

# Pressure Sensing for Industrial Applications

## An Application Note

### Background

When selecting a pressure transducer, design engineers must consider the environment these devices will be used in, as well as the device's specifications and features. Is it excessively hot? Are there voltage spikes to consider? Any electrical disturbances or unusual shock/vibration conditions possible? Once these environmental situations are understood, the design engineer can move further toward transducer selection in variation of his/her application challenges.

Design engineers are frequently challenged with monitoring and/or controlling processes, lines, hoses, and more. Many of these aspects may involve industrial hydraulic or pneumatic equipment and systems. Real-time pressure measurements can play an important role in this. Pressure transducers can provide the means of measurement and/or feedback used in R&D design on test stands, R&D testing, test laboratories, or production manufacturing, quality control, or quality assurance processes.

### Solution

The Honeywell Model FP5000, a next-generation media-isolated pressure sensor, is built on Honeywell's history of high-quality piezoresistive silicon sensing technology and is designed to offer repeatable, reliable, and accurate pressure measurements over time even in a variety of harsh environments.

Highly configurable, the FP5000 Series' fully analog low-noise signal path provides infinite output resolution in order to measure finite pressure changes or resolve a signal to infinite parts – which all translates into greater accuracy.

The FP5000 Series is engineered with True Zero Output capability for its voltage output sensors. Most three-wire voltage output sensors cannot reduce to 0 V (zero volts) due to output saturation which may leave tens of millivolts of output voltage error when the output tries to swing to 0 V (zero volts). An output signal that saturates at 50 mV corresponds to +1 %FS error on a 0 V to 5 V output sensor. The FP5000 transducer has on-board circuitry on its voltage output versions (0 V to 5 V, 0 V to 10 V) that allows the output signal to swing all the way to ground (True Zero) and even a little below it (~-0.2 V). This allows the sensor to be very accurate, detecting even the smallest of pressure changes.



### Features and Benefits

- Pressure ranges from 10 in-H<sub>2</sub>O [0.36 psi] up to 5000 psi
- Gage and absolute pressure types
- Higher accuracy to 0.1 %FSS BFSL
- Multiple output types: 0 Vdc to 5 Vdc, 0 Vdc to 10 Vdc, 4 mA to 20 mA
- Multiple electrical and pressure connection options
- Zero adjustment through potentiometer
- Operating temperature ranges from -40°C to 125°C [-40°F to 250°F]
- Multiple compensation temperature ranges
- Faster response and higher resolution
- Fully analog reduced-noise signal path provides continuous output resolution
- Stainless steel construction
- Ha C276 and 316L stainless steel wetted parts offer more enhanced durability with abrasive or corrosive media
- CE approved

These rugged, stainless steel, all-welded pressure sensors are pre-configured with the most commonly requested options. They may be used in many demanding, harsh environments and with a variety of media. Honeywell FP5000 Series pressure sensors help keep equipment functioning properly and minimize maintenance through reliable measurement of media (gas, fluid) under extreme environmental conditions.

Pressure feedback on either inlet sides and/or discharge sides may be used for both control and monitoring conditions such as fault monitoring to shut down or control equipment to avoid damage/field failures or cause field safety issues of other equipment, such as pumps, compressors, generators, and manifolds. They can also be used during assembly or manufacturing processes to improve yields, automate processes, provide product validations, or even for product/quality assurance measures. In pumps, compressors, generators, manifolds, pressure feedback on either inlet sides and/or discharge sides may be used for both control and monitoring conditions such as fault monitoring to shut down or control equipment to avoid damage or failure of other equipment in field or cause safety issues.

**INDUSTRIAL**

Honeywell FP5000 Series pressure sensors help keep people, equipment, and industrial manufacturing plants safe through reliable measurement of media (gas, fluid). Pressure feedback for both control and monitoring conditions can be used for fault monitoring, hydraulic/pneumatic fluid pressure monitoring/control, tank pressure monitoring, leak detection, pump control, process control/monitoring to shut down or control

equipment to mitigate equipment damage/failure, product deficiency, or safety concern.

