

## Application Note

### Basic Board Mount Pressure Sensors

### ABP Series—High Accuracy

### Digital or Analog Output, Compensated/Amplified

### 60 mbar to 10 bar | 6 kPa to 1 MPa | 1 psi to 150 psi

#### Background

The Basic Amplified ABP Series is a piezoresistive silicon pressure sensor offering a ratiometric analog or digital output for reading pressure over the specified full scale pressure span and temperature range.

The ABP Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects and accuracy errors (which include non-linearity, repeatability and hysteresis) using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz for analog and 2 kHz for digital.

The ABP Series is calibrated over the temperature range of 0 °C to 50 °C [32 °F to 122 °F]. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure gage and differential pressures.

The Basic Amplified pressure sensors are intended for use with non-corrosive, non-ionic gases, such as air and other dry gases. The following options extend the performance of these sensors to non-corrosive liquids.

- No silicone gel coating: The input port is limited to non-corrosive, non-ionic media such as dry air and gases and should not be exposed to condensation. The gases are limited to media that are compatible with high temperature polyamide, silicone, alumina ceramic, silicon, gold, and glass.
- Silicone gel coating: Uses the same materials in the wetted media path but is protected from condensation by a silicone-based gel coating; allows use in applications where condensation may occur.

All products are designed and manufactured according to ISO 9001 standards.

#### Solutions

##### POTENTIAL MEDICAL APPLICATIONS

##### Blood analyzers

**Description:** Blood analyzers using flow cytometry are used to examine microscopic cells and chromosomes by suspending them in a stream of fluid and passing them by an electronic detection apparatus in order to analyze their characteristics.

##### Sensing and Control

Flow cytometry is often used to diagnose health disorders, such as blood cancers, as well as in research and clinical practice.

**Function in application:** May be used to regulate the pressure in the pump system to draw and transport the blood samples.

**Customer benefits:** Designed to provide optimum system performance. The correct pressure ensures that the cells pass the LASER measurement device in the system one cell at a time and in focus so that they may be detected correctly by the equipment.

##### Blood pressure monitoring

**Description:** Blood pressure is measured by placing an inflatable cuff on the patient that restricts blood flow. A manometer is typically then used to measure the pressure which could be replaced by a pressure sensor to automate the reading and facilitate recording the patient's blood pressure measurement remotely so that multiple patients at the same time can be monitored by the medical staff.

**Function in application:** May be used to measure blood pressure.

**Customer benefits:** An accurate, compensated sensor is required to maintain accurate blood pressure readings. The sensor's small size helps to ensure that when the cuff is designed, it is as small as possible. The sensor's light weight helps to ensure that the cuff is light weight as well. These sensor attributes contribute to the patient's comfort because sometimes patients must wear a blood pressure cuff for long periods of time.

##### Hospital beds

**Description:** A hospital bed is designed to be adjustable for patients to ease comfort and to provide patient accessibility by physicians and the nursing staff. The air mattress bed style is generally intended for long-term use by the patient.

**Function in application:** May be used to monitor the air pressure in the bed so that the desired firmness can be controlled.

**Customer benefits:** Designed to maintain proper level of pressure so that the firmness can be controlled regardless of the patient's weight. The proper control of the pressure improves

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patient comfort. Additionally, by helping to facilitate alternating the pressure in the different zones of the mattress, the incidence of bedsores can be reduced. It has been found that by creating different zones in the bed and by alternating the pressure in the various zones, the pressure points experienced by the patient can be varied, which helps prevent bedsores in patients that use the bed for extended use.

#### Massage machines

**Description:** A patient undergoing massage treatment or therapy may wear a cuff on an arm, leg or trunk of the body. Different sections of the baffles within the cuff will compress or relax during treatment. This is done to facilitate healing in muscle regeneration or to facilitate better blood circulation. This type of treatment is sometimes used in a hospital setting, for instance, where a cuff is worn around the leg to help leg circulation to prevent deep vein thrombosis.

**Function in application:** May be used to monitor the pressure in the baffles to help ensure proper inflation.

**Customer benefits:** Designed to provide accurate pressure reading to ensure that enough compression is applied to help ensure proper therapy.

#### Oxygen concentrators

**Description:** An oxygen concentrator reduces the amount of nitrogen in the air, thereby increasing the oxygen level delivered to the patient. Oxygen concentrators are used with patients, such as those with lung disease, who have difficulty absorbing oxygen into the blood stream.

