

# **SOLUTIONS FOR MEDICAL APPLICATIONS**

Sensors and Switches

**Honeywell**



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# **WHEN LIVES ARE PARAMOUNT, COUNT ON HONEYWELL SENSING AND INTERNET OF THINGS.**

Lives can be on the line, so your sensor and switch technology should be exceptional. That's why so many businesses trust Honeywell to deliver high-quality, reliable products. Our broad product offering and experienced application engineering support help medical equipment designers to quickly find the sensing and switching solutions to meet their performance needs.

For medical applications, product performance is paramount. Our sensors are designed to meet product performance goals you can trust for enhanced reliability, product life, and accuracy. They're also designed for rugged environments.

Honeywell's sensors are widely used in a variety of medical applications, including ventilators, oxygen concentrators, patient monitoring systems, and laboratory test equipment, resulting in:

- Keeping patients alive
- Helping patients build strength
- Helping patients breathe
- Assisting with patient monitoring
- Running tests in laboratories

Our vast engineering and manufacturing teams are ready to help and support all medical sensor product needs:

- Application engineers are available to help you determine which existing product meets your design needs.
- If a new sensor design better meets your specifications, we can meet accuracy, reliability, and stability needs with a design that's easy to implement and enhances patient safety and care quality.
- Component samples are available that allow you to build the prototypes for your application.

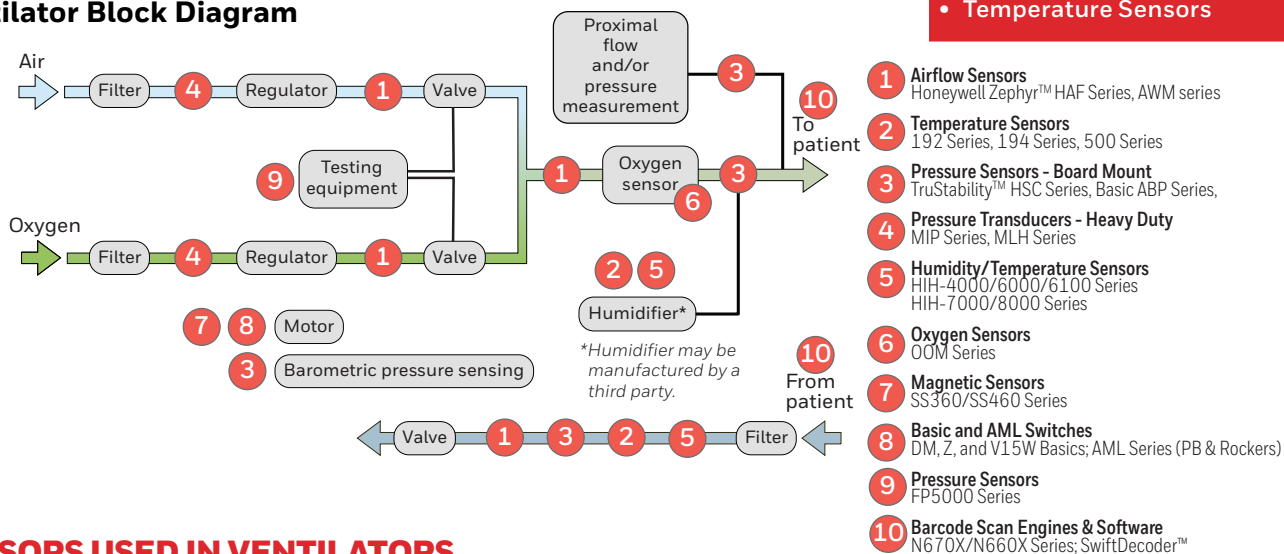
With a 75-year legacy in the sensor and switch business, Honeywell has earned a reputation for reliability and excellence. Our strong product designs, Six Sigma Plus manufacturing environment, and robust testing facilities help provide quality out-of-the-box, as well as enhanced, sustainable performance down the line.

# RESPIRATORY: VENTILATORS

Honeywell is a leading provider of sensors for respiratory applications. Our sensors are used by major medical OEMs and provide enhanced accuracy, sensitivity, reliability and long term stability. Honeywell's sensors are used in a variety of respiratory applications, including ventilators, CPAP, anesthesia delivery systems, and oxygen concentrators.

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.

## Ventilator Block Diagram



## SENSORS USED IN VENTILATORS

### AIRFLOW SENSORS:

- Monitor a patient's breathing and ensure air/oxygen delivery is controlled efficiently

### BASIC & AML SWITCHES:

- Used as on/off operator controls, as well as detection for covers, panels, and doors

### HUMIDITY & TEMP. SENSORS:

- Monitor and control the temperature and moisture content of the air delivered to the patient

### MAGNETIC SENSORS:

- Control motors and sense motor speed

### OXYGEN SENSORS:

- Measure and control oxygen concentration level of the air mixture delivered to the patient

### TEMPERATURE SENSORS:

- Monitor and control the temperature of the air delivered to the patient, improving patient comfort

### PRESSURE SENSORS:

- Monitor a patient's breathing and detect if breathing deteriorates
- Detect when air and oxygen inlet filters are clogged and need to be replaced
- Heavy duty pressure sensors monitor and control the flow of air and oxygen delivered to ventilators
- Used to test ventilator valves

### BARCODE SCAN ENGINES & SOFTWARE:

- Automated, more accurate and faster tracking of patient & caregiver IDs
- Ensures the right medication and equipment match the right patient

## Solutions for Ventilators

- Airflow Sensors
- Barcode Scan Engines & Software
- Basic and AML Switches
- Humidity & Temperature Sensors
- Magnetic Sensors
- Oxygen Sensors
- Pressure Sensors and Transducers
- Temperature Sensors

