

Sensors in Anesthesia Machine Applications

BACKGROUND

A medical anesthesia machine is designed to deliver drugs that help to eliminate pain and other unwanted sensations.

The continuous flow anesthetic machine provides an accurate and constant supply of medical gases (such as air, oxygen and nitrous oxide), mixed with an accurate concentration of anesthetic vapor (such as isoflurane), and delivers this mixture to the patient at a desired pressure and flow. (See Figure 1.)

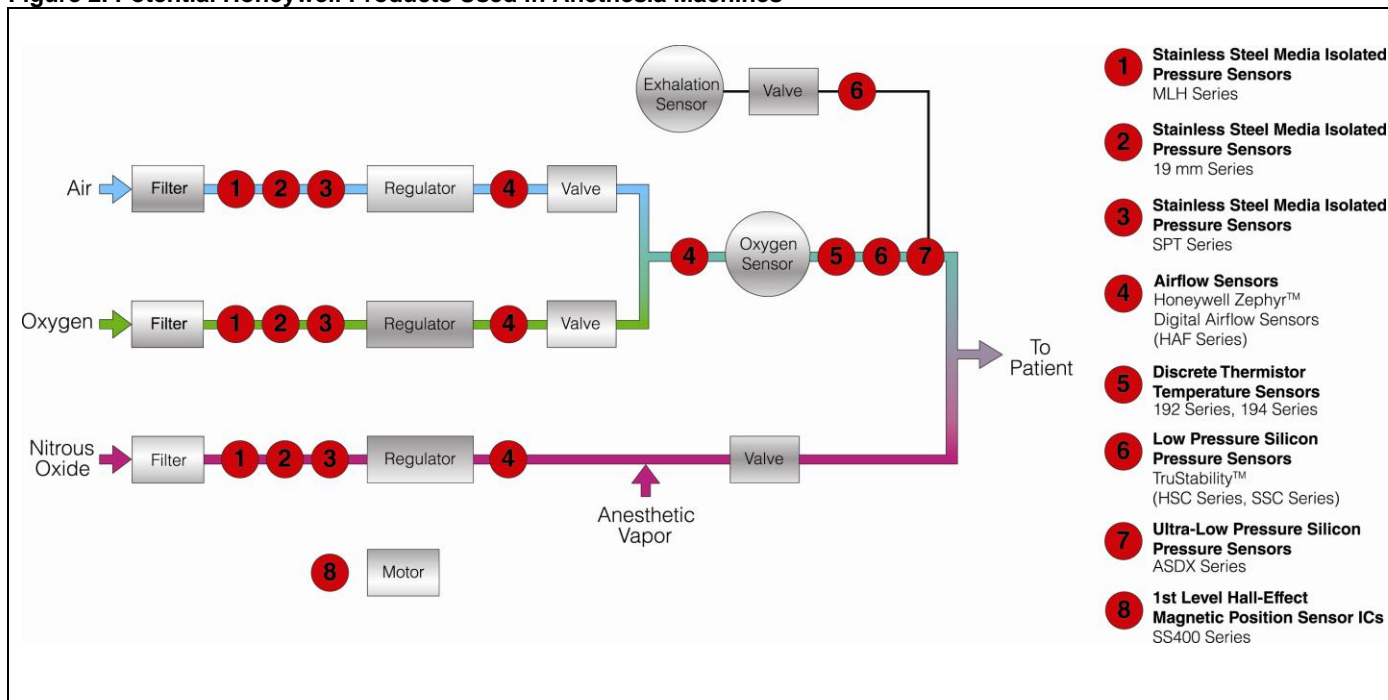
SOLUTIONS

Honeywell manufactures many products that may be used in anesthesia machines. They are designed to help control pressure, airflow and temperature, as well as to provide output for smooth motor control. (See Figure 2.)

Figure 1. Anesthesia Machine



Figure 2. Potential Honeywell Products Used in Anesthesia Machines



Sensors in Anesthesia Machine Applications

Pressure Sensors

Low Pressure Silicon: TruStability™ Silicon Pressure Sensors (HSC Series and SSC Series) are designed to measure air and oxygen pressure to and from the patient so the pressure doesn't exceed a desired level. The CPCL Series (CPCL10GFC) and the SDX010IND4 may also be used; however, they require a customer-provided amplifier or an ASIC-based solution for a signal conditioned output. (See Table 1.)

Ultra-Low Pressure Silicon: The ASDX Series is also designed to measure air and oxygen pressure to and from the patient so the pressure doesn't exceed a desired level. The CPCL Series (CPCL10GFC) and the SDX010IND4 may also be used;

however, they also require a customer-provided amplifier or an ASIC-based solution for a signal conditioned output. Although this option may provide the customer with increased design flexibility, it may take longer to design and may use more board space than the ASDX Series. (See Table 1.)

Stainless Steel Media Isolated: The MLH Series, 19 mm Series, and SPT Series pressure sensors are designed to provide a sensing solution when high pressure, steel pressure port interface and/or corrosive media are present. A male threaded pressure port and stainless steel wetted surfaces provide an air and oxygen inlet. (See Table 2.)

