



# TechniTalk

Summer 2009

## Welcome to the Techni Measure Newsletter

Whether you are reading this for the first time or have been following our series of publications, we hope that our fifteenth edition of **TechniTalk**, continues to inform readers of new products, whilst providing technical suggestions on how or where these products might be used. If you would rather receive this publication electronically in the future, please let us know.

## Conax Technologies

Techni Measure is please to introduce to our product offering, the Conax Technologies range of compression seal fittings, and temperature sensor assemblies. The temperature sensors are available as RTD or thermocouple assemblies and are offered in various configurations, including many different termination styles and mounting options. These sensors can of course be supplied along with an appropriate seal fitting to provide a complete pressure vessel solution.



Many different seals are available, and the Conax soft seal technology, allows for high pressure and high temperature applications. One such application involved several heater power feed-throughs for an autoclave in the Aerospace industry. While it was intended to be an exact physical replacement of an existing product, Conax developed a "plug and play" solution offering several key advantages - updates to the design, improved performance, longer life and ease of use. These units can be rebuilt in the field and spare parts are kept in stock at the customer site. Downtime is now limited to 3-4 hours to replace a few simple components, compared to 3-4 months for complete rebuilds of the previous design. Performance and longevity are improved so that the heating elements can function at peak performance at all times rather than a continuous degradation in performance until failure as with the old design. This application typifies what is possible from the Conax range and utilizing their application experience.

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### Rugged Dynamic Pressure



Dytran have just released their new rugged design dynamic piezoelectric pressure transducer. The model 2006V2 has a 50mV/g sensitivity giving a dynamic pressure range of 100psi. It differs from their other pressure sensors, in that it has a rugged 2-pin MIL-C-5015 connector, and a 1/4-28 NPT mounting thread.

There will be two other models in this series, with model 2006V3 having a 50psi range, and model 2006V1 having a 500psi range. They were designed for use in industrial pressure applications including pressure pulsations, acoustic studies and pipeline leak detection, where a rugged design and in particular a rugged cable and connection are required. The housing and diaphragm are made from 316L stainless steel that is fully hemetically sealed, and it is 43mm long with a 3/8 inch hex body for lightening. The unit has built in standard IEPE electronics with an upper temperature limit of 121 degC, and the housing is electrically isolated from ground, in order to prevent ground loop problems. The frequency response is up to 5kHz  $\pm 10\%$ , with a minimum rise time of 2 microseconds. The sensor is acceleration compensated, which minimizes the effect on the output signal, of any axial vibration that might be generated by the structure into which it is mounted.

Please ask for details of this sensor, and if you have any questions regarding the measurement of dynamic pressure in general, we would be pleased to visit you to discuss any possible application.

### Miniature AHRS

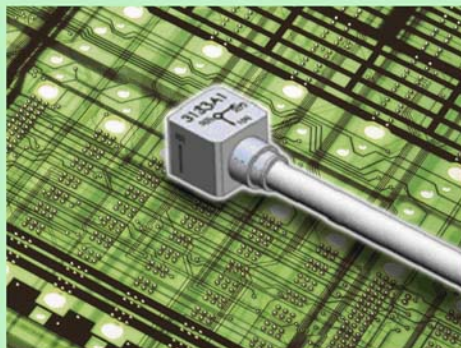


The new 3DM-GX3 series of miniature Attitude Heading Reference System (AHRS) sensors, starts with the introduction of the 3DM-GX3-25, which incorporates triaxial accelerometers, gyros and magnetometers. Future models will offer other sensor grades, a more basic inertia measurement unit, and a unit with GPS incorporated.

The main feature of this new system is the small size and weight. Excluding the mounting tabs this sensor is 44mm long, 25mm wide and 11mm high, and weighs just 18 grams. Output modes from this system include acceleration, angular rate, magnetic field, delta angle and velocity. Euler angles and rotation matrix. All quantities are fully temperature compensated and corrected for sensor misalignment. The 3DM-GX3 series offers improved navigation under vibration, as sensors are sampled at 30kHz and digitally filtered and scaled into physical units. They have a user adjustable data rate from 1 to 1000Hz. A  $\pm 5g$  accelerometer range and  $\pm 300$ deg/sec gyro range are standard, but there are options for other ranges. A lower cost and smaller OEM version is available with a USB or TTL interface, and a smaller connector. Applications for this device would include use in unmanned vehicles and robotics, platform stabilisation, antenna and camera pointing, and location tracking.

