TM TechniTalk

Autumn 2013

What Cal ?

We have decided to start a new series of pictures portraying some of the various calibration fixtures that our suppliers use to provide final calibrations on their sensors. The first one shows the huge testing facility at TML in Japan, where they can calibrate up to 10MN loads. Smaller load calibration facilities are relatively common, but there are not that many in the world that can measure up to this level. This system incorporates dead weights only for the lower range, but these are coupled with hydraulic rams for the higher ranges. It can generate traceable tension and compression force up to 1MN and compression force up to 10MN.

Techni Measure on Show...

Exhibitions booked for the rest of 2013 are listed below. We would be pleased to meet with anyone to discuss possible applications for our wide range of products and if you need tickets or further information, please let us know.

25 – 26th September
SENSORS & INSTRUMENTATION at Birmingham

2 – 3rd October
ENGINEERING DESIGN SHOW, at Coventry

12 – 13th November
ADVANCED ENGINEERING (Auto) at Birmingham

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 Calibration ?

To tie in with our new series of pictures of various calibration facilities, this technical note will try and explain some of the many methods involved in performing calibrations for a variety of sensors. It was back in the fifth edition of our Newsletter, that we had an article explaining what a calibration is and why it is needed. It was stated then that calibration is all about having the confidence that the acquired signal will be a true representation of the parameter being measured, and that the most common calibration method is to use a back to back system, where a similar sensor that has been tested to a traceable national standard, is compared to the test sensor. Please ask if you if you need a copy of that article. There follows a brief description of the methods used to calibrate most of the sensors we supply.

LOAD - The picture in the first of our series, shows a 10MN load system, where a strain gauge load cell can be checked at various loads by the use of a system of two hydraulic ram cylinders whose ratios are 1:20 and 1:200 respectively, combined with the addition of known weights (dead weights) that have been checked to a traceable standard. There are many different International standards that govern how these measurements are done, and the calibration facilities at TML are approved as a JCSS-accredited laboratory in the category of Force Calibrations, certified by International Accreditation Japan, National Institute of Technology and Evaluation. Other load calibrations may be done by simply using a hydraulic load machine and comparing the output of a certified load cell, directly with the one under test (back to back).

VIBRATION – This back to back method is common in the vibration world, where an accelerometer that has a mounting hole on the top and bottom, and that is sent to a national standards calibration house on an annual basis, is vibrated on a shaker at various frequencies, and the output compared to the output of the test sensor fitted to the top. A typical calibration would show the output at various traceable frequencies, but it is common to just use the stated sensitivity at 100Hz, as the sensitivity of the accelerometer.

PRESSURE – These sensors are typically calibrated using traceable dead weights placed onto a measured area, which is hydraulically coupled to the tested transducer. This gives a weight per given area such as pounds per square inch. As with other sensor calibrations, pressure sensors can also be calibrated back to back with another traceable sensor, with the same pressure applied to both.

FORCE – Force sensors are used for dynamic measurements, and are usually calibrated with a known weight, that is removed very fast, since by their nature these sensors do not respond to a static loading.

DISPLACEMENT – Sensors that measure displacement are usually checked directly against a very accurate mechanical micrometer gauge, so that their output can be determined at discrete steps of displacement, but there are now some more accurate laser devices that offer even greater traceable accuracy, especially for smaller measurement sensors.

STRAIN – Strain gauges have their sensitivity, known as the gauge factor, measured on a representative sample by applying gauges made from the same lot number of resistance material, to a beam which is then placed in a four point bending device that can test output against a known level of strain. This puts a section of the beam in constant bending with no shear. An alternative is to use a cantilever beam, with the beam tapered towards the point where the load is applied. Although the bending moment is not constant in the latter case, the surface strain is approximately so. The curvature of the beam is measured with displacement transducers and the surface strain calculated. The strain is then traceable to length standards via the calibrations of the displacement transducers.

ACCELERATION – DC accelerometers can of course be tested by simply turning over the sensor and measuring the 1g of gravity, but that does not really check outputs for higher g ranges. This can be done in the same way as a vibration sensor, or a centrifuge can also be used.

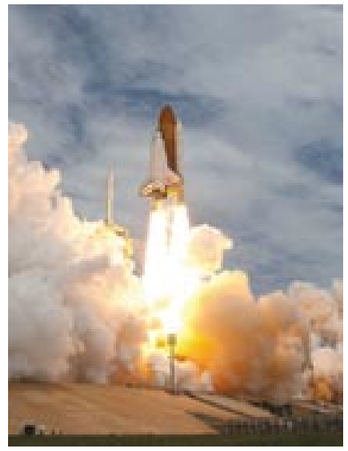
Calibration facility pictures for these other parameters will appear over the coming editions of this newsletter, but in the meantime if you have any questions, please ask.