**Function in application:** May be used to monitor the pressure internally in the sieve bed so that the sieve bed can generate the required oxygen levels to the patient. Air is comprised mostly of nitrogen (78%) and approximately 21% oxygen. By removing the nitrogen from the air, the concentration of oxygen is significantly increased. There are two sieve beds with zeolite materials that are pressurized with air. By pressurizing the air, the zeolite sieve bed absorbs the nitrogen. The higher the pressure, the more nitrogen is absorbed by the bed, thereby providing a higher concentration of oxygen to the patient. May also be used to detect when the patient begins to inhale so that oxygen can then be delivered efficiently and effectively.

**Customer benefits:** Controlling the pressure in the sieve bed helps control the concentration of oxygen in the air for the patient. The use of a pressure sensor to monitor when the

patient begins to inhale helps to enhance system response time and minimize wasting oxygen when the patient isn't inhaling. This allows the oxygen concentrator to be smaller and to operate more efficiently. Smaller equipment size also means lower power consumption, as well as greater portability.

#### Sleep apnea equipment

**Description:** Sleep apnea is the repeated cessation of breathing during sleep, sometimes hundreds of times during the night and often for a minute or longer. If left untreated, sleep apnea may cause high blood pressure, cardiovascular disease, memory, and weight problems. The resulting lack of restful sleep may also be responsible for job impairment and motor vehicle accidents. A main treatment option is the use of a Positive Airway Pressure (PAP) machine. The patient wears a mask that uses pressure to send air flowing through the nasal passages so they don't collapse and cause breathing to cease. CPAP (Continuous Positive Airway Pressure) provides a constant pressure to the patient. This positive pressure keeps the throat from collapsing during sleep and allows the patient to breathe freely without worry of episodes of non-breathing.

**Function in application:** May be used to monitor the pressure of air that is delivered to the patient.

**Customer benefits:** Designed to provide accurate pressure sensing to help ensure optimum airway pressure. Too little pressure and the airway may not stay open, defeating the purpose of the therapy. Too much pressure can cause user discomfort.

#### Urine analyzers

**Description:** Urine analysis, like blood analysis, uses flow cytometry to examine and count cells by separating them into individual cells, suspending them in a stream of fluid, and then passing them by an electronic detection apparatus in order to analyze their characteristics. Flow cytometry is often used to diagnose health disorders such as cancers and kidney stones. **Function in application:** May be used to control the pressure in the fluid.

**Customer benefits:** Enhances test results due to helping to ensure that an accurate pressure level is applied. If too little pressure is applied, the resulting count can be too low because multiple cells are presented concurrently to the detection equipment. If the pressure is too high, the image can be distorted, the count could be affected, and cells could be misidentified.

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#### Ventilators/portable ventilators

**Description:** A ventilator is designed to move a mixture of air and oxygen into and out of a patient's lungs to either assist in breathing or, in some cases, do the mechanical breathing for a patient who is breathing insufficiently or is physically unable to breathe.

**Function in application:** Designed to measure air and oxygen pressure so that the pressure doesn't exceed a desired level. Customer benefits: Provides the appropriate amount of air/oxygen to the patient as directed by the physician, helping to ensure patient safety.

#### Wound therapy

**Description:** Wounds may be caused by burns, ulcers, surgery, accidents, or pressure sores (e.g., bedsores). Physicians may use negative-pressure wound therapy (NPWT) to promote healing by creating controlled negative pressure over the wound, helping to promote healing.

**Function in application:** May be used to monitor the pressure applied to the wound via the suction system.

**Customer benefits:** Designed to provide maximum therapeutic effect without causing the patient harm.

#### POTENTIAL INDUSTRIAL APPLICATIONS

##### Air brakes

**Description:** Air brakes are generally used on heavy equipment, such as trucks. In these applications, due to safety concerns air is used in the braking system instead of hydraulics. If there is an air leak, the compressor and tank can resupply the required air so that when the brakes are engaged, that air is present to engage the drums or pads. If a hydraulic system were used, a leak could not readily be detected and corrected, which could result in the truck not having the required braking power to stop the vehicle.

**Function in application:** May be used to measure the pressure in the pressure cylinder to direct the compressor as needed to turn on or off to maintain the correct braking pressure to the drum/pads.

**Customer benefits:** Designed to provide an accurate pressure reading to detect an excess leak in the system and alert the driver that the braking system is compromised. An accurate pressure reading also increases the efficiency and gas mileage since the compressor is only turned on or off as need to keep the required pressure.