# RESPIRATORY: OXYGEN CONCENTRATORS

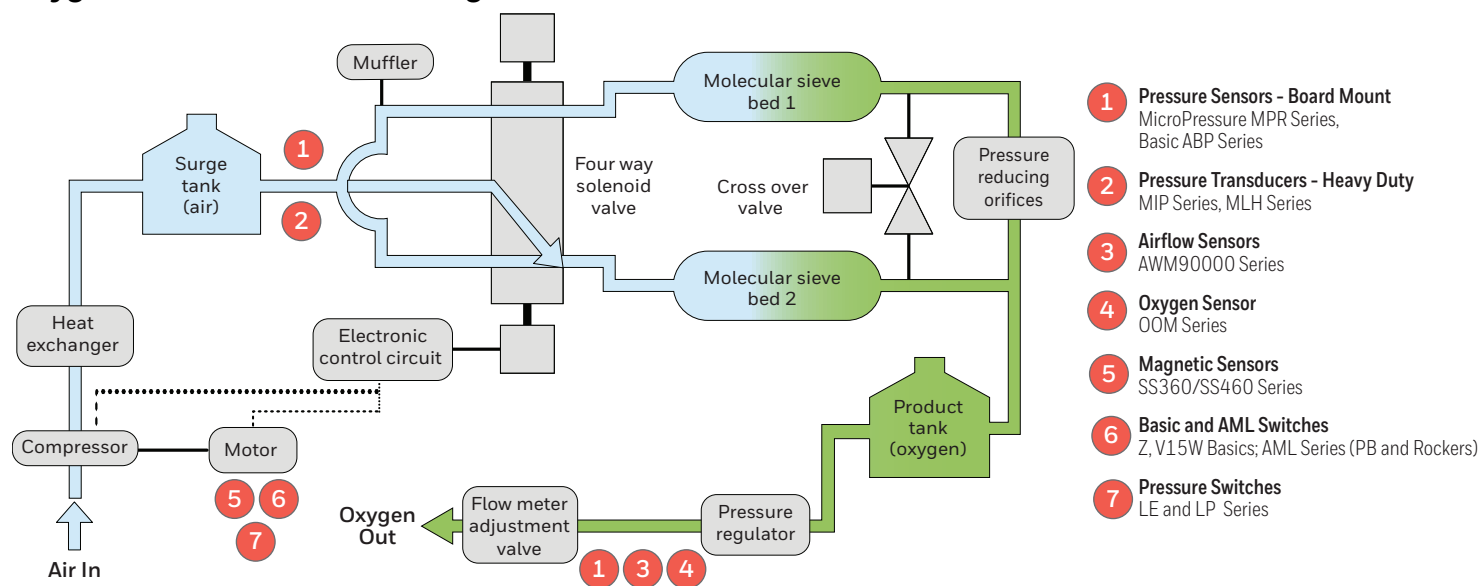
Oxygen concentrators reduce the level of nitrogen in the air, and increase the oxygen level. Oxygen concentrators are often used with patients, such as those with lung disease, who have difficulty absorbing oxygen into the bloodstream. These devices are used to assist patients with respiratory illnesses or lung disease.

An oxygen concentrator receives air, purifies it and then distributes the newly formed air. Air is made up of 80 percent nitrogen and 20 percent oxygen. An oxygen concentrator increases the oxygen content to 90 to 95 percent. Sieve bed filters contain Zeolite, which removes the nitrogen from the air. Oxygen concentrators can be used in hospitals, home and some devices are portable.

## Solutions for Oxygen Concentrators

- Airflow Sensors
- Basic and AML Switches
- Magnetic Sensors
- Oxygen Sensors
- Pressure Switches
- Pressure Sensors and Transducers

### Oxygen Concentrator Block Diagram



## SENSORS USED IN OXYGEN CONCENTRATORS

### AIRFLOW SENSORS:

- Monitor a patient's breathing to detect when the patient inhales, so that oxygen is only supplied when required and isn't wasted. This helps to minimize the overall system size by supplying oxygen only when required

### BASIC & AML SWITCHES:

- Used as on/off operator controls, as well as detection for covers, panels, and doors

### MAGNETIC SENSORS:

- Control motors and sense motor speed

### OXYGEN SENSORS:

- Measure and control oxygen concentration level of the air delivered to the patient

### PRESSURE SWITCHES:

- Act as high pressure warnings in the event of error or over-pressure

### PRESSURE SENSORS:

- Monitors sieve bed pressure to maintain the optimal pressure so that enough oxygen can be generated, but still remain at a relatively high oxygen concentration



Patient monitors are used in clinical environments (e.g., operating rooms, emergency rooms, intensive care, and increasingly, patient homes) to monitor and display the patient's vital signs, including ECG, SpO<sub>2</sub> (peripheral oxygen saturation), blood pressure, respiration, and temperature. Patient monitors can be standalone or multi-parameter. Honeywell sensors have been used in applications with blood pressure monitoring, glucose monitoring, respiratory monitoring, and temperature monitoring.

## SENSORS USED IN PATIENT MONITORING

**Respiratory monitoring** displays critical indices including capnography, which monitors the concentration or partial pressure of CO<sub>2</sub> in respiratory gases, and spirometers, which measure lung capacity

**Temperature monitoring** consists of monitoring patient temperature.

**Blood pressure monitoring** may be measured through either an inserted pressure transducer or non-invasively through a blood pressure cuff (NIBP).

**Glucose monitoring** measures the glucose level in the interstitial fluid. Continuous monitoring allows examination of how the blood glucose level reacts to insulin, exercise, food, and other factors.

