



Getting tough with electrolytic tilt sensors

Despite the growth in the use of MEMS tilt sensors, in harsh applications electrolytic tilt sensors can provide significant benefits, as **Jeff Gurr**, electromechanical product specialist at Charcroft Electronics, explains

MEMS tilt sensors are smaller and lower cost than electrolytic tilt sensors, so it would not be surprising to expect the rise in MEMS technology to signal the end of the electrolytic alternatives. The reality, however, is that in harsh applications the balance is firmly tipped in favour of electrolytic tilt sensors. In applications where drift and repeatability are of crucial importance and in which product lifetimes are measured in years, not months, then electrolytic tilt sensing can often be the preferred technology.

THE COST OF HIGH REPEATABILITY

The factors which are most important for measuring the performance of a tilt sensor are drift, repeatability and environmental durability.

There are considerable differences in the repeatability offered by off-the-shelf MEMS and electrolytic tilt sensors. Even low-cost off-the-shelf electrolytics can deliver repeatability of five arc-seconds, and high-end versions can achieve sub-arc-second repeatability. In comparison, this level of performance is only typically available on the highest-cost MEMS sensors and the need for additional support electronics adds to the total bill-of-materials cost. For example, a metal dual-axis $\pm 65^\circ$ electrolytic sensor generally costs under \$5, whereas achieving similar performance with a MEMS device and its supporting electronics can cost between three-and-a-half to five times this price.

THE COST OF CONTROLLING VOLTAGE VARIATIONS

Cost is also a factor in controlling drift which causes readings to become increasingly inaccurate over time, necessitating frequent re-calibration. To achieve optimum performance, MEMS sensors need a stable voltage supply over both time and temperature, with high-repeatability versions needing control within the microvolt range. This usually requires the use of high-precision, and therefore high-cost, power supplies. In comparison, the ratiometric measurement used by electrolytic tilt sensors makes these devices immune to variations in the voltage supply and allows for the use of lower cost power supplies.

LONGEVITY AND DURABILITY

Another factor which can significantly affect sensor performance is environmental durability. Here, MEMS sensors can be constrained by their operating temperature range and by their packaging options. Off-the-shelf electrolytic tilt sensors cover an operating temperature range from -60°C to 120°C and are hermetically sealed to enable them to withstand humidity and other environmental conditions. The fact that electrolytic sensors have no moving parts also helps them to handle vibration and shock to ensure a long operational lifetime.

Packaging and mounting options for electrolytic tilt sensors include a patented metal can for soldering directly onto a PCB, or ceramic versions with mounting holes for easier fixing into a rugged assembly. They can even be mounted remotely without the need for a custom PCB to carry the support electronics which would be needed by a MEMS sensor. Encapsulation can add a stable base with minimal thermal changes to ensure high repeatability and optimum performance over temperature.

A SIMPLE DESIGN PROCESS

Like MEMS sensors, electrolytic tilt sensors



Jeff Gurr

can be mounted onto a circuit board, but rather than needing complex support electronics, all they need is a power source; a microcontroller with two digital ports and an A/D converter; and a few passive components. Simply reading an analogue voltage provides the ratiometric measurements which are proportional to the angle being measured.

Because the reading is ratiometric, a perfectly stable voltage is not required if the A/D reference voltage is the same as that of the tilt sensor drive voltage.

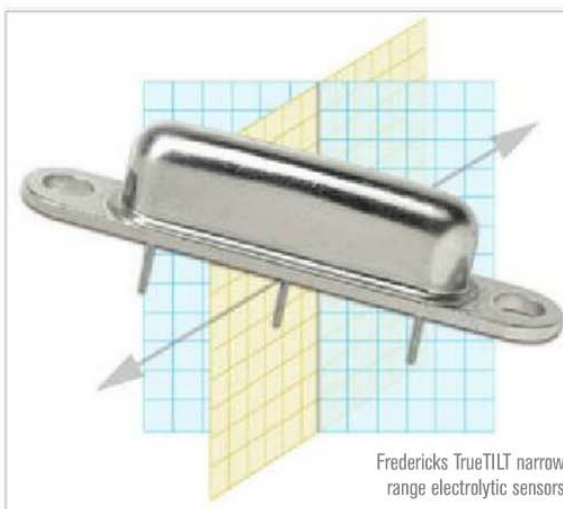
The electronics are further simplified by the electrolytic sensor's ability to operate at any voltage and its low power requirements.

