



# SMART SENSORS

Measuring pressure with precision can be a challenging job. Transducers provide the accuracy required

■ Brian Link

Over the past 25 years Honeywell has refined transducer technology to minimize the risks involved in pressure measurement. Honeywell developed its line of precision pressure transducers for military and commercial markets knowing the risks at stake and the financial impact that each day makes when transducers are not performing to customer expectations.

The evolution of Honeywell pressure transducers has served everything from large commercial to general aviation aircraft, and from drones to helicopters. With every stage of innovative aerospace advancement, Honeywell has been improving pressure transducer devices to deliver increasingly higher performance measurements for altitude and air speed in air-data applications as well as engine pressure in flight and on test stands. They have been modeled and tested to a variety of temperature and pressure ranges and environmental conditions. However one thing has remained the same: the Honeywell piezoresistive pressure sensor at the core of every transducer model.

The sensor is the heart of a transducer, gathering and translating pressure into a stable, accurate analog reading. Honeywell designed the sensors using a micro-

machined silicon chip with piezoresistive strain gages to be able to withstand the wide variety of environments encountered in aerospace testing. In technology terms this design is advanced enough to integrate easily into future-generation transducer models to progress with new levels of aerospace testing applications.

Sensors are integrated into the face of a thin, chemically-etched silicon diaphragm. A pressure change causes the diaphragm to flex, inducing a stress or strain in the diaphragm and the buried resistors. The resistor values change in proportion to the stress applied and produces an electrical output. A sophisticated, smart sensor supplies the reliability that a high-performance transducer requires. Without it, a transducer is just a transducer.

#### What makes sensors so smart?

Honeywell's high-tech sensors, coupled with a signal compensation microprocessor, lend unique attributes to its precision pressure transducers in that they let you choose any degree of accuracy you want. This flexibility not only provides the value of compatibility, but also contributes to accuracy for instrument builders requiring both analog and digital output readings.

You can use the device as a simple ana-

log-output transducer or as an addressable digital transducer with an RS-232 or RS-485 output to communicate with many other transducers. The serial output allows up to 89 units to be networked on a single bus, interface directly to a PC or other data acquisition system, and address and customize individual units. To keep up to fluctuation speeds, the smart precision pressure transducer can automatically increase its update rate if a rapid change of pressure is sensed, and it will set flags for out-of-range pressures or temperatures.

**Digital alternative**

The ability to configure transducers to either analog or digital is in high demand and is a complementary feature in the Honeywell Precision Pressure Transducer (PPT) product line. Digital correction enables a wide variety of benefits in respect to signal output versatility. The microprocessor-based signal compensation is the differentiator, enabling digital correction and compensation to achieve a high accuracy of  $\pm 0.05$  percent of full-scale output, including temperature effects from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

As aerospace test requirements evolve to a completely digital platform, the need will increase for a highly accurate, reliable, digital pressure output. Honeywell's PPT product line is positioned to help customers with this measurement.

Pure digital signals offer advantages in flexibility and usability as well as accuracy. When aerospace test engineers require digital transducers, the Honeywell PPT in its completely digital mode will offer these programmable measurement options:

- Selectable pressure units: atmosphere; bar or millibar; inches or millimeters of mercury; inches or meters of water; kilograms per square centimeter; pounds per square inch; kilopascals and megapascals;
- Programmable sample rate from 8.3msec to 51.2 minutes;
- Skipping readings to reduce network communications traffic;
- Addressable networking (as many as 89 PPTs) on an RS-485 bus;
- Tracking input changes – the PPT automatically changes its reading rate as a function of pressure changes.

**Tailored to perform**

Pressure readings can be greatly affected by temperature, generating a high demand for transducers that operate accurately over a wide temperature range. Designed with silicon, temperature sensing is a natural function of Honeywell's PPT and its ruggedized model (PPTR). This attribute,

1. The HPA serves well for altimeter and airborne measurement applications
2. The PPTR is a ruggedized model of the pressure transducer designed to withstand harsh media and extreme environments.
3. Engineers can take advantage of the digital and analog features of the PPT to record air data for avionics, barometric meteorology measurements, calibration equipment and turbine test stands
4. The LG237 pressure transducer offers high accuracy of up to 0.03 percent full scale over a wide temperature range



combined with digital correction abilities, makes the pressure transducer nearly impervious to extreme conditions. Integral digital signal compensation greatly simplifies the task for the designer who requires high accuracy over temperature. For gage, absolute and differential pressure types, pressure ranges of the Honeywell PPT line achieve from 0 to 500 psi.

Exposure to the environment affects how a transducer performs. The sensor technology and transducer construction indicate whether it can maintain accuracy. Honeywell designs products that will withstand media conflicts and products undergo high levels of testing to ensure that PPT and PPTR products meet MIL standards for environmental ruggedness, vibration, and mechanical and thermal shock.

For avionics instruments, flight testing and other applications susceptible to electromagnetic interference (EMI), the Honeywell PPT is also available with a metal military-style bayonet connector and a filter/voltage suppression circuit.

To achieve high accuracy retention in extreme conditions over a long period of time, Honeywell designed the LG1237 smart absolute pressure transducer to provide accurate measurements over a 25-year or 100,000-hour operating life. Since the early 1990s, military and commercial airlines used the LG1237 for jet engines, air data/flight control, flight test, meteorology and other test activities subjected to high levels of temperature, acceleration, vibration and shock. Due to high-speed

digital processing and compensation algorithms, the LG1237 maintains accuracy from pressure ranges of 0.5 to 1,000psi.

**Programmable design options**

Some of the wide varieties of aerospace testing applications require particular functions of a pressure transducer. Honeywell transducers can be easily tailored to specific configurations with the programmable features available. Customization can be implemented using a simple set of commands from any PC with a factory-supplied cable connecting the PPT to the PC communications port. User-selectable parameters include update rate, dead-band, analog voltage range and pressure measurement units. Customized configurations of the PPT available beyond standard requirements include full-scale pressure, pressure connection, temperature range and accuracy requirement.

**Confidence beyond technology**

Even with the level of science and complexity in precision pressure transducer technology, two values hold true for aerospace test engineers seeking the right transducer products – trust and confidence. Transducers need to be precise at first pass and continue to provide stable readings for many years. ■

*Brian Link is product line manager, pressure sensor products, at Honeywell Aerospace Electronic Systems, based in Plymouth, Minnesota, USA*

