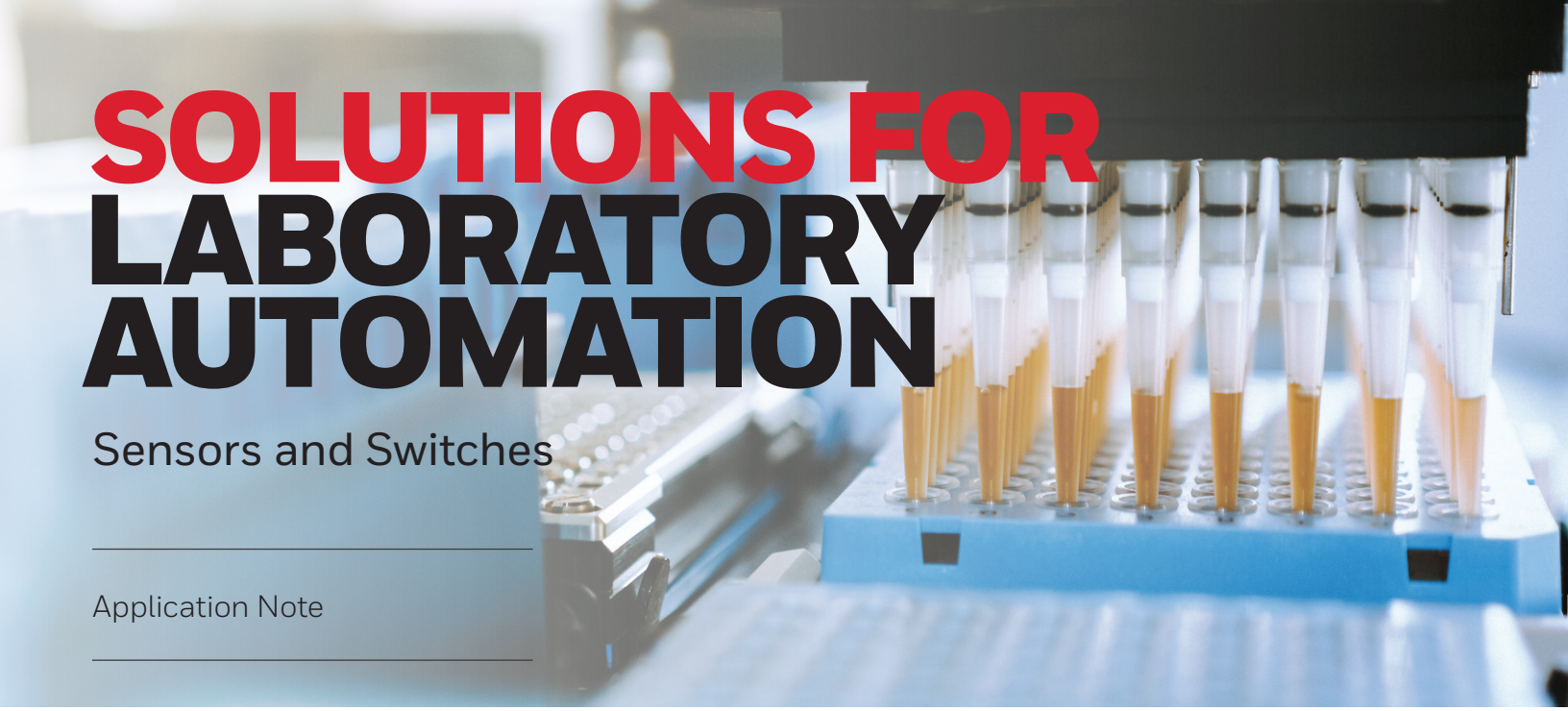


SOLUTIONS FOR LABORATORY AUTOMATION

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.

SOLUTIONS FOR LAB AUTOMATION APPLICATIONS

- Board-Mount Pressure Sensors
- Airflow Sensors
- Magnetic Sensors
- Force Sensors
- Basic and AML Switches

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.

Grandview Research reported, "The lab automation market is projected to reach USD 11.60 billion by 2030, growing at a compound annual growth rate (CAGR) of 6.64% from 2023 to 2030."[1] The growth of the market is attributed to increasing spending on pharmaceutical R&D, growing food safety concerns, stringent regulation in healthcare.

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).