### AIRFLOW SENSORS:

- Measures patient breathing (inhalation/exhalation volumes) to ensure the patient is breathing correctly by sensing the air flow in the respiratory path

### BARCODE SCAN ENGINES & SOFTWARE:

- Automated, more accurate and faster tracking of patient & caregiver IDs
- Ensures the right medication and equipment match the right patient

### HUMIDITY & TEMPERATURE SENSORS:

- Measure and monitor ambient temperature and humidity either in the hospital room or in the patient's breath/respiratory path

### OXYGEN SENSORS:

- Measure oxygen concentration level of the air mixture delivered to the patient

## Solutions for Patient Monitoring

- Airflow Sensors
- Barcode Scan Engines & Software
- Humidity & Temperature Sensors
- Oxygen Sensors
- Pressure Sensors and Transducers
- Temperature Sensors
- SpO<sub>2</sub> Sensors

### PRESSURE SENSORS:

- Monitor a patients breathing to detect when they inhale and exhale, also used to detect if breathing deteriorates
- Measures patient blood pressure to keep track of the patents health
- Detect when air and oxygen inlet filters are clogged and need to be replaced

### TEMPERATURE SENSORS:

- Used to measure both the patient's temperature, as well as the temperature in the patient's respiratory system

### SPO<sub>2</sub> SENSORS:

- Measure the percentage of oxygenated hemoglobin (hemoglobin containing oxygen) compared to the total amount of hemoglobin in the blood (oxygenated and non-oxygenated hemoglobin)

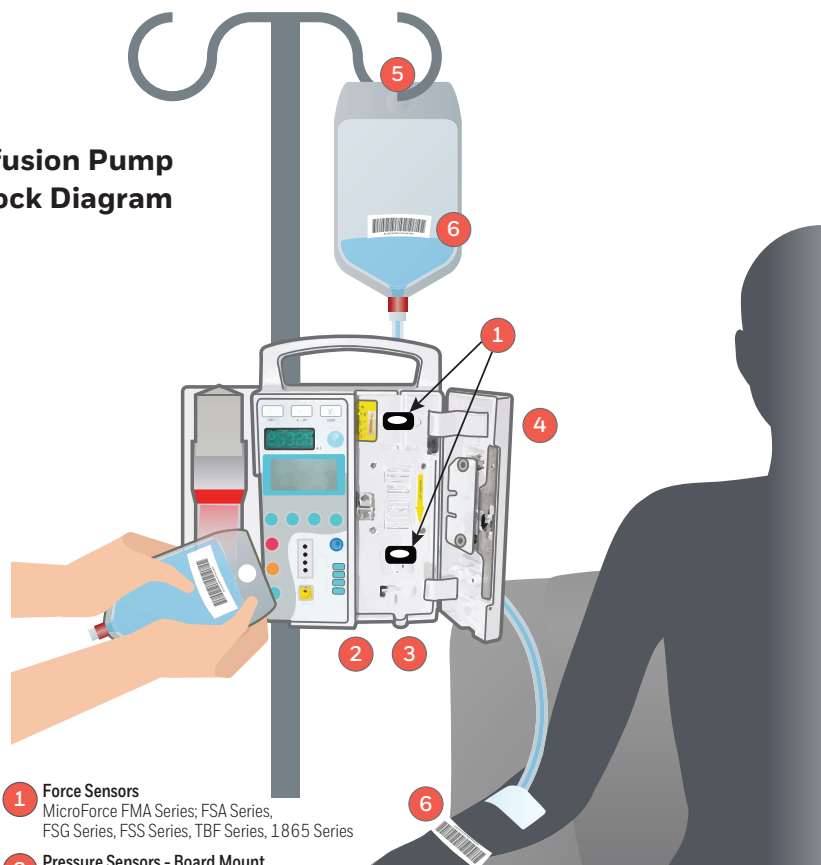


# INFUSION PUMPS

Infusion pumps are used to deliver fluids, medicines or nutrients to patients. Fluids and medicines are delivered intravenously, directly into the blood stream and nutrients are delivered directly into the stomach. Infusion pumps are commonly used in hospital intensive care units and wards, but smaller portable infusion pumps are now being used to treat patients at home.

Infusion pumps control the flow of fluids and ensure that patients get the correct dosage, due to the wide variety of medicines used and the cleaning requirements, force sensors are typically used to measure the pressure inside the delivery tube.

**Infusion Pump Block Diagram**



- 1 **Force Sensors**  
MicroForce FMA Series; FSA Series, FSG Series, FSS Series, TBF Series, 1865 Series
- 2 **Pressure Sensors - Board Mount**  
Basic ABP Series; MicroPressure MPR Series (peristaltic pump applications)
- 3 **Magnetic Position Sensor ICs**  
Hall-Effect: SS490 Series; SS360NT, SS360ST, SS460S; Micropower SL353 Series or Magnetoresistive: Nanopower Series
- 4 **Basic and AML Switches**  
ZD and ZW Series Sealed Basics; AML Series (Pushbutton and Rocker)
- 5 **Subminiature Load Cells**  
Models 31 and 11
- 6 **Barcode Scan Engines & Software**  
N670X & N660X Series; SwiftDecoder™

## Solutions for Infusion Pumps

- Force Sensors
- Barcode Scan Engines & Software
- Basic and AML Switches
- Magnetic Position Sensor ICs
- Pressure Sensors
- Subminiature Load Cells

## SENSORS USED IN INFUSION PUMPS

### FORCE SENSORS:

- Monitor the delivery of fluids, medicines or nutrients to the patient
- Detect blockages and determine when the bag containing fluids needs to be changed

### BARCODE SCAN ENGINES & SOFTWARE:

- Ensures the right treatment is administered to the right patient by reading the barcodes on the IV bag and on the patient wrist band

### BASIC & AML SWITCHES:

- Used as on/off operator controls, as well as detection for covers, panels, and doors

### MAGNETORESISTIVE POSITION SENSOR ICs:

- Monitor placement of tube in pump cavity to ensure proper orientation along with pump motor speed control

### PRESSURE SENSORS – BOARD MOUNT:

- Used in non-invasive location if peristaltic pump is used to control pressure to the pneumatic pincher rollers

### SUBMINIATURE LOAD CELLS:

- Monitor the weight of the IV bag

# LABORATORY EQUIPMENT BLOOD AND SALIVA ANALYZER

Honeywell sensors are used within a variety of medical laboratory test equipment to improve the accuracy and efficiency of testing. Laboratory testing includes blood, saliva, urine testing and gas chromatography.

