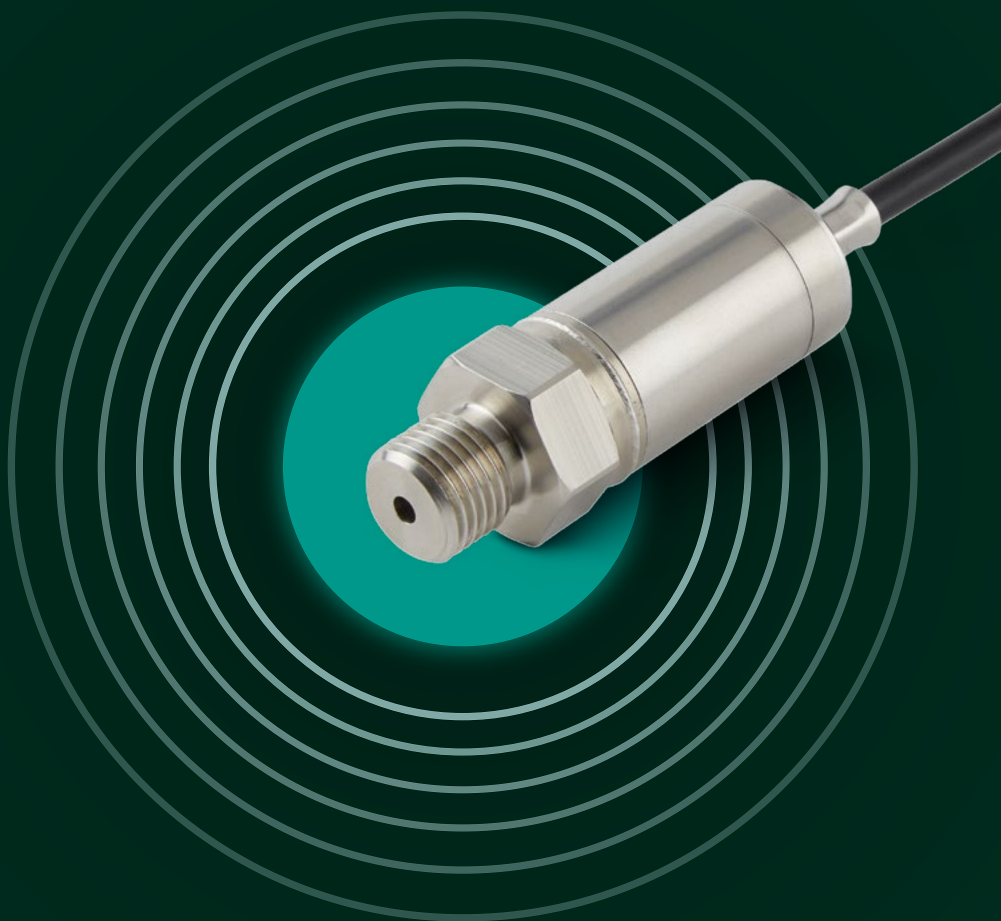
ADROIT6000

One Sensor, No Compromises.