#### HVAC transmitters

**Description:** Many buildings do not have HVAC system controls in all sections of the building. Instead, transmitters are used in a particular branch of the system so the HVAC master controller can adjust its airflow delivery to those different branches based on information the transmitters send to the HVAC master controller.

**Function in application:** Can be positioned in outlying areas of the building.

**Customer benefits:** Designed to provide precise airflow pressure sensing and reduces system costs by eliminating the need for multiple HVAC system controllers.

#### Life sciences

**Description:** Pressure sensors are sometimes used in life science applications to measure the pressure of the media that contains carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and sometimes methane (CH<sub>4</sub>). Pressure sensors may be used to evaluate photosynthesis in lab studies and in landfill monitoring.

**Function in application:** May be used to measure the pressure of the media to aid in the calculation formulas used to help determine the amount of gas present.

**Customer benefits:** Testing results are more accurate when the pressure reading output is accurate. Low sensor drift is critical since these systems are in use long term to monitor the gases present.

#### Process gas monitoring

**Description:** Process gas monitoring may be used where the monitoring of process gas is critical to the application, such as welding equipment where argon gas is monitored and controlled to ensure a high quality weld is achieved, and gas analyzers that are used to detect the levels of various gases to ensure that the process is under control.

**Function in application:** May be used to measure the pressure and flow of gas to ensure that the proper gas level is being recorded.

**Customer benefits:** Designed to provide accurate pressure measurement to help improve process efficiency.

#### Valve positioning and positioners

**Description:** A valve positioner is used in combination with a valve actuator to significantly increase accuracy by measuring actual valve position against the set point value and

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pneumatically correcting the valve position until the difference between the set point and actual position is 0 (or some allowed tolerance). The use of a valve actuator alone may not accurately position the valve due to imprecise calibration, differential pressure across the valve (pressure drop causes valve lift), valve wear or other reasons. A valve positioner can be used for precise valve positioning based on a signal from a central control system. With a valve positioner, the command is given, the valve positioner reads the opening, verifies position, and readjusts (if necessary) to the position needed. This allows for excellent precision in the valve adjustment. A valve positioner's power source can be a manual gearbox or an electronic device with control and measuring devices. Valve positioners are available with hydraulic, pneumatic, and electric operating mechanics. Valve positioners help deliver precisely controlled valves, which allow facilities to achieve higher throughputs and higher product quality levels. Valve positioners are used throughout the process industries including oil and gas, refining and petrochemicals, chemicals, power, pharmaceutical, food and beverage, pulp and paper, other processes, and pipelines.

**Function in application:** May be used to monitor diaphragm pressure.

**Customer benefits:** Designed to provide accurate control of the valve to minimize under- or over-shoot of the valve in a fast closed loop arrangement. This increased control will allow more accurate positioning of the valve, based on the set point.

#### Pneumatic control and regulation

**Description:** Pneumatic control applications have a flow or pressure generation source (such as a compressor or pump) that is used in conjunction with valves to control actuators in a wide variety of industrial components and systems. Some pneumatic pumps, valves, and actuators contain integrated pressure sensors. Pressure sensors are also placed throughout other points of the pneumatic circuit in many industrial systems. Analytical devices for weather, air quality, and contaminants also make use of pneumatic controls for consistent and accurate sampling. Some of the pneumatic circuits prevalent in industrial applications are:

- Pneumatic components: Valves, pumps and actuators
- Pneumatic systems: HVAC transmitters, automated pneumatic assembly equipment, pneumatic operator control systems
- Gas collection/delivery: Industrial gas supply
- Precise sampling/gas flow: Barometry, gas chromatography, analytical instrument sampling systems

**Function in application:** In these industrial systems, the pressure sensors are used for both monitoring and control of pneumatic flow and system pressure.

**Customer benefits:** Designed to provide precise and efficient performance.

#### POTENTIAL COMMERCIAL APPLICATIONS

##### Air beds

**Description:** Air beds are becoming more prevalent instead of a coiled spring mattress due to the increased comfort potential they offer. The person can adjust the pressure level of the different baffles that are in the air bed to achieve the desired firmness, helping to provide a more comfortable rest. Most models allow for at least two separate zones so that two people can individually control the firmness on their side of the bed.

**Function in application:** May be used to control the pressure in bed to maintain the desired level as adjusted by the consumer.

**Customer benefits:** Designed to provide feedback if minor leaks are present to maintain the firmness throughout the nights rest.