Key applications within lab testing:

Liquid level - Accurately measure the sample volume

Liquid flow - Accurately control the flow of liquids during testing

Gas analysis - Accurately control the flow of gases during analysis

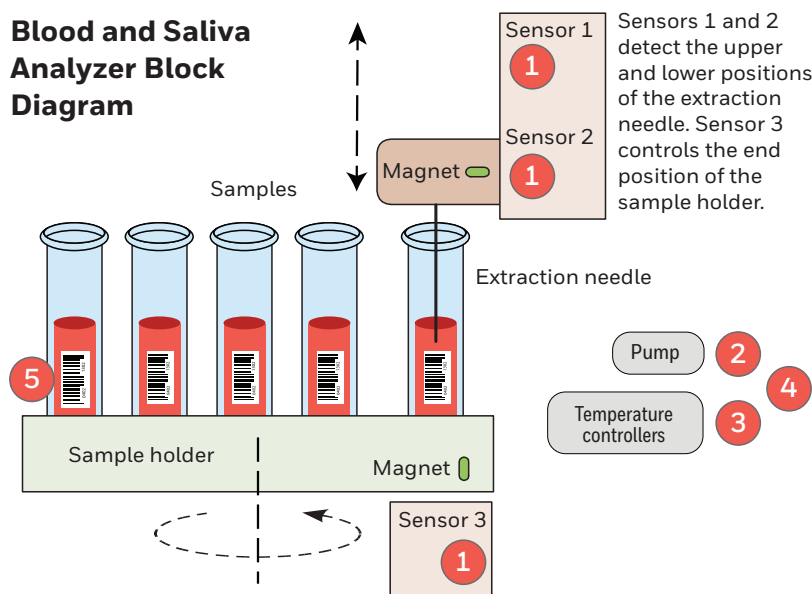
Fume extraction - Ensure dangerous fumes are removed

Barcode scanning - Accurately track and validate samples

## Solutions for Lab Equipment

- Barcode Scan Engines & Software
- Force Sensors
- Magnetic Sensors
- Pressure Sensors
- Temperature Sensors

### Blood and Saliva Analyzer Block Diagram



- 1 Magnetoresistive Position Sensor ICs**  
SM Series
- 2 Pressure Sensors - Board Mount**  
Basic ABP Series; MicroPressure MPR Series
- 3 Thermistor Sensing Elements**  
192 Series, 194 Series, 500 Series
- 4 Force Sensors**  
MicroForce, FMA Series
- 5 Barcode Scan Engines & Software**  
N5680, N660X & N670X Series; CM Series & Vuquest 3330G; SwiftDecoder™

## SENSORS USED IN BLOOD AND SALIVA ANALYZERS

### BARCODE SCAN ENGINES & SOFTWARE

- Tracks and validates the sample ID and associated information at any point in the work flow

### FORCE SENSORS:

- Measures the force applied to and within the pump

### MAGNETORESISTIVE POSITION SENSOR ICs:

- Senses position of magnet to indicated position of the extraction needle or sample

### PRESSURE SENSORS - BOARD MOUNT:

- Provides feedback to control the flow of the test fluids

### TEMPERATURE SENSORS:

- Help monitor the temperature of the sample holder

# LABORATORY EQUIPMENT

## FLOW CYTOMETRY

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

### SENSORS USED IN FLOW CYTOMETRY

#### BARCODE SCAN ENGINES & SOFTWARE

- Tracking and validating the sample ID and associated information at any point in the work flow

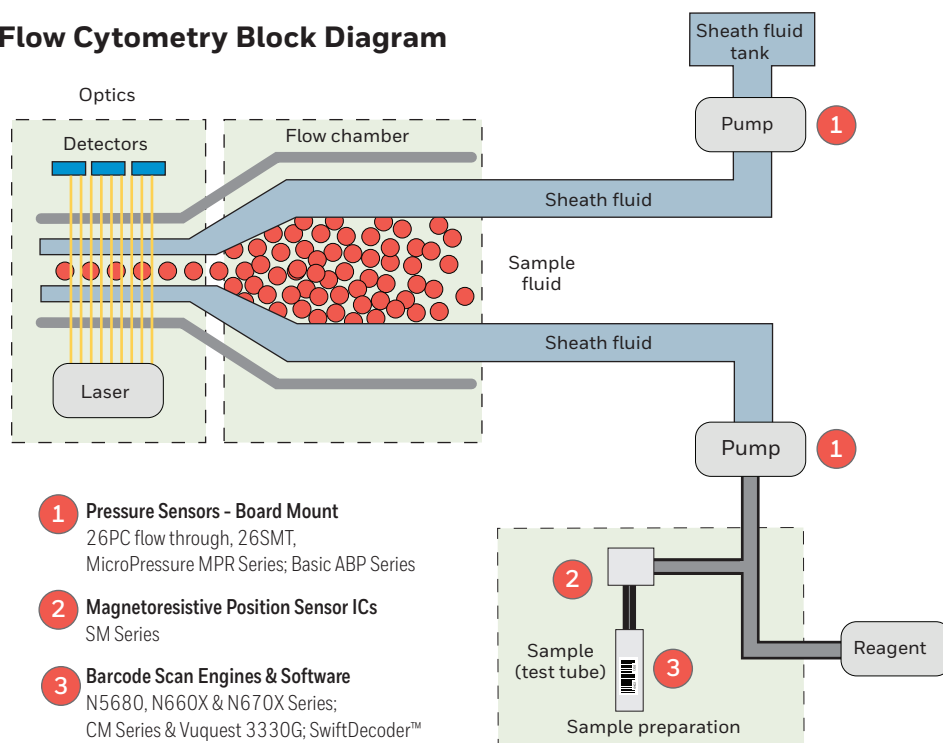
#### PRESSURE SENSORS – BOARD MOUNT:

- Applies pressure to specimens to force the blood cells into a smaller and fewer cells so just one cell at a time can pass by the detector

#### MAGNETORESISTIVE POSITION SENSOR ICs:

- Confirms the sample tube's position

Flow Cytometry Block Diagram





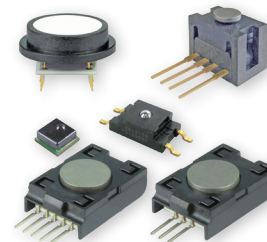
HAF Series - Low Flow



HAF Series - High Flow



AWM90000 Series



## AIRFLOW SENSORS

HONEYWELL ZEPHYR™ HAF SERIES; AWM90000 SERIES (AWM92100V); AWM40000 SERIES

### Ventilators and Oxygen

**Concentrators:** Zephyr Airflow Sensors are designed to measure the flow of air, oxygen, and nitrous oxide. Airflow sensors are utilized in ventilators and oxygen concentrators to measure and control the airflow to the patient and monitor the patients breathing.

**Respiratory Monitoring:** AWM92100V Series airflow sensors monitor a patients breathing. Zephyr Airflow Sensors 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.

**Gas Chromatography:** Medical gas chromatography requires precise and accurate monitoring and regulation of gas flow. Honeywell's AWM40000 Series airflow sensor's ceramic flow tube is designed to minimize outgassing with enhanced accuracy and reliability.

### Benefits to Customer

- **High accuracy:** Precise airflow measurements in demanding applications.
- **High sensitivity:** Detect presence of very low airflow or absence of airflow.
- **High stability:** Enhancing long-term performance and reliability of equipment, eliminating need for frequent system calibration.
- **Customizable:** Variety of custom or off-the-shelf products available.
- **Low pressure drop detection:** Improves patient comfort in medical applications, and reduces noise and system wear in components such as motors/pumps
- **Linear output:** Enhanced output signal, reducing production and design costs

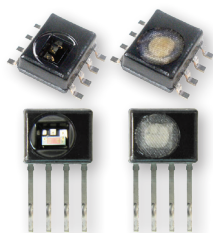
## FORCE SENSORS

FSA SERIES, FSG SERIES, FSS SERIES, TBF SERIES, 1865 SERIES

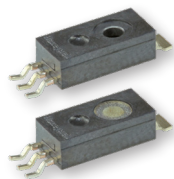
Force sensors are typically used within infusion pumps to monitor and control the deliver fluids, medicines, or nutrients to patients. If the tube becomes blocked, the force sensor alerts the patient, nurse, or doctor via an audible alarm that the therapy isn't being delivered.

### Benefits to Customer

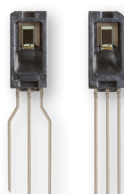
- **High accuracy:** Precise fluid flow-rate measurements ensure the patient is receiving the correct dosage
- **Sensitive:** Enables early detection of blockages, enhancing patient safety.
- **Stability:** Enhances long-term performance and reliability of equipment.
- **Easy to use:** Sensor is external to the tubing (media isolated), minimizing the need for cleaning/sterilization



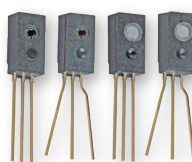
Honeywell  
Humidicon™  
HIH8000 Series



HIH-5030/5031  
Series



HIH-4000 Series



HIH-4020/4021  
Series

## HUMIDITY AND TEMPERATURE SENSORS

### HONEYWELL HUMIDICON™ HIH8000 SERIES, HIH-5030/5031 SERIES, HIH-4000 SERIES

Honeywell humidity and temperature sensors play a vital role in medical equipment as they monitor and control the temperature and moisture content of the air delivered to the patient, improving patient comfort. In addition, they measure and monitor ambient temperature and humidity either in the hospital room or in the patient's breath/respiratory path.

#### Benefits to Customer

- **Accuracy:** Precise measurements over the entire humidity range of 0 %RH to 100 %RH

- **Stability:** Enhanced long-term performance and reliability of equipment
- **Durable:** Multi-layer construction and a hydrophobic filter provides enhanced resistance to condensation and contaminants
- **Small form-factor:** Small housing profile allows for application flexibility
- **Cost-effective:** Reducing total cost of ownership



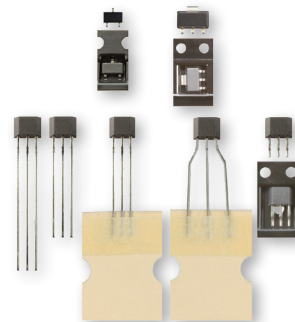
## BARCODE SCAN ENGINES AND SOFTWARE

### N670X, N660X, N5680, CM SERIES; VUQUEST 3330G; SWIFTDECODER™

Honeywell barcode scan engines, modules and decoding software are used in medical applications to help improve patient safety and enhance operational effectiveness. Integrating Honeywell barcode reading OEM solutions supports automated, more accurate and faster tracking of sample, patient and caregiver IDs and associated information in the workflow, ensuring the right medication, treatment and equipment match the right patient.