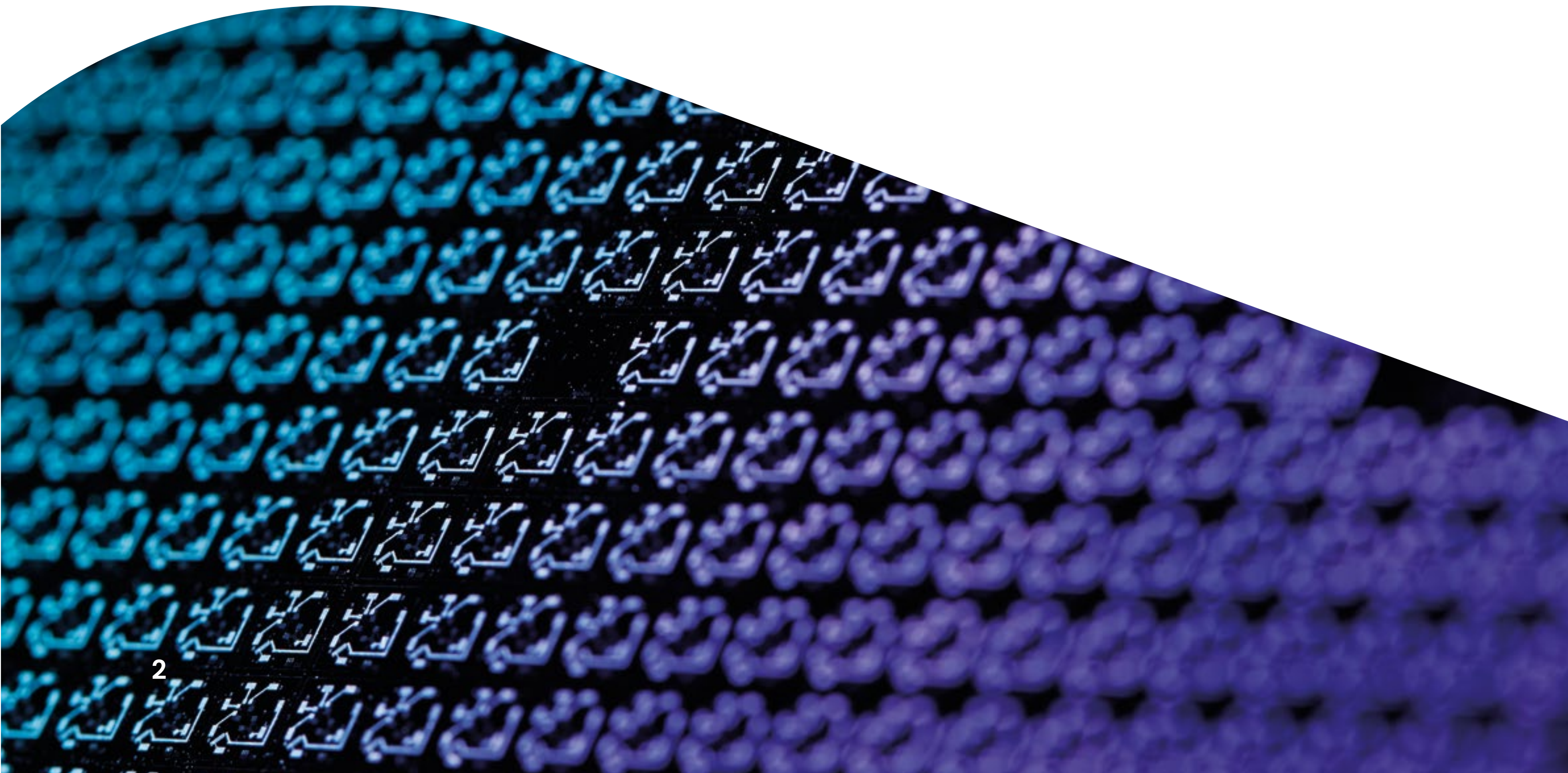
druck.com

From predicting the weather, to making our cars work cleanly and efficiently. From supplying the utilities we all rely on to manufacturing the goods we all enjoy. Measurement is the first stage of what makes our world work for us. The second most measured physical aspect of our world (after temperature) is pressure and measuring pressure presents a series of challenges. Druck was amongst the first in the 1970's to introduce silicon as a sensing element for pressure and the business continues to develop products to support the most challenging applications for pressure measurement.

Druck's ADROIT6000 has been designed to avoid hidden traps when measuring pressure.

ADROIT6000 is a new family of sensors that embodies over 45 years of experience in the development of these new industrial grade sensors. ADROIT6000 raises the bar on performance for multiple applications where the reliable and accurate measurement of pressure is important.