Honeywell

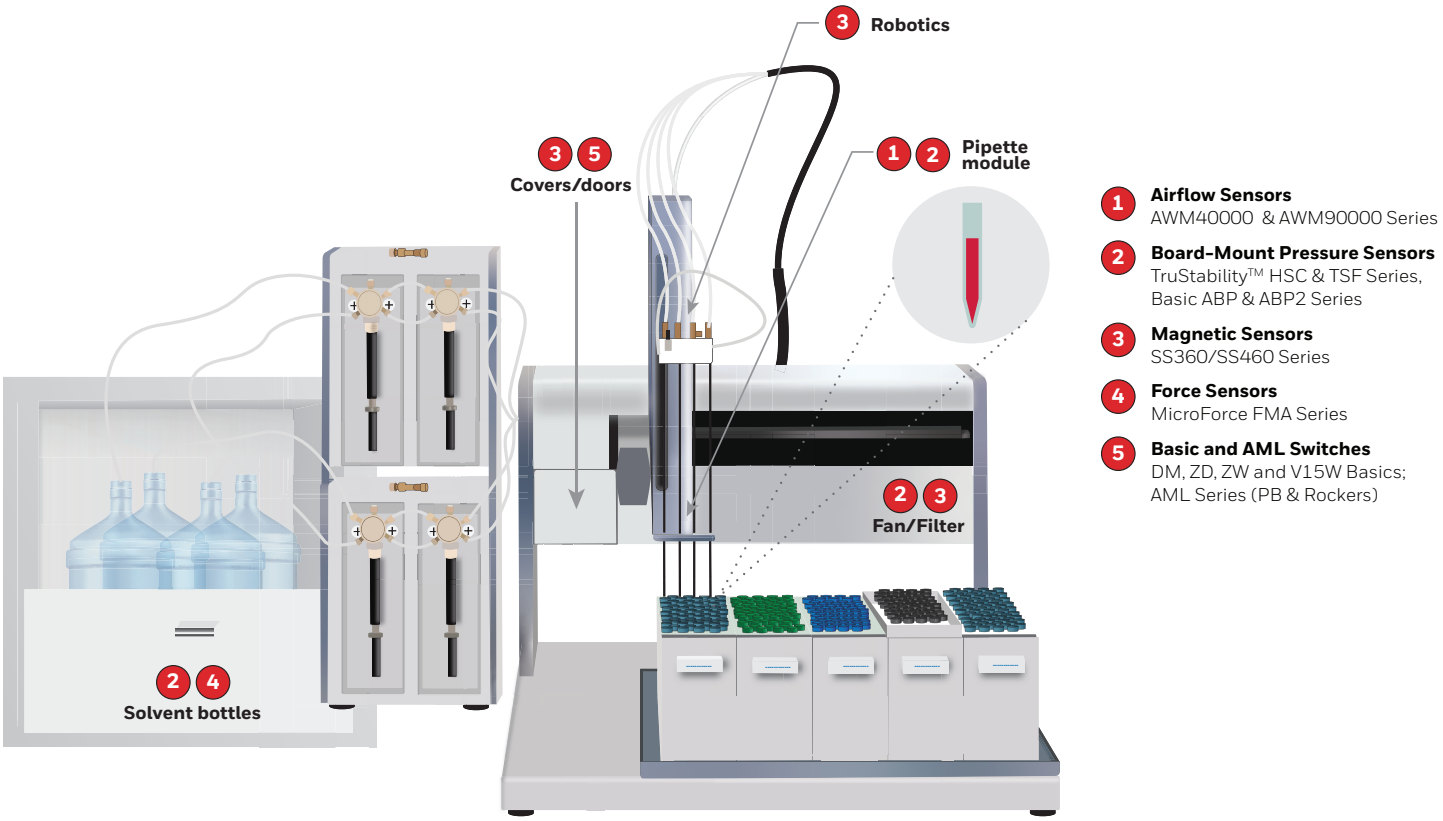


Figure 1. Solutions for Laboratory Automation

PRESSURE SENSORS AND TRANSDUCERS

Board Mount: TruStability® HSC & TSF Series; Basic ABP & ABP2 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

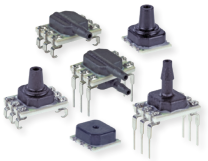
Board mount pressure sensors (see Table 1) are extensively used within medical equipment due to high levels of accuracy, sensitivity, reliability, and small-size. Pressure sensors are used to check for leaks and levels, control the filling volume of reagent applied to the sample, and also monitor the liquid level in the reagent containers to determine when this needs to be refilled.