We would be pleased to discuss any application where this sensor could be used, and if you have any questions regarding the measurement of orientation in general, we would be pleased to visit you to discuss any possible application.

# Product News



### Ultra-mini Triaxial Accelerometer

The ultra miniature triaxial accelerometer series 3133A, weighs in at just 0.8 grams, and comes in a 6mm cube with integral cable. This sensor will be available in sensitivities of 2mV/g, 5mV/g and 10mV/g and is for adhesive mounting only for minimal mass loading. Even though the 3133A sensors are tiny, they have a robust construction with a welded titanium housing that is epoxy sealed. The sensor is ideal for tests involving environmental stress screening, printed circuit board vibration measurements, mechanical shock applications or general purpose vibration monitoring where space or weight is at a premium. The device has integral IEPE electronic circuitry providing a sensitivity of 2mV/g (3133A2), 5mV/g (3133A3), or 10mV/g (3133A1), and can operate at temperatures from -51 degC to 148 degC. It is designed for adhesive mounting and offers a frequency response up to 30kHz  $\pm 10\%$ . For such a small sensor it also has a low frequency response down to 0.4Hz  $\pm 10\%$ . It uses ceramic sensing elements in a planar shear mode, that helps to reduce base strain effects and thermal transient response. The integral lightweight cable is almost 1m long and terminates in a 4-pin connector for easy lead wire extension.

*These sensors are the smallest in the Dytran range of miniature triaxial accelerometers and we would be very pleased to discuss any application that you may have for low weight vibration measurements.*



### Dytran New Product Guide...

Call us on 01527 854103 to receive your FREE copy of Dytran's new 2009 Product Guide that includes brief details on many new products in their range of Piezoelectric Transducers.

### Multi Element Seals



New from Techni measure is the Conax range of pressure and vacuum seal fittings, offering a wide choice for sealing single or multi-element conductors or wires. Compression seal fittings restrain the elements from moving as a result of pressure differentials, prohibit the leakage of gas/liquid media along the elements, and can electrically isolate the elements from the mounting device. Single element seals consist of a body, cap, sealant and follower, whereas multiple element seals also include a seat, follower and an anti-rotation pin to prevent wires/conductors from twisting and shearing. The element to be sealed passes through the holes in the sealing assembly components and the cap is then torqued to the recommended value, thus translating an axial force on the follower. This force compresses the sealant contained within the body housing so that the sealant conforms to the element, creating a seal. The elastic nature of the sealant allows it to flow into any voids between the seal and the element. Typical applications include pressure vessels, autoclaves, furnaces, holding tanks and pipelines. The PL series is for multiple power leads and come supplied with 8 to 20 AWG Kapton insulated wire pre-installed. The TG series are supplied with or without wires and are for low voltage applications such as strain gauges and thermocouples. Split seals are also available.

Please ask for further details on this new series of seals or for any advice you may need, on any seal applications. We have the products and expertise to solve most applications.

### 4-wire Strain Gauges



MicroStrain are now offering their proven SG-Link wireless circuit on a small PCB for applications where space is tight. The standard design is on a 30mm square board, having one differential channel that includes full strain gauge conditioning with programmable gain and offset, and one single ended voltage input channel. Other OEM custom configurations are available. Featuring 2 kHz sweep rates (4 kHz for 1 channel only), combined with a 2MB flash memory, these little nodes pack a lot of power into such a small package. The node can operate over a wireless connection to a base station up to 70m away, and is compatible with a wide range of analogue sensors, including strain gauges, displacement sensors, load cells, torque transducers, pressure sensors, accelerometers, temperature sensors, inclinometers and others. An external 3.2 to 9 volts supply is required. The bi-directional RF communications link in the 2.4GHz range, can trigger a sample to be logged, or request real time data to be transmitted to the host PC for data acquisition and analysis. Typical applications include condition monitoring of machines, structures or vehicles, and as an example it is used in the MicroStrain Shear pin product, used to measure shear forces on bolted structures.

For additional information on these or any of the other wireless sensors in the MicroStrain range, please let us know what you wish to measure. We would be pleased to visit you to discuss any possible application.