##### Coffee machines

**Description:** Coffee machines are used to brew coffee. In recent years, many home and office coffee machines have seen improvements in reliability and coffee quality. Electric drip coffee machines have been replaced with higher end single-serve or single-cup coffeemakers.

**Function in application:** May be used to measure the liquid level of the water in the reservoir. In the past, this was performed by a float that could become encrusted and render it ineffective.

**Customer benefits:** Designed to provide a better cup of coffee by helping to ensure that enough water is in the reservoir to make a full container of coffee so that the coffee isn't too strong that can be caused by only a partial amount of water being used.

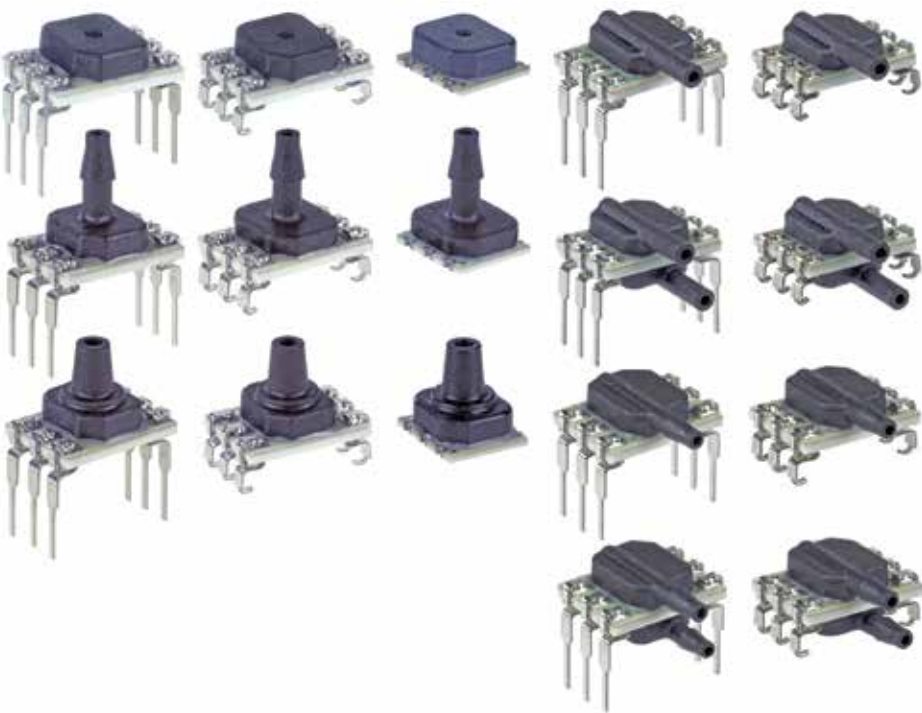
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ABP Series	Features
	<ul style="list-style-type: none"><li>• Proprietary Honeywell technology</li><li>• Protected by multiple global patents</li><li>• Industry-leading long-term stability: <math>\pm 0.25</math> %FSS</li><li>• Total Error Band (TEB): <math>\pm 1.5</math> %FSS</li><li>• Industry-leading accuracy: <math>\pm 0.25</math> %FSS BFSL</li><li>• High burst pressures</li><li>• Industry-leading flexibility</li><li>• Wide pressure range: 60 mbar to 10 bar   6 kPa to 1 MPa   1 psi to 150 psi</li><li>• Meets IPC/JEDEC J-STD-020D.1 Moisture Sensitivity Level 1 requirements</li><li>• Optional internal diagnostic functions</li><li>• Energy efficient</li><li>• Output: ratiometric analog; I<sup>2</sup>C- or SPI-compatible 14-bit digital output (min. 12-bit sensor resolution)</li><li>• Small size: As small as 8 mm x 7 mm</li><li>• REACH and RoHS compliant</li><li>• Sleep mode option (see <a href="#">Technical Note</a>)</li><li>• Temperature output option (see <a href="#">I<sup>2</sup>C Technical Note</a> or <a href="#">SPI Technical Note</a>)</li><li>• Liquid media option</li></ul>

#### Find out more

To learn more about Honeywell's sensing and control products, call **1-800-537-6945**, visit **[sensing.honeywell.com](http://sensing.honeywell.com)**, or e-mail inquiries to **[info.sc@honeywell.com](mailto:info.sc@honeywell.com)**

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008287-1-EN IL50  
July 2015  
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