SOLUTIONS FOR
LABORATORY AUTOMATION

Sensors and Switches

Application Note

Laboratory automation plays a major role in saving time, lowering costs, reducing human error and improving the efficiency of scientific experiments and testing.

BACKGROUND

Laboratory automation is used to enable mass production of medicines and vaccines and improve the speed and efficiency of medical diagnostic testing. Laboratory automation lowers cost, reduces human error and improves the accuracy and consistency of medical diagnostic testing along with the production of medicines and vaccines on a global scale. Automation enables laboratories to achieve their goals for greater efficiency, accuracy, standardization, quality and safety whilst addressing industry demands.

The automation of common lab procedures, such as sample preparation involving dilution, filtration and the addition of reagents, can cut costs and improve productivity. Laboratory automation can reduce human error, especially in repetitive tasks, by 50 percent, while increasing productivity by as much as 75 percent. At the same time, it can help reduce reagent waste by up to 25 percent.[2]

A multitude of different sensors and switches are used in laboratory automation to control the flow of liquids and gases, control the movement of internal robotics and ensure the safe operation of the equipment. Laboratory automation plays a vital role in reducing healthcare costs and for this reason it is vitally important that high quality sensors and switches are used within laboratory automation to avoid equipment failures and unplanned downtime.

Global Newswire reported, "The lab automation market is projected to reach USD 5.5 billion by 2025 from an estimated USD 4.3 billion in 2020, at a CAGR of 5.2 % during the forecast period. The growth of the market is attributed to increasing spending on pharmaceutical R&D, growing food safety concerns, stringent regulation in healthcare."[1]

SOLUTIONS FOR LAB AUTOMATION APPLICATIONS

- Airflow Sensors
- Board-Mount Pressure Sensors
- Barcode Scan Engines & Software
- Magnetic Sensors
- Force Sensors
- Basic and AML Switches

Honeywell

Figure 1. Solutions for Laboratory
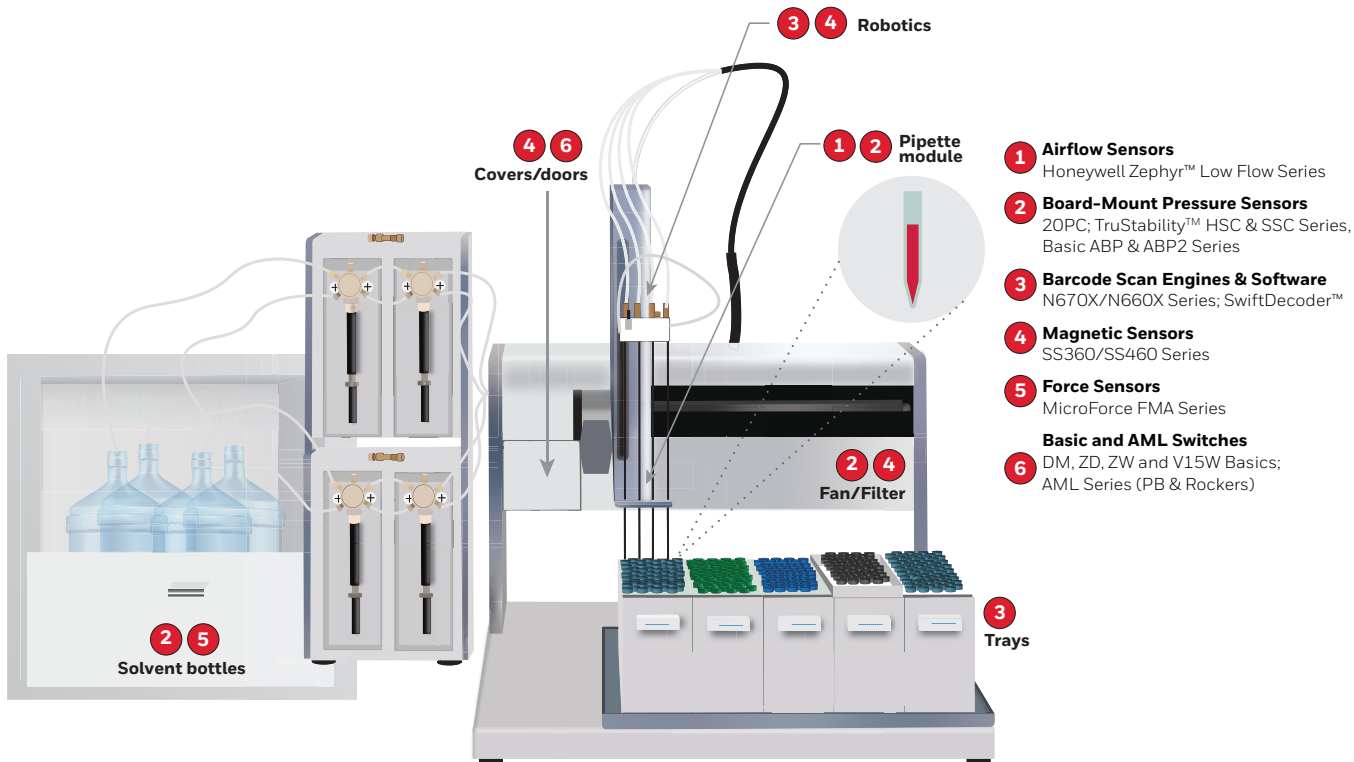
BusinessWire also reported, "The application of automation systems has also led to a significant increase in the productivity of the drug discovery process. These systems can operate for long hours with minimal monitoring and instruction. They also allow more time for researchers to focus on their core work and reduce their time on repetitive tasks."[3]