**INDUSTRIAL | FACTORY AUTOMATION**

FP5000 transducers may be used in several factory automation applications, including:

- Production/process equipment
- End-of-line testers
- Leak detection systems
- Product/material test machines

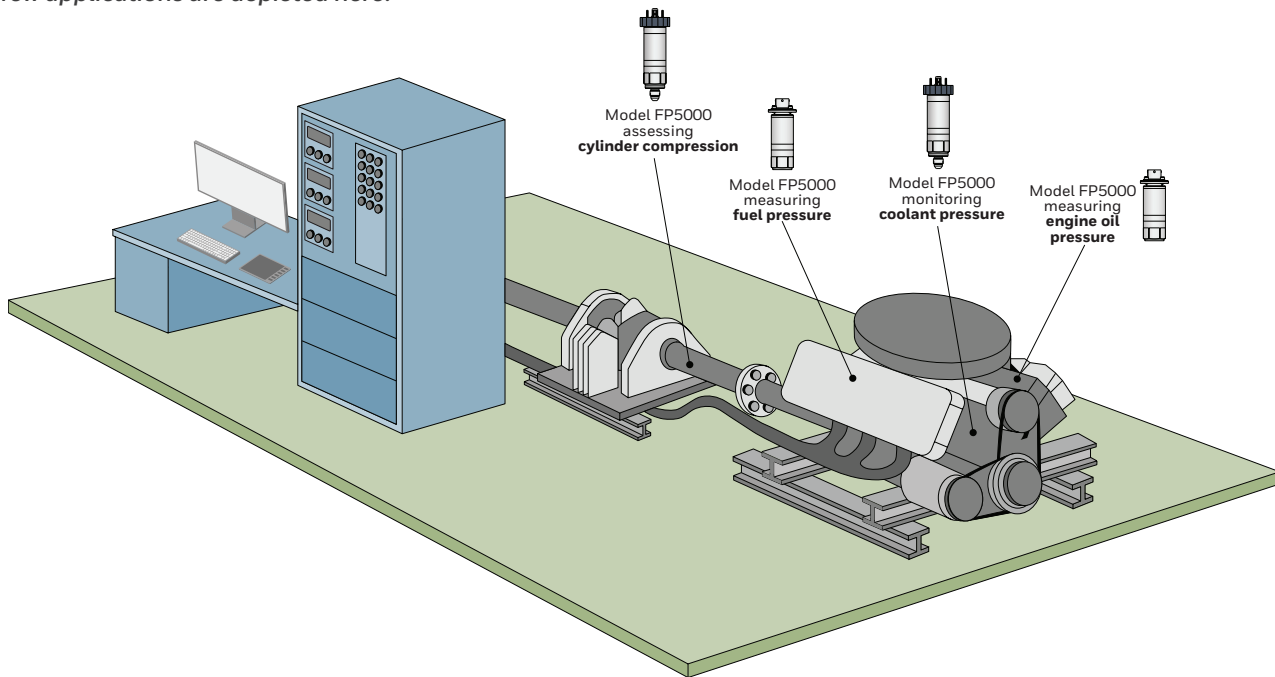
**INDUSTRIAL | TRANSPORTATION**

Pressure transducers can be used for transportation assembly and assembly test applications, such as:

- Automated paint systems using pressure
- Automated sealant dispensing systems
- End-of-line leak testing stations
- Oil pump testing
- Cold engine testing for possible leaks or imperfections
- Fuel injection system pressures
- Vehicle fluid fill control pressures

**Figure 1. Model FP5000 Pressure Transducers on Engine Test Stands**

Model FP5000 pressure sensors can fulfill many measuring and monitoring applications on engine test stands. A few applications are depicted here.



## INDUSTRIAL | COMPONENT TESTING

To ensure quality, FP5000 Series transducers can be used in component testing (See Figure 1) for the following:

- Fluid pump pressure
- Brake system testing
- Tire manufacturing mold pressure control
- Air bag system testing
- Suspension pressure
- Hydraulic pressure testings

## INDUSTRIAL | VEHICLE

In the rugged industrial manufacturing environment, vehicle health and maintenance are important. Honeywell FP5000 sensors can help monitor:

- Oil pressure
- Coolant pressure
- Fuel flow, consumption, flow, and pressure
- Intake air flow
- Manifold vacuum testing
- Transmission pressure testing
- Emissions testing

## INDUSTRIAL | HVAC

Throughout HVAC systems, there are many options for FP5000 sensors to be utilized, including:

- Blowers, chillers, cooling towers, and pumps to monitor system performance for proper environmental control and personal comfort in large industrial settings

## INDUSTRIAL | INJECTION/BLOW MOLDING MACHINES

In injection/blow molding machines, it's important to monitor for even flow and prevent bursting. Honeywell transducers can be used to:

- Monitor the amount of pressure forced into the injection
- Measure to prevent bursting from too much pressure
- Control material dispensing or forming

## INDUSTRIAL | PACKAGING MACHINES

With packaging machines, transducers monitor pressure as the bag/pouch is filled; once a specific pressure is reached, the machine stops either sealing or filling the bag. Honeywell transducers can:

- Monitor ~~monitor~~ bag inflation, nitrogen purging, leak detection, or sealing integrity

## INDUSTRIAL | SEMICONDUCTOR MANUFACTURING

Through measurement of air line pressure, sensors provide mechanism control during grinding with go/no-go feedback to stop the process if there's a manufacturing problem, thereby, reducing scrap as the sensors stop the process. FP5000 sensors can deliver:

- Process control during the manufacturing process (grinding, cleaning, etc.) of silicon wafers

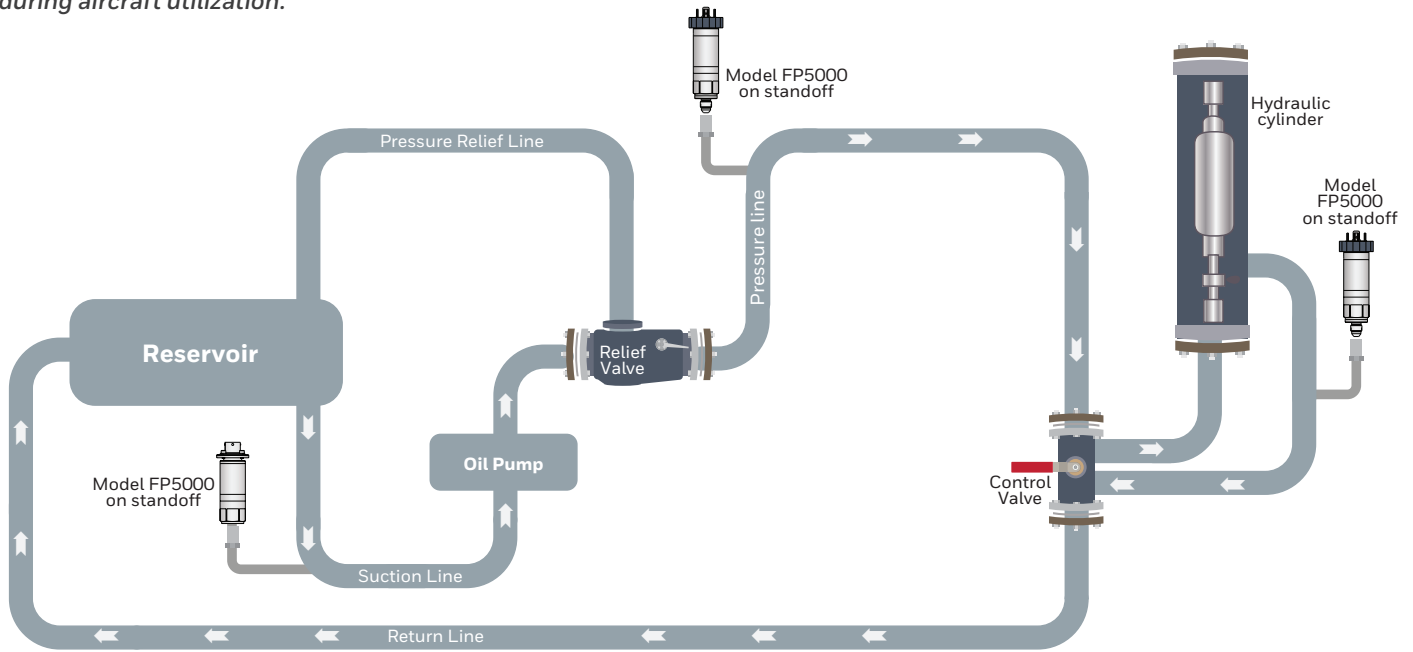
## AEROSPACE | TEST AND RESEARCH LABS

Subcontractors test and certify hydraulic systems (see Figure 2) before shipping to the aerospace manufacturer as part of the acceptance testing for product quality control. Test validation assures that the systems are properly functioning through the collection of data, control data, and validation results. Pressure transducers play an important role in measuring and certifying the flow and rate of the hydraulic fluid within the aircraft actuator being tested, and may provide:

- Design validation such as testing an air wing or other subassembly aspects on aircraft or systems by monitoring various pressure lines

**Figure 2. Model FP5000 Pressure Transducers Used in an Hydraulic Test Stand**

The test stand's data acquisition system takes the Model FP5000's 0 Vdc to 5 Vdc output for recording and reporting purposes. Honeywell's Model FP5000 helps to measure the aircraft actuator functionality to ensure repeatable performance during aircraft utilization.



**⚠ 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. 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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