There are many aspects to the performance of a pressure sensor. Most obviously the relationship between the input (pressure) and output (voltage signal). This is normally a percentage quoted on a datasheet that is entitled "accuracy" and values of around 0.1% are typical. On initial inspection this number is relatively small and meets the requirements of most industrial measurements. In a benign environment (soon after a calibration) sensors will generally perform well inside this specification. However, for the unwary, there are hidden traps in real-life applications that can make the actual difference much greater than this stated value. Furthermore, it may not be obvious that the output is significantly different from the actual value. Druck's ADROIT6000 has been designed to avoid these traps.



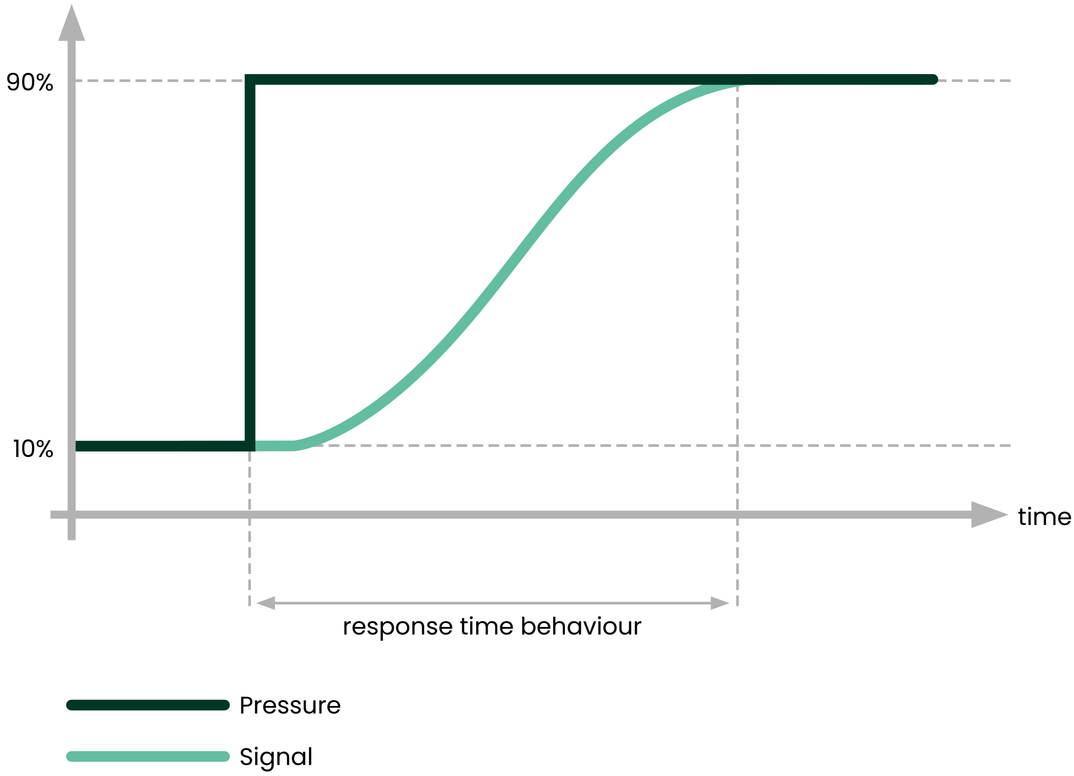
Managing Temperature

In many real-life applications temperatures are variable, and the pressure output will change with temperature. Often stated on datasheets as a percentage of full scale per degree Celsius (%FS/°C). Over a wide operating temperature this number often becomes the largest contributor to accuracy, typically 1-2%, which is ten times the single temperature pressure error. The ADROIT6000 solves this challenge by creating a digital map of pressure over temperature and by doing so reduces the error to less than 0.1% FS. However, there is a further trap. In application temperature is not only different, it is also often dynamic. If the pressure and temperature sensing elements are not at the same temperature an error of around 0.2% per °C of separation can be created. In a rapidly changing temperature situation this error can be dramatic. This is often mitigated by mounting the temperature device close to the pressure device. However, the only complete solution is to use the technique deployed in ADROIT6000, where the reading of temperature is taken from the same resistors used to measure pressure.

