

## Application Note

### Honeywell Zephyr™ Digital Airflow Sensors: HAF Series-High Accuracy, 10 SLPM, 15 SLPM, 20 SLPM, 50 SLPM, 100 SLPM, 200 SLPM or 300 SLPM

#### Background

Honeywell's Zephyr™ Digital Airflow Sensors: HAF Series-High Accuracy, provide a digital interface for reading airflow over specified full-scale flow and compensated temperature ranges. The thermally-isolated heater and temperature sensing elements help these sensors provide a fast response to air or gas flow.

Zephyr sensors are designed to measure mass flow of air and other non-corrosive gases. Standard flow ranges are 10 SLPM, 15 SLPM, 20 SLPM, 50 SLPM, 100 SLPM, 200 SLPM or 300 SLPM. The sensors are fully calibrated and temperature compensated with an onboard Application Specific Integrated Circuit (ASIC).



Anesthesia delivery machine

#### Solutions

##### POTENTIAL MEDICAL APPLICATIONS

**Anesthesia Delivery Machines** measure the flow of air, oxygen and nitrous oxide so that a specified mixture, as set by the doctor, is delivered to the patient.

*Customer Benefits:* Improves patient comfort and eases patient breathing; reliable and accurate.

**Ventilators** measure the flow of air, and oxygen so that a specified mixture, as set by the doctor, is delivered to the patient.

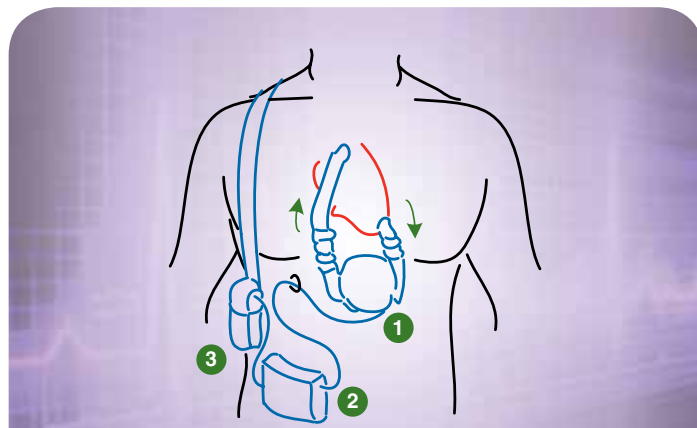
*Customer Benefits:* Improves patient comfort and eases patient breathing; reliable.



Ventilator

**Ventricular Assist Devices (Heart Pumps)** are mechanical pumps that assist the heart by pumping blood to the rest of the body for patients with congestive heart failure. Almost all VADs are made up of three parts:

- 1 Pump: A pump is placed inside or outside the body, and is connected to the heart by a tube. Blood travels from the heart, down the inflow tube, and into the VAD. The VAD then pumps the blood into the outflow tube and delivers it to a major blood vessel.



Ventricular assist device

#### Sensing and Control

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- 2 Controller: A system controller is placed outside the body to control the VAD. The Honeywell Zephyr™ Digital Airflow Sensor may be used in the controller to measure the flow of air so that the correct amount of air is delivered to the pump that drives blood flow through the heart. The VAD and the controller are connected by a cord that exits the body via an opening on the side of the abdomen.
- 3 Energy source: An outside energy source, either an AC power adapter or a battery pack, powers the pump.

*Customer Benefits:* Highly accurate, sensitive and stable; low pressure drop typically improves patient comfort; fast response time improves response to airflow change; low operating voltage and power consumption enhance portability.

**Spirometers** are instruments that measure lung capacity for patients with respiratory disorders. Honeywell's airflow sensor measures the airflow from the patient on exhalation.

*Customer Benefits:* Sensitive, accurate and reliable.

**Laparoscopy** is a surgical procedure performed by making small incisions in the abdomen. The abdomen is then inflated to allow the surgical instruments to be maneuvered inside the cavity. This minimally-invasive procedure speeds recovery, reduces time in the hospital, and potentially reduces costs to the patient.

*Customer Benefits:* The media typically used during this procedure is CO<sub>2</sub>, the flow of which needs to be tightly controlled to prevent the abdomen from deflating or inflating too much, possibly injuring the patient. By using a Honeywell Zephyr™ airflow sensor to accurately control the flow of gas, a gastro inflator allows the doctor to concentrate on the surgical procedure itself, without having to worry about keeping the abdomen inflated to the proper amount.



Spirometer



Laparoscopy

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### POTENTIAL INDUSTRIAL APPLICATIONS

#### **Analytical Instrumentation (Spectrometry, Chromatography)**

includes equipment used in the analysis of solid materials, gases or chemical compounds in many industrial, scientific, environmental and security applications. Spectrometry assesses the amount of a given chemical, while chromatography separates mixed chemical substances. These applications require precise control for accurate measurement. Honeywell's airflow sensor measures the gas flowing through the instrument to validate that the correct amount of gas is flowing through the system, and then notifies the machine if it is not correct so that the machine can compensate. The flow rate eliminates outgassing and provides the most accurate result for the instrument.

*Customer Benefits:* Improves accuracy, reliability and stability.