SOLUTIONS

Honeywell sensor and switch solutions are designed to enhance the performance and reliability of laboratory automation to ensure accurate and efficient operation (See Figure 1).
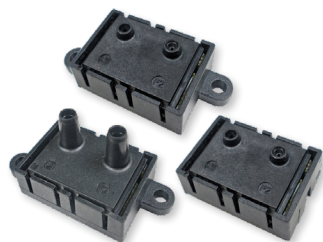
AIRFLOW SENSORS

Honeywell Zephyr™ Series

Function/Action

• Measures flow in the pipette module

The Honeywell Zephyr™ HAF Series (low flow) (see Table 1) can be used to control the flow of fresh air into the lab automation device and prevent the build-up of harmful gases

Honeywell Zephyr™ HAF Series sensors provide an analog 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.
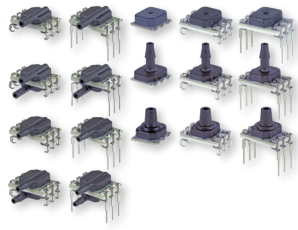
TABLE 1. AIRFLOW SENSOR FEATURES
HONEYWELL ZEPHYR™ LOW-FLOW SERIES
• Fast response time
• Wide range of airflows: ±50, ±100 ±200, ±400 or ±750 SCCM, or custom flow ranges
• Customizable flow ranges and configurable package styles
• 0.049 %FS resolution increases ability to sense small airflow changes
• Full calibration and temperature compensation

TruStability®
HSC Series

Basic ABP Series

20PC Series

PRESSURE SENSORS AND TRANSDUCERS

Board Mount: TruStability® HSC; Basic ABP & ABP2; 24PC FlowThough Series

Functions/Actions

- Measures flow using pressure sensing in the pipette module
- Detects when filters are becoming clogged and need to be cleaned/replaced
- Monitors filling level for reagent and buffer containers to alert when they need to be emptied
- Measures fluid volume: both air and occlusion in pipetting system within the sample/reagent dispenser

Board mount pressure sensors (see Table 2) are extensively used within medical equipment due to high levels of accuracy, sensitivity, reliability and small-size. Pressure sensors are used to check for leaks and levels, control the filling volume of reagent applied to the sample and also monitor the liquid level in the reagent containers to determine when this needs to be refilled.

TABLE 2. BOARD MOUNT PRESSURE SENSOR FEATURES
TRUSTABILITY® HSC SERIES
• Pressure range 1.6 mbar to 10 bar
• Absolute, gage and differential
• Amplified and temperature compensated
• Analog or digital (I^2C/SPI) output
• Supports liquids and dry gases
BASIC ABP2/ABP SERIES
• Pressure range 5 mbar to 12 bar
• Absolute, gage and differential
• Amplified and temperature compensated
• Analog or digital (I^2C/SPI) output
• Supports liquids and dry gases
24PC FLOWTHOUGH SERIES
• Pressure range 0.5 psi to 250 psi
• Absolute, differential, wet-wet differential, gage and vacuum gage
• Robust media compatibility
• Selectable seals available to match media used
• Also available in DIP, SIP and SMT packages

BARCODE SCAN ENGINE & SOFTWARE

N670X, N660X, SwiftDecoder™

Functions/Actions

- Automated, more accurate and faster tracking of patient samples and results
- Ensures the right sample and equipment match the right patient

Honeywell barcode scan engines, modules and decoding software are used in medical applications to help improve patient safety and enhance operational effectiveness.

Tracking patient samples, results and equipment can enhance patient's safety when the patient and/or equipment is relocated. Historical readings can be bound to a particular patient if needed, by associating the patient ID to the results.