ADROIT6000 solves this challenge by creating a digital map of pressure over temperature.

Managing Time: Response

There is always a time delay between a change in input and a change in output.



When taking readings at a speed approaching the response time it is possible to generate very large errors, so it is important to allow a change to settle for long enough for the output to catch up before taking a reading. There are multiple contributors to the response time of a system, each of which add to the overall lag in the output of the system. Thankfully piezo resistive sensing elements are very fast (in the order of 100 microseconds). In fact, so much faster than other parts of the system that they can usually be ignored. Conditioning electronics are variable, but in the order of 1 to 100 milliseconds. Possibly even more variable than the electronics is the installation, where a narrow and long pressure connection can, depending on the media, restrict the change to many seconds. If fast readings are needed, then wide short connections are required. Non compressible liquids will transfer pressure through themselves very quickly, whereas gases, particularly low-pressure gases can take some time to transfer a pressure into a device. ADROIT6000 avoids this trap in two ways. Firstly, the electronics are fast with a 1ms response of output to a change of pressure. Secondly it is small and can operate at high temperature and hence it can be installed close to the pressure source, thus minimising any lag due to the transmission of a pressure wave through a connecting pipe. A further benefit is the reduction of installation costs of expensive pressure connection pipework.

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Managing Thermal Hysteresis

Beyond temperature and time, which can both be mitigated by an understanding of these issues and careful sensor installation, there are several underlying sources of error that can only be managed by the sensor manufacturer. Chief amongst these is thermal hysteresis. Thermal Hysteresis is the difference in output at a temperature depending on whether the temperature was approached from a previously warmer or colder temperature. This makes it impossible to correct, even with the most sophisticated supporting electronics. It increases as the extreme of temperature that the sensor encounters increases. So, a sensor in a laboratory which is cycling from 20 °C to 25 °C will have a very small thermal hysteresis, but a sensor in an engine bay in Arctic conditions cycling from -40 °C to 125 °C will have a much larger value. ADROIT6000 has been designed using techniques that minimize thermal hysteresis. These include; choice of the materials of construction, reduction in oil volume, and multiple details of mechanical design. By employing these techniques thermal hysteresis can be reduced to around 0.1% for a compensated temperature range of -40 to 125 °C. For digitally compensated sensors thermal hysteresis is the largest contributing factor to the Total Error Band (TEB) stated on datasheets and explains why sensor performance worsens when utilised over wider operating temperature ranges.

ADROIT6000 has been designed using techniques that can minimize thermal hysteresis.

Managing Time: Stability

Second to thermal hysteresis in terms of error sources is long term stability. Like thermal hysteresis and because it is variable over time, it is impossible to compensate using electronics. Keeping this error small is only possible through careful mechanical design of the pressure sensing module contained within the pressure sensor. ADROIT6000 uses high-grade machined metal parts, stable silicon sensing elements and low energy, yet high penetration welds. These factors all contribute to making sensing modules that are very stable. Typical stability values in the first year are 0.05% and the sensors become more stable as they age.

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Managing Calibration

In some applications regular recalibration is required to confirm that accuracy is being maintained. ADROIT6000's performance can be measured using standard calibration equipment such as Druck's DPI620 Genii multifunction calibrator. If adjustments are required, Druck have created an easy to use interface and an App to complement ADROIT6000. On inputting zero and span data into the App, a single button push adjusts the sensor accordingly. Even without calibration equipment the App will allow a zero set to be carried out.

The ADROIT6000 combines:

- Digital temperature compensation
- Analogue signal outputs
- Fast response times
- High quality mechanical design
- A small package for easy installation.

These features create a product of the highest performance that can give long reliable service and is effective even in the toughest of environments.

This means that you can select ADROIT6000 for your test or OEM application and be confident of:

- Accurate data (in any conditions)
- Long, accurate service life
- Easy interfacing to existing analogue systems
- Reduced cost of installation
- Reduced cost of ownership.