Welcome to the Techni Measure Newsletter

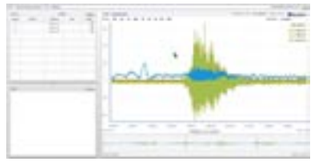
Whether you are reading this for the first time or have been following our series of publications, we hope that our twenty second edition of **Techni*Talk***, continues to inform readers of new products, whilst providing technical suggestions on how or where these products might be used. If you are reading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

NASA Shuttle Launch Measurements

The noise generated by rocket exhaust during launch events generates considerable effects on the safety of spacecraft, ground facilities, and equipment. Accumulated stress threatens the safe operation of exposed systems and LORD MicroStrain Sensing Systems worked with NASA Kennedy Space Center researchers to implement a wireless sensor solution. Conventional, hardwired solutions cannot monitor the strain experienced by these hazardous systems due to limited accessibility and extreme operating conditions. The solution enabled web based monitoring of far-field shuttle launch acoustics and test results corroborated prediction models with accurate, easily accessible field data. Furthermore, the deployed sensor network provides NASA with the foundation to implement a scalable remote sensor network capable of proactively monitoring high-value, hazardous systems. Deployed sensor systems were required to remain powered and alert in anticipation of a window of launch times, so these conditions demanded that the wireless sensor networks operate on limited power while still providing a measurement frequency capable of capturing the brief but dynamic nature of launch acoustics.



The system hardware consisted of two wireless G-Link® acceleration nodes, one wireless SG-Link® strain gauge, a WSDA® wireless sensor data aggregator, and SensorCloud™®. Nodes were instrumented on a cantilever plate which had a low natural frequency.The plate was installed on Shuttle PAD 39B which is near to Shuttle PAD 39A where the last several launches had taken place. At this location the plate is exposed to acoustic and vibrational launch effects approximately 1.3 miles from the Shuttle liftoff, and where far-field acoustics are of interest.



The resulting big data was remotely aggregated on SensorCloud, LORD MicroStrain's web based data visualization, reporting, and analytics platform, where researchers collaborated on vibration analysis.

For further information please see the full article at: *http://www.microstrain.com/news/nasa-deploys-microstrainsensor-network-monitor-acoustic-shock-during-shuttle*

IN THIS ISSUE

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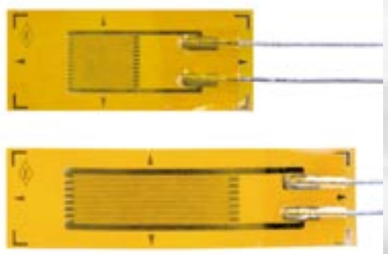
Product News

High Endurance Strain Gauges



TML have just released details of their newly developed strain gauges that offer a high fatigue life at high levels of dynamic strain. The new DSFLA series are available with active gauge lengths of 3mm and 5mm, both with a gauge grid width of 2mm and with a 350Ohm resistance. The gauge factor is approximately 3.5.

Any strain gauge, when subjected to continuous cyclic strain at high strain levels, can be subject to fatigue damage. A permanent change in gauge resistance will usually be noticed first (zero shift), followed by cracks appearing in the strain gauge grid itself, especially under tension. The fatigue limit is defined as a zero variation of 10% of +/-3,000 microstrain. Standard TML foil strain gauges are specified with a fatigue life of 1,000,000 cycles at a strain level of only ±1500 microstrain, but these new gauges have been tested at TML to withstand a cyclic loading of more than 1,000,000 at 3000 microstrain in tension, but also more than 1,000,000 cycles at 4000 microstrain by experiments conducted at the Japan Aerospace Exploration Agency. The fatigue life of a strain gauge depends mainly on the properties of the foil used in the grid as well as the backing material and adhesive used. These gauges have a special alloy grid with a polyimide backing, and would usually be applied using cyanoacrylate adhesive. The operating temperature is -60 to +200 deg. C, but there is no temperature compensation applicable. This type of strain gauge would be especially useful when applied to materials that require fatigue testing under cyclic loading.

Please ask for further details on this new high endurance strain gauge, or for any advice you may need for any strain gauge application.

Wireless Accelerometer Node

LORD MicroStrain Sensing Systems, have introduced a new version of their popular wireless triaxial DC accelerometer. The G-Link2-LXRS comes in a small IP67 rated enclosure and offers an on board triaxial accelerometer with either a ±2g or ±10g measurement range, or a compatible external single axis accelerometer can be fitted instead, which come in ranges from ±5g up to ±200g.

The new 16-bit G-Link2 enables vibration/acceleration measurement and monitoring in remote applications. The node can simultaneously log data to the internal memory and/or transmit real-time data to a host computer at user programmable data rates. Node Commander® software supports configuration of the wireless node including discovery, initialization, radio frequency, sample rate, reading/writing to node EEPROM, calibrating node sensors, managing node power including sleep, wake, and cycle power, and upgrading node firmware. The node comes packaged in a 68 x 85 x 33.5mm aluminium housing with a clear polycarbonate lid, which also houses a 3.6V replaceable AA lithium battery. External power can also be supplied if required. High resolution data is ensured with the 16-bit A/D converter, and user programmable filters can be set for optimized anti-aliasing. The G-Link2 is compatible with any of LORD MicroStrain's WSDA®-Base or WSDA®-1000 base stations. Applications would include vibration monitoring on moving structures, condition-based monitoring of rotating machines, and health monitoring of aircraft, structures and vehicles.