#### Benefits to Customer

- **Optimal design:** Reliable, small form factor that is based on the same interface and software platform
- **Broad portfolio:** Choice of optical engines and modules with a wide variety of optics, performance, symbologies, illuminations and aimers
- **Proven scanning:** Enhanced motion tolerance, extended depth of field and high resolution barcode scanning combined with Honeywell's best-in-class software
- **Superior support:** World-class engineering, local technical support and inhouse manufacturing support both high volume and high mix production



## MAGNETIC POSITION SENSOR ICs

### HALL-EFFECT: SS490 SERIES; SS360NT, SS360ST, SS460S; SM SERIES; MICROPOWER SL353 SERIES

### VALUE ADDED: 103SR AND SR16/SR17

### MAGNETORESISTIVE: NANOPOWER SERIES

These magnetic position sensors are designed to provide reliable, highly accurate output for smooth motor control that reduces noise and vibration in the pump's motor assembly and improves its efficiency. Its solid state reliability often reduces repair and maintenance costs, and its small size allows for design into many compact, automated, lower-cost assemblies.

**Blood analyzers:** May use a series of rotating blood probes from which an extraction needle or pipette removes samples. Equipment designers must find a reliable solution for sensing position in a non-contact, mechanical system. To control the automated mechanisms, a series of ICs may be used to detect extraction needle movement.

#### Benefits to Customer

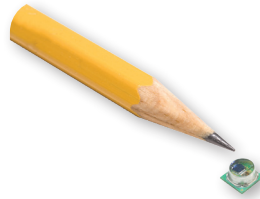
- **Energy efficient:** Hall-effect sensors consume little energy and help improve motor efficiency
- **Accurate:** Analog Hall-effect sensors provide accurate and linear output, enabling an extended sensing range
- **Cost-effective:** Allows for compact designs and automated, lower-cost assemblies
- **Quiet:** Reliable, accurate sensor output for smooth motor control



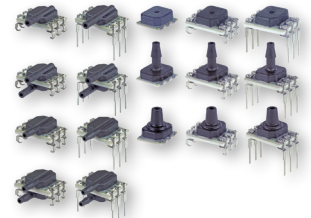
Oxygen Sensors



TruStability RSC Series,  
HSC Series, SSC Series



MicroPressure, MPR Series



Basic ABP Series

## OXYGEN SENSORS

Oxygen sensors are the oxygen-sensing component of an oxygen analyzer that measures oxygen concentration in breathing gas mixtures. Honeywell's lead-free oxygen sensors are an innovative one-to-one, drop-in replacement for existing lead based oxygen sensors.

Not only does the sensor fulfill the RoHS II regulatory requirements by being lead-free, this advanced technology is temperature compensated and provides high accuracy of the sensor signal, low signal drift, and low cross interferences from common components of breathing gases.

**Oxygen Concentrators:** Measure and control oxygen concentration level of the air delivered to the patient

### Benefits to Customer

- Compliant to EU RoHS Directive 2011/65/EU
- Compliant with European MDD (CE certification)
- One-to-one replacement
- High accuracy and reliability in response
- Enhanced signal stability and product quality
- Low influence against elements in breathing gasses
- Low signal drift (<1 % volume O<sub>2</sub>/month)
- Reliable lifetime (application-specified to 2 to 3 years)
- Short delivery times

## PRESSURE SENSORS

### BOARD MOUNT PRESSURE SENSORS: TRUSTABILITY™ HSC, SSC, TSC, NSC SERIES; BASIC ABP, TBP, NBP SERIES; MPR SERIES

**Oxygen Concentrators:** Monitor a patient breathing to detect if breathing deteriorates and ensure air/oxygen can be delivered efficiently and effectively. Board mount pressure sensors may be used to detect when the patient begins to inhale so that oxygen can then be delivered efficiently and effectively. Not only can this enhance system response time, it can also minimize oxygen waste when the patient isn't inhaling, allowing the oxygen concentrator to be smaller and to operate more efficiently. Smaller equipment size also means lower power consumption, as well as greater portability

**Infusion Pumps:** Honeywell's TruStability board mount pressure sensors may be used to monitor and control the fluid flow.

### Blood Pressure and Glucose

**Monitoring:** Honeywell's board mount pressure sensors are used to control the pumps that draw blood and return it to the patient in continuous glucose monitors used in critical care units. These pressure sensors meet the size requirements for handheld glucose meters equipped glucose monitoring pressure measurement.

**Blood Analyzers:** Honeywell's TruStability and 26PC Series board mount pressure sensors are used to regulate the pressure in the pump system to draw and transport the blood samples.

**Gas Chromatography:** Honeywell's TruStability board mount pressure sensor is used to sense and control gas stream pressure to maintain a constant and more precise flow.

**Honeywell board mount pressure sensors** are extensively used within medical equipment due to high levels of accuracy, sensitivity and reliability. Board mount pressure sensors are commonly utilized at ultra-low pressure ranges within ventilators and oxygen concentrators to monitor a patient breathing and detect when filters are clogged and need to be replaced.

### Benefits to Customers: Board-Mount Pressure Sensors

- **High accuracy:** Precise ultra-low pressure measurements
- **High sensitivity:** Detect pressure changes quickly.
- **High stability:** Enhancing long-term performance and reliability of equipment
- **Small form-factor:** Simplifies integration into equipment confined spaces
- **Flexible:** Wide selection pressure ranges, port types and output types etc.
- **Value:** Enhanced accuracy, sensitivity, and stability with minimal drift over time



MLH Series



FP5000 Series



MIP Series



192 Series, 194 Series

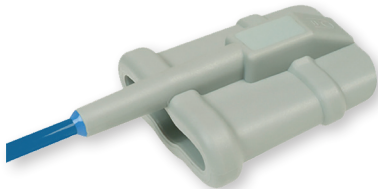
## PRESSURE SENSORS

### HEAVY DUTY PRESSURE TRANSDUCERS: MIP, PX, MLH SERIES, 19MM SERIES, SPT SERIES, FP5000 SERIES

**Honeywell heavy duty pressure sensors** support pressure ranges up to 550 bar (8,000 psi) and are designed for demanding applications and environments. Heavy duty pressure sensors support a wide variety of media and are offered with a wide choice of ports and outputs. Heavy duty pressure sensors are used to monitor and control the flow of air and oxygen delivered to ventilators and oxygen concentrators. Heavy duty pressure sensor is used to monitor and control pressure within the surge tank.