TABLE 1. BOARD MOUNT PRESSURE SENSOR FEATURES

TruStability® HSC Series	TruStability® TSF Series	ABP Series	ABP2 Series
Pressure range 1.6 mbar to 10 bar	Pressure range ±1 psi to ±100 psi	Pressure range 60 mbar to 10 bar	Pressure range 2.5 mbar to 20 bar
Absolute, gage and differential	Gage	Gage and differential	Absolute, gage and differential
Amplified and temperature compensated	Unamplified and temperature compensated	Amplified and temperature compensated	Amplified and temperature compensated
Analog or digital (I^2C/SPI) output	Analog mV	Analog or digital (I^2C/SPI) output	Analog or digital (I^2C/SPI) output
Supports liquids and dry gases	Supports liquids, small dead space	Supports liquids and dry gases	Supports liquids and dry gases

TruStability® HSC Series

TruStability TSF Series



Basic ABP Series

Basic ABP2 Series

AIRFLOW SENSORS

AWM40000 & AWM**9**0000 Series

Functions/Actions

- Measures flow in the pipette module

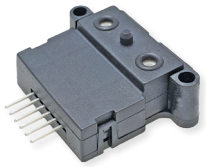
The AWM40000 & AWM90000 Series (see Table 2) can be used to control the flow of fresh air into the lab automation device and prevent the build-up of harmful gases.

The AWM40000 Series airflow sensors are based on proven microbridge technology and include both unamplified sensor-only devices and amplified signal conditioned devices

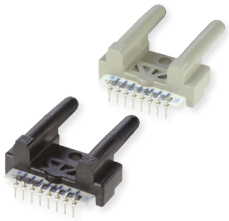
The AWM90000 Series microbridge mass airflow sensors are available in two versions, mass flow and differential pressure. They operate with a supply voltage from 8.0 Vdc to 15.0 Vdc, while consuming only 50 mW of power.

TABLE 2. AIRFLOW SENSOR FEATURES

AWM40000 Series	AWM90000 Series
Sensitivity to low flows (0.1 SCCM to 6 SLPM)	Mass flow and differential types
Precision silicon micromachining	Flow range: ±200 SCCM
Adaptable for use with higher flows	Pressure range: ±5 mbar; ± 500 Pa; ±2.0 inH_2O
Analog output	1 ms response time
Low power consumption allows for use in portable devices and battery-powered applications	Bi-directional sensing capability



AWM40000 Series



*AWM**9**0000 Series*

MAGNETIC SENSORS

SS360/SS460

Functions/Actions

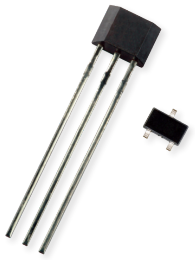
- Acts as switches for covers and doors
- Senses position of robotics
- Controls fan speed and efficiency
- Provides both sample position and identification
- Detects open covers

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 3). 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 3. MAGNETIC SENSOR FEATURES

SS360/SS460
Fast response time
No chopper stabilization
High sensitivity; latching magnetics
Wide operating voltage range



SS360/SS460

FORCE SENSORS

MicroForce FMA Series

Functions/Actions

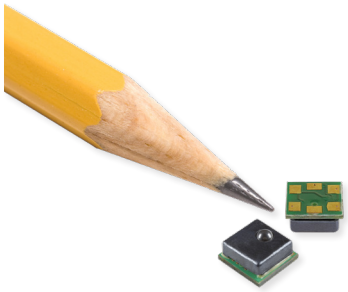
- Senses position of robotics
- Monitors filling level for reagent and buffer containers to alert when they need to be emptied
- Detection of buffer and waste container fill level

Force sensors (see Table 4) 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 4. FORCE SENSOR FEATURES

FMA Series
Amplified and temperature compensated
Accuracy: ±2 % FSS typical
Small form factor: 5 mm × 5 mm [0.20 in × 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



MicroForce FMA Series

BASIC AND AML PUSHBUTTON SWITCHES

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

Functions/Actions

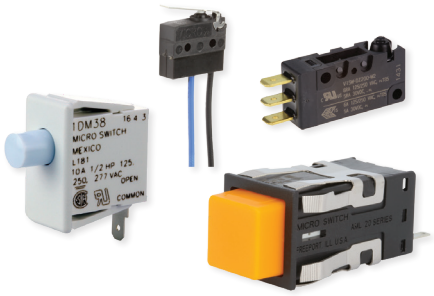
- Used as on/off operator controls, as well as detection for covers, panels and doors

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 5). They are often used in medical equipment as off/on operator controls on the external face of the equipment.

TABLE 5. BASIC AND PUSHBUTTON SWITCH FEATURES

MICRO SWITCH BASIC switches	AML Pushbutton switches
Watertight, dust tight; leaded versions are sealed to IP67	Pushbuttons, paddles, rockers, key-actuated and indicators within AML Series for coordinated panel appearance
High current capacity	Less than 1.75 inch panel depth
Many different switch characteristics, actuators, and terminations	Furnished lighted or unlighted
Miniature and subminiature size	–
Lower power consumption	–
Choice of momentary, push-pull, or pull-to-cheat actions (DM)	–



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

⚠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.

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 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 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.**

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[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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