Table 1. Silicon Pressure Sensors





TruStability™ (HSC Series and SSC Series)	ASDX Series
	
Features and Benefits	
<ul style="list-style-type: none"> • Temperature compensation and calibration provide an amplified signal, typically allowing removal of components associated with signal conditioning from the PCB, increasing space and reducing associated costs • Industry-leading stability often eliminates need for calibration after PCB mount, and periodically over time • Digital ASIC output in either I²C or SPI protocols from digital sensors accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors and microcontrollers • Multiple packaging, mounting, power, and signal options combine with customized calibration capabilities to increase flexibility 	<ul style="list-style-type: none"> • Repeatable output designed for enhanced accuracy and sensitivity over range of device • Customizable output designed for application flexibility • Fully compensated for ease of use

Table 2. Stainless Steel Media Isolated Pressure Sensors

MLH Series	19 mm Series	SPT Series	Features and Benefits
			<ul style="list-style-type: none"> • Media isolated transducer (stainless steel wetted surfaces) designed for compatibility with many corrosive fluids and gases • Threaded pressure port designed for easy installation in customer manifold • Optional weldable interface designed to support a hermetic interface • Temperature-compensated electrical output • Amplified and non-amplified options


Sensors and Flexible Heaters in Anesthesia Machine Applications

Airflow Sensors

The Honeywell Zephyr™ Digital Airflow Sensors (HAF Series) are designed to measure the flow of air, oxygen and nitrous oxide. They may be used so that the desired mixture, as set by

the doctor, is delivered to the patient. The total mixture that is delivered to the patient is also measured and is displayed on the ventilator panel. (See Table 3.)

Table 3. Airflow Sensors


Honeywell Zephyr™ Digital Airflow Sensors (HAF Series)	Features and Benefits
	<p>Features and Benefits (★ = competitive differentiator)</p> <ul style="list-style-type: none"> ★ Meet high accuracy specifications: High 2.5% accuracy allows for very precise airflow measurement, often ideal for demanding applications with high accuracy requirements ★ Customizable: Allows the sensor to be designed to meet specific end-user needs ★ High sensitivity at very low flows: Allows the customer's application to detect presence or absence of airflow ★ High stability: Reduces errors due to thermal effects and null shift to provide accurate readings over time, often eliminating need for system calibration after printed circuit board mount, and periodically over time ★ Low pressure drop: Low pressure drop typically improves patient comfort in medical applications, and reduces noise and system wear in components such as motors/pumps ★ Saves customers time and money: Linear output provides a more intuitive sensor signal than the raw output of basic airflow sensors, often eliminating the need for customers having to linearize the output which can help to reduce production and design costs and implementation time ● Simplifies customer's production requirements: ASIC-based I²C digital output compatibility eases integration to micro-processors or micro-controllers, reducing PCB complexity and component count ● Small: Occupies less space on PCB, allowing easier fit and potentially reducing production costs; PCB size may also be reduced for easier fit into space-constrained applications ● Flexible: Low 3.3 Vdc voltage option and low power supply allows for battery-driven and other portable applications

Discrete Thermistor Temperature Sensors

Air that is warm and moist helps to provide the patient with a comfortable breathing situation and may reduce sore throats caused by breathing cold, dry air. As such, the temperature of the air delivery system is often monitored and controlled to help ensure that the air stream is maintained at the desired level of warmth. The 192 Series and 194 Series are installed directly into the air stream, and are designed to monitor and control air temperature. The sensor is coupled to a

microcontroller designed to monitor air stream temperature and interact with the controller which controls and regulates the temperature of the air stream. Honeywell offers several types of configurations. The packaged sensors are available as discreet components for customer-built assemblies, or Honeywell can provide a full assembly solution that the customer may simply pigtail into the system. (See Table 4.)

Table 4. Discrete Thermistor Temperature Sensors

192 Series, 194 Series	Features and Benefits
	<ul style="list-style-type: none"> ● Bare leads (192 Series) or insulated leads (194 Series) designed for improved application flexibility ● Resistance temperature(R-T) curve interchangeability designed to offer standardization of circuit components and simplification of design/replacement, as well as potential cost savings ● Small size often eases use in confined spaces


Sensors and Flexible Heaters in Anesthesia Machine Applications

1st Level Hall-Effect Magnetic Position Sensor ICs

This robust and durable SS400 Series is designed to provide enhanced output accuracy for smooth motor control that reduces noise and vibration in motor assembly fan systems. Its small size often reduces replacement costs and allows for

design into many compact, automated, lower-cost assemblies. A thermally balanced integrated circuit that is accurate over a full temperature range is designed to provide proper fan functionality. (See Table 4.)

Table 4. 1st Level Hall-Effect Magnetic Position Sensor ICs

SS400 Series	Features and Benefits
	<ul style="list-style-type: none"> • Quad Hall-effect design minimizes effects of mechanical or thermal stress on output and promotes a stable output • Unipolar, bipolar or bipolar latching magnetics and customizable operate/release points provide application flexibility • Negative compensation slope optimized to match negative temperature coefficient of lower-cost magnets, providing robust design over wide temperature range • Band gap regulation promotes stable operation over supply voltage range • Low power consumption enhances energy efficiency

⚠ WARNING

PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

MISUSE OF DOCUMENTATION

- The information presented in this application note is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

SALES AND SERVICE

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

E-mail: info.sc@honeywell.com

Internet: www.honeywell.com/sensing

Phone and Fax:

Asia Pacific	+65 6355-2828 +65 6445-3033 Fax
Europe	+44 (0) 1698 481481 +44 (0) 1698 481676 Fax
Latin America	+1-305-805-8188 +1-305-883-8257 Fax
USA/Canada	+1-800-537-6945 +1-815-235-6847 +1-815-235-6545 Fax

Sensing and Control

Honeywell

1985 Douglas Drive North

Golden Valley, MN 55422

www.honeywell.com/sensing

009042-4-EN IL50 GLO Printed in USA

April 2010

Copyright © 2010 Honeywell International Inc. All rights reserved.

Honeywell