#### Benefits to Customers: Heavy Duty Pressure Sensors

- **High accuracy:** More precise mid-high pressure measurements
- **High sensitivity:** Detect pressure changes quickly
- **High stability:** Enhancing long-term performance and reliability of equipment
- **Robust:** Designed for demanding applications and environments
- **Flexible:** Wide selection pressure ranges, port types and output types etc.



## SPO<sub>2</sub> SENSORS

### PRODUCTS FOR PULSE OXIMETRY

Honeywell sensors are for determining arterial oxygen saturation (SpO<sub>2</sub>) and pulse rate (PR) as well as handheld monitoring systems (pulse oximeters). A finger sensor that can be seamlessly integrated in existing cleaning, disinfections and sterilization processes, reused again and again and withstands maximum mechanical stress. This means a rapid return on investment and huge cost savings compared with alternative solutions.

#### Benefits to Customer

- Maximum safety with steam sterilization
- Mechanical and manual cleaning and disinfection
- High wearing comfort; outstanding cost efficiency
- Maximum resistance to mechanical stress
- DIN EN ISO 17664 compliant
- Effectiveness of sterilization validated and certified by an independent institute
- Satisfies the recommendations of the Robert Koch Institute

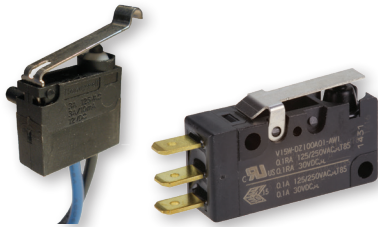
## TEMPERATURE SENSORS

### 192 SERIES, 194 SERIES, 500 SERIES

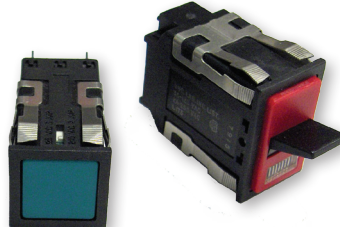
Warm, moist air from ventilators and oxygen concentrators helps to provide the patient with comfortable breathing, reducing sore throats caused by breathing cold, dry air. Temperature sensing elements are installed directly into the air stream to monitor control the air temperature. Packaged temperature sensors are available as discrete components for customer-built assemblies, or Honeywell can provide a full assembly solution that the customer may simply pigtail into the system.

#### Benefits to Customer

- **High accuracy:** More precise temperature measurement
- **Small form-factor:** Simplifies integration confined spaces
- **Flexible:** Wide selection of resistance, housing and termination options
- **Customizable:** Variety of custom or off-the-shelf products available
- **Cost-effective:** Reducing total cost of ownership



ZD Series and V15W Series  
Basic Switches



AML Series (Pushbutton,  
and Rocker/Paddle) Switches



LE, LP Series  
Switches

## MICRO SWITCH BASIC SWITCHES

### DM, ZD, ZW, V15W SERIES

MICRO SWITCH Basic Switches can be used as presence/detection for covers, panels, and doors acting as a fail-safe to prevent switching the machine when doors/panels are ajar. Several series are sealed to protect against fluids.

#### Benefits to Customer

- **MICRO SWITCH technology:** Highly accurate, repeatable, and durable with extended life.
- **Customizable:** Offers a variety of straight, roller, simulated roller, and special actuators from which to choose.
- **Reliable:** Provides repeatable and consistent performance within a range of conditions.
- **Industry-leading current capability:** A wide range of current ratings, from 0.1 A to 10 A.

## MICRO SWITCH AML SWITCHES

### AML SERIES (PUSHBUTTONS AND ROCKERS)

MICRO SWITCH AML Series are available as pushbuttons, keyswitches, and rockers/paddles. They are often used in medical equipment as off/on operator controls on the external face of the equipment.

#### Benefits to Customer

- **MICRO SWITCH technology:** Highly accurate, repeatable, and durable with extended life.
- **Electrical capability:** Well suited for power-duty and logic-level loads
- **Configurable:** Pushbuttons, paddles, rockers, key-actuated, and indicators within AML Series for coordinated panel appearance.
- **Contacts:** Fine silver contacts for switching electrical loads, optional gold contacts for logic level applications.

## MICRO SWITCH PRESSURE SWITCHES

### LE, LP SERIES

MICRO SWITCH Pressure Switches can act as high-pressure warnings in the event of an error. The switch could illuminate a warning light/sound, or simply cut power in the event of a dangerous, over-pressure event.

#### Benefits to Customer

- **Smart Diagnostic technology:** Through optional smart diagnostic technology, Honeywell pressure switches are able to detect failures such as open circuits, cut wires, worn insulation, and more.
- **Environmentally sealed:** IP67 sealing provides enhanced durability in harsh environmental and applications.
- **Cost-effective:** Can reduce tooling, service, and manufacturing labor costs due to standard connections, extended product life, and expedited design and production cycle.



Model 31  
Load Cell

Model 11  
Load Cell

## SUBMINIATURE LOAD CELLS

### MODELS 31 AND 11

Honeywell's subminiature load cells are designed to fit into systems with limited space or tight clearances. Constructed of rugged stainless steel for precise measurements and excellent long term stability and reliability. These load cells are designed to eliminate or reduce to a minimum the effect of off-axis loads.