THE FUTURE OF ELECTROLYTIC TILT SENSORS

Despite the fact that electrolytic sensors from the 1960s are still in production, manufacturers such as Fredericks continue to make innovations in this technology.

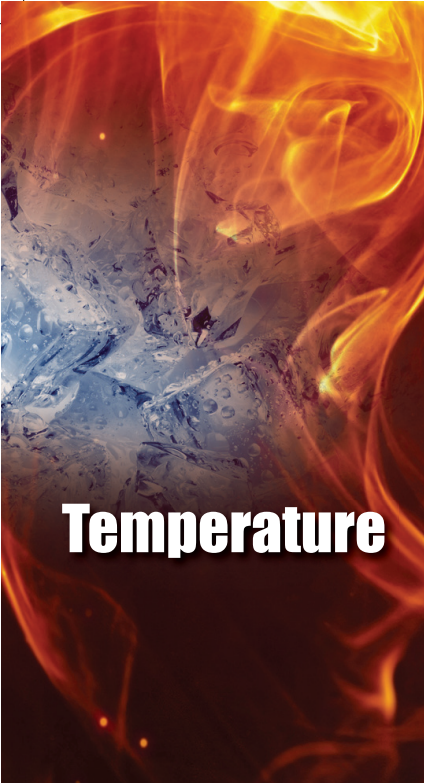
Glass tilt sensors based on thick-film technology, for example, will measure with sub-arc second repeatability at significantly lower cost, whilst ceramic sensors will operate at even higher temperatures. In addition, the latest generation of metal sensors will deliver high repeatability with larger measuring angles and a smaller size.

Charcroft Electronics
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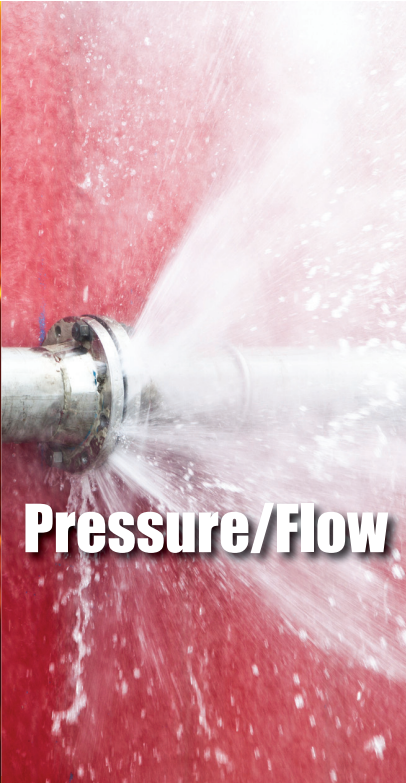


Fredericks TrueTILT narrow range electrolytic sensors

Electrolytic tilt sensors and other components for sensing flow, pressure, position and temperature in harsh environments, will be featured on Charcroft Electronics' stand, C11, at Sensors & Instrumentation 2016



Temperature



Pressure/Flow



Tilt/Position

Stand No: C11
Sensors &
Instrumentation
Show

Accurate sensing for tough applications

Sensing does not get tougher than this. That's why Charcroft add their specialist design support to some of the world's most robust sensors.

Tilt

- CAN Bus SAE J1939 TrueTILT™ electrolytic sensor
- Integrated signal conditioner
- Minimal output drift compared to MEMS devices

Position & steering torque

- Non-contacting Hall-effect rotary sensors
- Free-floating torque rotor for infinite rotational life

Temperature

- Temperature range: -53.9 to +2200°C
- High current switching up to 40A at 120 and 240V AC resistive

Flow

- Gas flow up to 1000m³/hr
- Liquid flow up to 100m³/hr
- Alarm and transmitter options
- ATEX intrinsically safe approval

Pressure

Switches

- Programmable switching output
- 64x64 matrix OLED display for excellent readability

Sensors

- Thin film, ceramic capacitive, piezo-resistive and silicon capacitive
- Flexible configuration options



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