**Air-to-Fuel Ratio** is the mass ratio of air to fuel present during combustion. In air-fuel ratio sensing applications, such as fired heaters, power plant steam generators and large gas-fired turbines, Honeywell's airflow sensors may be used to control the mixture of air and fuel to optimize operation.

*Customer Benefits:* Improves accuracy and reliability.

**Fuel Cells** are chemically-generated energy that require controlled amounts of air or gas to optimize operation. Honeywell's airflow sensor enables precise control over the different gases involved in the fuel cell system to optimize performance.

*Customer Benefits:* Improves accuracy, reliability and stability.

**Fume Hoods** in chemical labs expel chemical fumes from work areas.

*Customer Benefits:* Improves personnel safety.



Analytical instrumentation



Air-to-fuel ratio



Fuel cells



Fume hood



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**Gas Leak Detection** is possible with the use of airflow sensors on a gas meter to find small amounts of gas flow so that even the smallest leaks in a gas system are reported.

*Customer Benefits:* Provides accurate reporting and enhances safety.

**Process Control Gas Monitoring** includes a variety of applications to monitor and control the flow of process gases. Several examples include plasma cutting and welding operations

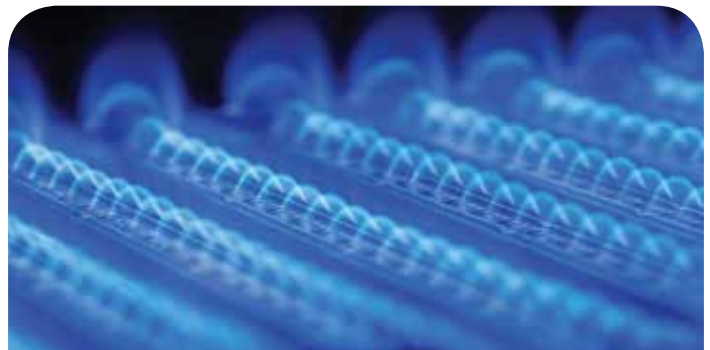
*Customer Benefits:* Honeywell's Zephyr™ airflow sensor may be used in a closed loop control to tightly control the flow of process gases, helping to minimize gas waste and potentially reducing the cost of using the device. Additionally, by applying the desired amount of gas, the process is better controlled and the resulting cut or weld can be optimized.

**Vacuum Pump Monitoring** may be needed when a vacuum pump is used to remove air from the inside of a closed container (i.e., a vacuum leak checker).

*Customer Benefits:* Honeywell's Zephyr™ airflow sensor may be used in a vacuum pump monitor to accurately measure the flow of the vacuum so that the desired levels are achieved. The more accurate the measurement, the more accurately the process can be controlled.



Gas leak detection



Process control gas monitoring



Vacuum pump monitoring

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<b>Zephyr™ Digital Airflow Sensors: HAF Series-High Accuracy, 10 SLPM, 15 SLPM, 20 SLPM, 50 SLPM, 100 SLPM, 200 SLPM or 300 SLPM</b>	<b>Features and Benefits</b> (★ = competitive differentiator)
	<b>Features and Benefits</b> (★ = competitive differentiator) <ul style="list-style-type: none"> <li>★ Industry's smallest Total Error Band (TEB) allows for precise airflow measurement, often ideal for demanding applications with high accuracy requirements</li> <li>• High accuracy is ideal for use in demanding applications</li> <li>• Fast response time allows the customer's application to respond quickly to airflow change, important in critical medical (e.g., anesthesia) and industrial (e.g., fume hood) applications</li> <li>• High stability reduces errors due to thermal effects and null shift to provide accurate readings over time and often eliminating the need for system calibration after PCB mount and periodically over time</li> <li>• High sensitivity at very low flows provides a fast response time at the onset of cessation of flow</li> <li>• High 12-bit resolution increases the ability to sense small airflow changes, allowing customers to more precisely control their application</li> <li>★ Wide airflow range measures mass flow with standard flow ranges of 10 SLPM to 300 SLPM, or custom flow ranges, increasing the options for integrating the sensor into the application</li> <li>★ Choice of port styles (manifold mount, 22 mm OD tapered male fitting, and G 3/8 female threaded fitting) provide flexibility to choose the pneumatic connection that is best for the customer's application</li> <li>★ Linear output provides a more intuitive sensor signal than the raw output of basic airflow sensors, which can help reduce production costs, design, and implementation time</li> <li>• Wide supply voltage range: flexible regulated power circuit (3 Vdc to 10 Vdc) gives the designer the flexibility to choose the supply voltage that works best in the system</li> <li>• ASIC-based I<sup>2</sup>C digital output simplifies integration to microprocessors or microcontrollers, reducing PCB complexity and component count</li> <li>• Factory or custom calibration for multiple gas types: can be factory calibrated for many gases, such as dry air, helium (He), argon (Ar), nitrogen (N<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and carbon dioxide (CO<sub>2</sub>), or custom calibrated for the end customer, eliminating the need to implement gas correction factors</li> <li>• RoHS-compliant materials meet Directive 2002/95/EC</li> </ul>

### Find out more

To learn more about Honeywell's sensing and control products, call **1-800-537-6945**, visit **sensing.honeywell.com** or e-mail inquiries to **info.sc@honeywell.com**

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Sensing and Control

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