For more information about this wireless accelerometer node, please ask for a copy of the G-Link2 leaflet. We would be very pleased to discuss any application that you may have for wireless vibration monitoring.

High Temperature Vibration

Dytran Instruments have just released a new version of their high temperature accelerometer. The model 3316M3 is designed to be used up to 538°C (1000°F), and extends the range of high temperature accelerometers to a new level. The charge mode element is mounted in a hermetically sealed, miniature Inconel housing and utilizes the latest in planar shear technology.

In order to operate at such high temperatures, the model 3316M3 was designed with a unique, Dytran patented feature. Units employ a "silver window" on the top cover of the accelerometer housing, which provides oxygen access to the crystal at high temperatures whilst maintaining the unit's hermetic sealing. The 3316M3 weighs just 5 grams and has a height of just 9.8 mm. It is offered with a sensitivity between 1 and 2 pC/g, with a 10KHz upper frequency response, and has a 10-32 tapped hole for mounting and a 10-32 radial connector. With its durability, broad operating temperature range and miniature, lightweight design, the 3316M3 is ideal for very high temperature environments where mass loading is a concern including automotive vibration studies, exhaust system analysis, engine vibration analysis and Environmental Stress Screening (ESS). To prevent ground loop interference at high temperatures, it is recommended to use model 6998 isolated mounting block in order to isolate the sensor from the mounting surface. Additional recommended accessories for model 3316M3 include the model 6946A hard-line cable assembly and model 4754B in-line charge amplifier. In addition to this new sensor, Dytran have just issued early details on a model 3330C accelerometer that has a differential output, and is already ground isolated. It measures 22.9 x 12.7 x 11mm high, and is mounted via a through hole 10-32 bolt. It comes with an integral hard line cable terminating in a 3-pin connector, and lock-wire holes are provided. It has the same silver window design of the 3316 series, but is capable of measurements at 649°C (1200°F).

For more information about the model 3316M3 or the 3330C, or other high temperature products, please contact us. We would be very pleased to discuss any application that you may have for high temperature vibration measurements.

Wireless Power Monitoring

LORD MicroStrain Sensing Sytems, have introduced a new wireless system specifically designed for use with mains line current measurement sensors. The Watt-Link™-LXRS makes it easy for users to collect time synchronised power and energy measurements, without the need to install and maintain expensive wiring. Once configured the Watt-Link™ will periodically transmit measurement values at user settable intervals.

The Watt-Link™ can be deployed in both local and remote monitoring applications. For local applications, users can select a WSDA® base station with a USB, RS232, or analogue interface options, and for remote monitoring the system can be linked to a WSDA®-1000 gateway for ethernet connection via a network or modem, for secure long term data storage. Nodes may be deployed up to 1km away (line of sight) from the wireless base station, and they are designed to be parasitically powered from the mains being monitored, with status indicators for phases A, B and C. Models are available for several different types of electrical service, and measurement values include true RMS power and energy, reactive power and energy, AC frequency and computed RMS current. Split core current transformers are also available for use with this node for different current levels ranging from 5 Amps to 250 Amps, and these offer outstanding linearity and very low phase angle error, with easy one handed opening and closing.

Applications include synchronised monitoring of critical power systems, reliable wireless energy management, building automation and metering, and equipment performance monitoring.

For additional information on this new system, or for advice on any of the other wireless systems available from LORD MicroStrain, please let us know details of any possible application.

Vibration Trend Meter

The Vib Meter 330 designed by C-Cubed, is a hand held meter fitted with a single channel industrial accelerometer, which can be used to display and record vibration data on a route, and for downloading these readings into a software package that shows trending and other powerful fault diagnosis.

The Vib Meter 330 is a simple to use, low cost vibration meter that analyses and displays vibration readings at the push of a button. The overall vibration values are displayed with colour coded alarm levels for ISO values, bearing condition and machine fault diagnosis. The meter also includes a high resolution zoomable vibration spectrum display with a fully dynamic cursur, displaying frequency and amplitude values. It also features a colour coded frequency band alarm display, based on run speed, which can be used to diagnose machine faults such as balance, misalignment and looseness. An optional tacho strobe can be supplied to measure the rotational run speed, and optional bluetooth headphones can be supplied to allow the engineer to listen to the vibration. The meter weighs just 280 gms (not including the sensor), has an IP67 rating, and runs from 2 AA bateries. It comes supplied with a 100mV/g (50g range) accelerometer with a 1.4m long cable and a magnetic mounting base. The meter has an optical link through to the USB connection in a small docking station, so that data can be easily downloaded via the supplied USB cable to a computer and into the powerful VibTrend software for monitoring and analysis.

We would be please to discuss any application where this meter could be used, and if you have any questions regarding vibration monitoring in general, we would be pleased to visit you to discuss solutions.