## Who's Where?

As a new supplier for Techni Measure, we thought it was appropriate to return to the 'who is where' series and show the Conax facility in Buffalo, New York State. Conax were founded back in 1953 and have a 92,000 square foot facility with a modern, diversified machine shop of around 18,000 square feet. They engineer and machine compression seal fittings and temperature sensor assemblies. Applications vary from down-hole to aerospace, pharmaceutical to semiconductor, and single point to multiple profiling. Conax are ASTM E1137 compliant for RTD's and are an ISO 9001 certified company. They were the originators of "soft seal" technology for pressure seals and have an in-house NIST traceable calibration laboratory.



## Techni Measure on Show...

These are the exhibitions planned for the rest of 2009, where we would be pleased to meet with anyone to discuss possible applications for our wide range of products. If you need tickets or further information then please let us know.

### 9th September

EMEX at Cambridge.

### 7-8th October

INSTRUMENTATION SOUTH at Reading.

Please remember that if it is not possible to attend any of these shows and you need a demonstration or explanation of any of our products, we will always be pleased to visit you instead.

## Tech Note

### What is ... Accuracy ?

A discussion arose within our own organisation regarding the various descriptions of accuracy that we commonly deal with. Consequently we decided to include this article in this Newsletter, and hope it will be useful for others. It is not intended to get into the theory of errors, but is more aimed to give a more practical insight, especially with respect to sensors and instrumentation. Firstly a few basic definitions -

**Accuracy** - the closeness of a measurement to the conventional true value of the quantity.

**Resolution** - the smallest change in input that produces a perceptible change in output. That is the smallest increment of change that can be detected by a measurement system.

**Linearity** - the closeness to which an output signal approximates to a straight-line input.

**Repeatability** - the closeness of agreement between successive measurements carried out under the same conditions of measurement.

**Hysteresis** - a reading of the same value that differs as a function of whether the measurement is rising or falling.

**Drift** - a gradual change in reading over a period of time, with no change in input.

**Response** - the ability for a sensor or system to respond and measure in time, to any given input.

Accuracy is conventionally stated as a percentage error from the true value, and with instrumentation it should be stated as either at the 'Reading' (i.e. anywhere over the scale range), or at the 'Full scale' reading (FS). Thus a quoted  $\pm 2\%$  FS accuracy would mean accurate with an error of no more than  $\pm 2\%$  of the true value, as a percentage of the full-scale sensor range. The true value should be traceable to a primary standard, but most sensors would be calibrated to a secondary standard, with defined errors. Apart from the inherent differences in the sensor system itself, there may be short or long term drift characteristics to consider. Effects of changes in temperature can be seen as a potential drift in accuracy, so that most accuracy figures are quoted at a specific temperature, with an associated temperature sensitivity output curve or coefficient also quoted. There are other causes of sensor drift that could have a similar effect on accuracy. The response of a sensor system might also not be fast enough to actually measure the true input, so that the measured response would be lower than the input and accuracy therefore affected. For dynamic measurements the response of the measurement system must always be significantly higher than the frequency of the input.

Resolution is the smallest change that can be detected and is usually related to the noise in the system, or if there are increments in the sensor output. Many analogue output sensors can be thought of as having infinite resolution (no increments), however any inherent noise, or noise in the associated electronics, will effectively increase the measurement resolution. Analogue to digital converters can add to this and it should be noted that the resolution of digital panel meters can be quoted as  $\pm 2$  digits. Digital sensors would usually have resolutions stated in terms of 'Bits'.

Linearity probably deserves an article on its own since there are several different ways in which this can be described, so it will be addressed in a future Newsletter.

Repeatability defines the ability of a sensor system to faithfully repeat the same measured result at any given input, without any other changes in the environmental conditions that could affect the system. This would normally be stated as percentage error compared to the full-scale range.

Finally, hysteresis describes any difference in signal at any measurement point, when the measured parameter is either rising or falling. This could be due to mechanical changes in the function of the sensor, or maybe creep in the material used.

Many of these errors can be summed up as one overall accuracy figure, maybe expressed as a root mean sum of the squares of the combined errors, but it should be understood that this might not be the case and that actual accuracy could be worse than portrayed in such a specification.