a</td>
<td>3× ignition aid</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1× seal HNV 100 (9×1.6)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1× centering ring</td>
<td></td>
</tr>
<tr>
<td>10a</td>
<td>Set of ignition aids, consisting of:</td>
<td>BN 845 995 -T</td>
</tr>
<tr>
<td>10a</td>
<td>10× ignition aid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mounting tool for ignition aid</td>
<td>BG 510 600</td>
</tr>
<tr>
<td>2</td>
<td>Electronics unit PKR 261</td>
<td>PT 120 140 -T</td>
</tr>
<tr>
<td></td>
<td>Measurement system, complete</td>
<td>BN 846 472 -T</td>
</tr>
<tr>
<td></td>
<td>DN 25 ISO-KF flange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DN 40 ISO-KF flange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DN 40 CF-F flange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange gauge (return defective gauge to Pfeiffer Vacuum)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DN 25 ISO-KF</td>
<td>PT R26 250 -A</td>
</tr>
<tr>
<td></td>
<td>DN 40 ISO-KF</td>
<td>PT R26 251 -A</td>
</tr>
<tr>
<td></td>
<td>DN 40 CF-F</td>
<td>PT R26 252 -A</td>
</tr>
</tbody>
</table>

Diagram: [Diagram of spare parts setup]
10 Disposal

**WARNING**

Caution: substances detrimental to the environment
Products, operating materials etc. may have to be specially disposed of.
For environmentally compatible disposal, please contact your nearest Pfeiffer Vacuum Service Center.
Appendix

A: Relationship between measuring signal and pressure

Conversion formulae

\[ p = 10^{U / 10.67} \]

\[ U = c + 0.6 \log_{10} p \]

<table>
<thead>
<tr>
<th>Unit</th>
<th>V</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>mbar</td>
<td>6.8</td>
<td>11.33</td>
<td></td>
</tr>
<tr>
<td>µbar</td>
<td>5.0</td>
<td>8.333</td>
<td></td>
</tr>
<tr>
<td>Torr</td>
<td>6.875</td>
<td>11.46</td>
<td></td>
</tr>
<tr>
<td>mTorr</td>
<td>5.075</td>
<td>8.458</td>
<td></td>
</tr>
<tr>
<td>micron</td>
<td>5.075</td>
<td>8.458</td>
<td></td>
</tr>
<tr>
<td>Pa</td>
<td>5.6</td>
<td>9.333</td>
<td></td>
</tr>
<tr>
<td>kPa</td>
<td>7.4</td>
<td>12.33</td>
<td></td>
</tr>
</tbody>
</table>

where \( p \) pressure

\( U \) measuring signal

\( c, d \) constant (pressure unit dependent)

valid in the range:

\[ 5 \times 10^{-9} \text{ mbar} < p < 1000 \text{ mbar} \]

\[ 3.8 \times 10^{-7} \text{ Torr} < p < 750 \text{ Torr} \]

\[ 5 \times 10^{-5} \text{ Pa} < p < 1 \times 10^5 \text{ Pa} \]

Conversion curves
### Conversion table

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.5</td>
<td>Sensor error</td>
<td>Underrange</td>
<td></td>
</tr>
<tr>
<td>0.5 ... 1.82</td>
<td>5.0×10⁻⁹</td>
<td>3.8×10⁻⁹</td>
<td>5.0×10⁻⁷</td>
</tr>
<tr>
<td>2.0</td>
<td>1.0×10⁻⁸</td>
<td>7.5×10⁻⁹</td>
<td>1.0×10⁻⁶</td>
</tr>
<tr>
<td>2.6</td>
<td>1.0×10⁻⁷</td>
<td>7.5×10⁻⁸</td>
<td>1.0×10⁻⁵</td>
</tr>
<tr>
<td>3.2</td>
<td>1.0×10⁻⁶</td>
<td>7.5×10⁻⁷</td>
<td>1.0×10⁻⁴</td>
</tr>
<tr>
<td>3.8</td>
<td>1.0×10⁻⁵</td>
<td>7.5×10⁻⁶</td>
<td>1.0×10⁻³</td>
</tr>
<tr>
<td>4.4</td>
<td>1.0×10⁻⁴</td>
<td>7.5×10⁻⁵</td>
<td>1.0×10⁻²</td>
</tr>
<tr>
<td>5.0</td>
<td>1.0×10⁻³</td>
<td>7.5×10⁻⁴</td>
<td>1.0</td>
</tr>
<tr>
<td>5.6</td>
<td>1.0×10⁻²</td>
<td>7.5×10⁻³</td>
<td>10</td>
</tr>
<tr>
<td>6.2</td>
<td>0.1</td>
<td>7.5×10⁻⁴</td>
<td>75</td>
</tr>
<tr>
<td>6.8</td>
<td>1.0</td>
<td>0.75</td>
<td>100</td>
</tr>
<tr>
<td>7.4</td>
<td>10</td>
<td>7.5</td>
<td>1000</td>
</tr>
<tr>
<td>8.0</td>
<td>100</td>
<td>75</td>
<td>1.0×10⁴</td>
</tr>
<tr>
<td>8.6</td>
<td>1000</td>
<td>750</td>
<td>1.0×10⁵</td>
</tr>
<tr>
<td>8.6 ... 9.5</td>
<td>Overrange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.5 ... 10.5</td>
<td>Sensor error (Pirani defective)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### B: Gas type dependence

**Indication range above 10⁻² mbar**

Pressure indicated (gauge calibrated for air)
Indication range below $10^{-5}$ mbar

In the range below $10^{-5}$ mbar, the pressure indication is linear. For gases other than air, the pressure can be determined by means of a simple conversion formula:

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

where

<table>
<thead>
<tr>
<th>gas type</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>air (N₂, O₂, CO)</td>
<td>1.0</td>
</tr>
<tr>
<td>Ne</td>
<td>4.1</td>
</tr>
<tr>
<td>Xe</td>
<td>0.4</td>
</tr>
<tr>
<td>Ar</td>
<td>0.8</td>
</tr>
<tr>
<td>H₂</td>
<td>2.4</td>
</tr>
<tr>
<td>He</td>
<td>5.9</td>
</tr>
</tbody>
</table>

These conversion factors are average values.

**Note**

A mixture of gases and vapors is often involved. In this case, accurate determination is only possible with a partial pressure measurement instrument, e.g. a quadrupole mass spectrometer.
Declaration of contamination

The repair and/or service 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 can only be completed and signed by authorised and qualified staff.

1. **Description of product**
   - Type
   - Article No.
   - Serial No.

2. **Reason for return**

3. **Operating fluid(s) used**

4. **Process related contamination of product:**
   - toxic no [ ] yes [ ]
   - corrosive no [ ] yes [ ]
   - biological hazard no [ ] yes [ ] *
   - explosive no [ ] yes [ ] *
   - radioactive no [ ] yes [ ] *
   - other harmful substances no [ ] yes [ ] *

5. **Harmful substances, gases and/or by-products**

   * Products thus contaminated will not be accepted without written evidence of decontamination!

6. **Legally binding declaration:**

   I hereby declare that the information supplied on this form is complete and accurate. The dispatch of the contaminated product will be in accordance with the appropriate regulations covering packaging, transportation and labelling of dangerous substances.

   **Name of organisation or company**
   **Address**
   **Phone**
   **E-Mail**
   **Name**

   **Date and legally binding signature**
   **Company stamp**

Copies: Original to manufacturer or representative - 1 copy attach to consignment packaging - 1 copy for file of sender