TABLE 6. SCAN ENGINE AND SOFTWARE FEATURES
N670X, N660X SERIES SCAN ENGINES
• Slim height makes it easier to fit compact devices
• Wider operational temperature range
• Available with SR or HD optics
• Delivers motion tolerance of up to 6 m/s
• Lower power consumption
• Parallel or MIPI interface availability
SWIFTDECODER™ SOFTWARE
• More quickly and reliably scans millions of barcodes
• Faster barcode scanning
• Capable of aggressive and more accurate reading
• Effectively reads poor quality barcodes
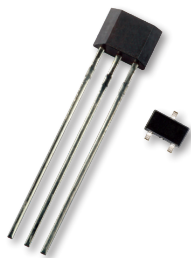
MAGNETIC SENSORS

SS360/SS460

Function/Action

- Acts as switches for covers and doors
- Senses position of robotics
- Controls fan speed and efficiency
- Provides both sample position and identification
- Detects open covers

Magnetic Hall-effect Sensor ICs are designed to provide reliable, highly accurate output for smooth motor/fan control and operation that reduces noise and vibration and improves efficiency (see Table 4). Magnetic sensors can also be used to sense when a door panel or flap is open or ajar to ensure the safe operation of the equipment. Its solid state reliability often reduces repair and maintenance costs.

Their small size allows for design into many compact, automated, lower-cost assemblies. A thermally balanced integrated circuit is designed to provide proper fan functionality.

TABLE 4. MAGNETIC SENSOR FEATURES

SS360/SS460

- Fast response time
- No chopper stabilization
- High sensitivity; latching magnetics
- Wide operating voltage range
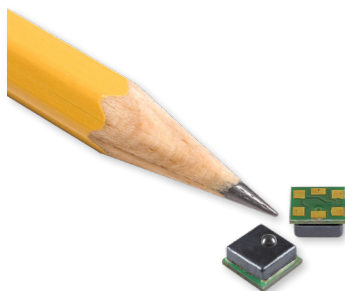
FORCE SENSORS

MIcroForce FMA Series

Function/Action

- Senses position of robotics
- Monitors filling level for reagent and buffer containers to alert when they need to be emptied
- Detection of buffer and waste container fill level

Force sensors (see Table 5) can be used to monitor reagent filling levels within laboratory automation. In addition, they can be used to determine the presence and weight of the reagent containers to alert when these need to be refilled. In addition, they provide accurate positioning of the equipment's robotics system.

Direct mechanical coupling allows for easy interface with the sensor, coupling with tubing, membrane or a plunger, providing repeatable performance and a reliable mechanical interface to the application.

TABLE 5. FORCE SENSOR FEATURES

FMA SERIES

- Amplified and temperature compensated
- Accuracy: ±2 %FSS typical
- Small form factor: 5 mm x 5 mm [0.20 in x 0.20 in]
- Digital (I^2C/SPI) output
- Available in a wide variety of standard and configurable force ranges
- Stable, stainless steel sphere interface
- Internal diagnostic functions available
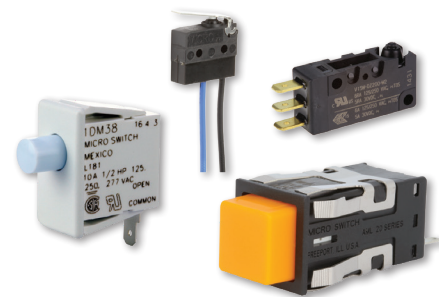
BASIC AND AML PUSHBUTTON SWITCHES

DM, V15W, ZW Series; ZD Series; AML Series

Function/Action

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

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 (see Table 6). Several Series are sealed to protect against fluids.

MICRO SWITCH AML Series are available as pushbuttons, key switches and rockers/paddles (see Table 6). They are often used in medical equipment as off/on operator controls on the external face of the equipment.

TABLE 6. BASIC AND PUSHBUTTON SWITCH FEATURES

MICRO SWITCH BASIC SWITCHES

- Watertight, dust tight; leaded versions are sealed to IP67
- High current capacity
- Many different switch characteristics, actuators, and terminations
- Miniature and subminiature size
- Lower power consumption
- Choice of momentary, push-pull, or pull-to-cheat actions (DM)

AML PUSHBUTTON SWITCHES

- Pushbuttons, paddles, rockers, key-actuated and indicators within AML Series for coordinated panel appearance
- Less than 1.75 inch panel depth
- Furnished lighted or unlighted

⚠ WARNING
IMPROPER INSTALLATION

- Consult with local safety agencies and their requirements when designing a machine control link, interface and all control elements that affect safety.
- Strictly adhere to all installation instructions.

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

FOR MORE INFORMATION

Honeywell Advanced Sensing Technologies services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing, or the nearest Authorized Distributor, visit sps.honeywell.com/ast or call:

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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.

[1] https://www.globenewswire.com/fr/news-release/2020/12/04/2139680/0/en/The-lab-automation-market-is-projected-to-reach-USD-5-5-billion-by-2025from-an-estimated-USD-4-3billion-in-2020-at-a-CAGR-of-5-2.html

[2] Jones M. (2016, November). Lab Automation and Productivity. Retrieved from http://laboratory-manager.advanceweb.com/lab-automation-and-productivity

[3] https://www.businesswire.com/news/home/20210504005722/en/Global-Laboratory-Automation-Market-2021-to-2026---Industry-Trends-Share-Size-Growth-Opportunity-and-Forecasts---ResearchAndMarkets.com

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