#### Benefits to Customer

- **Reliable:** Accuracies of 0.25 % to 0.80 % full scale
- **Configurable:** Offers load ranges from 150 g up to 1,000 lb

# POTENTIAL APPLICATIONS OVERVIEW

POTENTIAL APPLICATION	HONEYWELL PRODUCT	PRODUCT FUNCTION IN APPLICATION	CUSTOMER BENEFITS
RESPIRATORY			
Ventilators	Airflow Sensors	Measure the flow-rate of air and oxygen delivered to the patient	Highly accurate, customizable, stable, low pressure drop, saves time and money
	Barcode Scan Engines and Software	Track patient and caregiver ID; ensure the right medication and equipment match the right patient	Improves patient safety and operational effectiveness
	Basic and AML Switches	Used as on/off operator controls, as well as detection for covers, panels, and doors	Highly configurable, highly accurate, repeatable, reliable
	Humidity & Temperature Sensors	Measure combination of temperature and humidity (moisture content) of air flow delivered to patient	Highly accurate, flexible, cost-effective, durable
	Oxygen Sensors	Measure oxygen concentration of air delivered to patient	Highly accurate, flexible, low-drift, durable
	Pressure Sensors – Board Mount	Monitor patient breathing (inhale/exhale) and detect filter conditioning	Highly accurate, sensitive, responsiveness, low-drift
	Pressure Sensors – Test	Test ventilator valves	Highly accurate and configurable pressure sensor
	Pressure Transducers – Heavy Duty	Measure the pressure of air and oxygen cylinders to determine the volume remaining	Easy to use, highly accurate, improves patient safety, easy to design in
	Thermistor Sensing Elements	Monitor and control the air temperature	Flexible, cost-effective, small
Oxygen Concentrators	Airflow Sensors	Detect ultra-low levels at 0.1 cm <sup>3</sup> to determine when the patient exhales and when the system should reduce airflow	Improves patient comfort, eases patient breathing, quiet, portable, reliable
	Basic and AML Switches	Used as on/off operator controls, as well as detection for covers, panels, and doors	Highly configurable, highly accurate, repeatable, reliable
	Oxygen Sensors	Measure oxygen concentration of air delivered to patient	Provides high accuracy, low signal drift, and low cross interferences from common components of breathing gases
	Pressure Sensors – Board Mount	Detect when the patient begins to inhale so that oxygen can then be delivered efficiently and effectively	Highly accurate, sensitive, responsiveness, low-drift
	Pressure Sensors – Heavy Duty	Sense pressure from the surge tank, providing feedback to the compressor which allows the compressor to maintain the desired pressure level	Sensitive, highly accurate, reliable, cost-effective, efficient
	Pressure Switches	Act as high pressure warnings in the event of error or over-pressure	Highly configurable, highly accurate, reliable
PATIENT MONITORING SYSTEMS			
Respiratory Monitoring	Airflow Sensors	Monitor patient's respiratory function	Highly accurate, customizable, stable, low pressure drop
Blood Pressure and Glucose Monitoring	Pressure Sensors – Board Mount	Monitors the patient's blood pressure and reports out to ensure patient safety/well being	Improves patient safety with enhanced stability and low drift, portable, highly accurate
Temperature Monitoring	Thermistor Sensing Elements	Monitor patient temperature	Flexible, cost-effective, small
Patient Monitoring Systems	Barcode Scan Engines and Software	Track patient and caregiver ID; ensure the right medication and equipment match the right patient	Improves patient safety and operational effectiveness
INFUSION PUMPS			
Infusion Pumps	Basic and AML Switches	Used as on/off operator controls, as well as detection for covers, panels, and doors	Highly configurable, highly accurate, repeatable, reliable
	Barcode Scan Engines and Software	Ensure that the right treatment is administered to the right patient by reading the barcodes on the IV bag and on the patient wrist band	Improves patient safety and operational effectiveness
	Force Sensors	Provide an occlusion detector to detect blockage in the infusion or insulin pump's tube that delivers the medication to the patient	Sensitive, stable, reliable, easy to use, portable
	Magnetic Position Sensor ICs	Provide reliable, highly accurate output for smooth motor control that reduces noise and vibration in the pump's motor assembly and improves its efficiency	Quiet, cost-effective, energy-efficient, highly accurate
	Pressure Sensors – Board Mount	Monitor and control fluid flow	Highly accurate, easy to design in, stable
	Subminiature Load Cells	Monitor IV levels based on the weight of the IV bag and its contents	Small form factor, highly accurate
LABORATORY EQUIPMENT			
Gas Chromatography	Airflow Sensors	Regulate the flow rate to help determine the concentration level of the media being evaluated	Reliable, non-outgassing to reduce the risk of contamination, highly accurate, stable, easy to implement
	Pressure Sensors – Board Mount	Sense/control gas stream pressure to maintain a precise flow	Highly accurate, stable
Blood and Saliva Analyzers	Magnetoresistive Position Sensor ICs	Sense position of rotating blood samples and extraction needles	Small, low Gauss operation, versatile
	Pressure Sensors – Board Mount	Regulate pump system pressure to draw and transport the samples	Highly accurate, reliable, stable, repeatable, contaminant and corrosion resistant, product availability
	Thermistor Sensing Elements	Monitor chamber, lamps, and motor temperature to prevent overheating	Flexible, cost-effective, small
Laboratory Equipment	Barcode Scan Engines and Software	Track and validate sample IDs and associated information at any point in the work flow	Improves patient safety and operational effectiveness

## Warranty/Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment 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 that Honeywell, in its sole discretion, 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 Honeywell may provide application assistance personally, through our literature and the Honeywell web site, it is buyer's sole responsibility 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 writing. However, Honeywell assumes no responsibility for its use.

## FOR MORE INFORMATION

Honeywell Sensing and Internet of Things services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing, or the nearest Authorized Distributor, visit [sensing.honeywell.com](http://sensing.honeywell.com) or call:

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