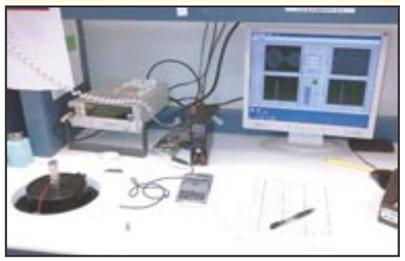
TM TechniTalk

Spring 2014

What Cal ?

For the second picture in our series of calibration facilities, we have a photo of one of the accelerometer calibration stations at Dytran Instruments. The picture shows the top of a shaker that is actually mounted on a stand that separates the shaker from the bench so as not to excite the entire set-up when vibrating. On the top of this is the back-to-back reference accelerometer mentioned in the last issue of our Newsletter, with a "transverse sensitivity" fixture mounted to it. The shaker is set to run through the traceable frequencies, and the calibration data is produced from the results.



Techni Measure on Show...

Exhibitions booked for the rest of 2014 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.

9 – 10th July
BSSM at ICEM16 at Cambridge University

30th September – 1st October
SENSORS & INSTRUMENTATION at Birmingham

22 – 23rd October
ENGINEERING DESIGN SHOW at Coventry

11 – 12th 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 Hammer Testing ?

Something we are asked from time to time is "What exactly is hammer testing and how can it help me?" In this article we will try to explain the basics. Hammer testing is also sometimes referred to as Modal Testing, and it is a way of testing to determine the dynamic behaviour of a structure in response to an applied stimulus. A transfer function of a mechanical system describes this dynamic behavior, and there are six major transfer functions used in mechanical systems analysis, with each describing the dynamic behavior in a different fashion, and each involving the ratio of the output response to the input stimulus. Response can be measured most conveniently with accelerometers placed at important points throughout the structure under test, and Spectrum analyzers perform the necessary mathematical ratio transform on the input and response signals to produce, almost instantaneously, the desired transfer function.

The input stimulus (forcing function) may be applied to the structure by various methods. One way to excite structures is by use of an electrodynamic or hydraulic shaker with a force sensor attached to the armature driving the test object, to measure the input force amplitude. However when the test object is too large to be excited in this fashion, or when it is physically impossible to do so, the structure can be hit with a calibrated dynamic impulse hammer. A force sensor mounted in the head of the hammer transforms the input force pulse into a waveform that contains the necessary amplitude and phase information to completely describe the forcing function. Impact tip material stiffness helps determine the frequency content of the input forcing function by controlling the impact pulse duration. By defining the frequency and amplitude of the forcing function, impulse hammers present a fast, simple way to excite structures in a well-defined fashion.

The user can combine various head extenders to alter the hammer head mass, and select different impulse tips, to create different impulse waveforms. Fourier analysis shows that faster rise time pulses with short pulse duration contain the highest frequencies, so use the metal (aluminum or steel) impact tips and no head extender for quickest rebound to produce impulses with the highest frequency content, and the opposite for low frequency excitation. Heavier structures with lower frequency responses (resonances) require lower frequency excitation at higher input force levels.

The result of the impact from the hammer would ideally be measured with an array of accelerometers mounted on the structure, but one accelerometer could be fitted and then the structure impacted at several points.

Typical impulse hammer analysis system

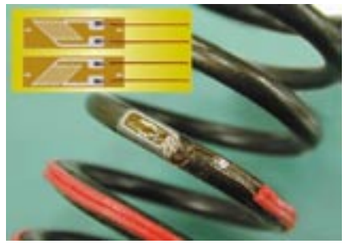
For further information on impact testing or details of the Dytran range of impact hammers, please let us know what you need to do.

Welcome to the Techni Measure Newsletter

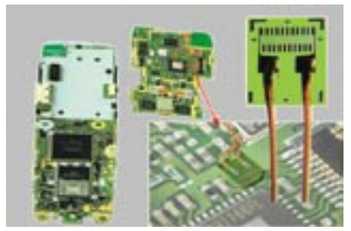
Whether you are reading this for the first time or have been following our series of publications, we hope that our twenty third edition of **Techni*Talk***, continues to inform readers of new products, whilst providing technical suggestions on how or where these products might be used. If you are reading 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.

Special Strain Gauge Applications

For the front page in this issue, we thought we would show a few pictures of some typical applications for some of our more special types of strain gauges. Most applications we deal with require standard linear, cross or rosette type strain gauges, either with or without integral lead wires, however there are many other gauges in the TML range that offer solutions for more extreme or unusual applications. With over 40 years of experience we would be pleased to offer our advice on which gauge will best suit a particular application, but please ask for a copy of the TML strain gauge catalogue, or view their web site at www.tml.jp/e if you require more details of the gauges and accessories that are available.



Shear type strain gauge fitted to a spring

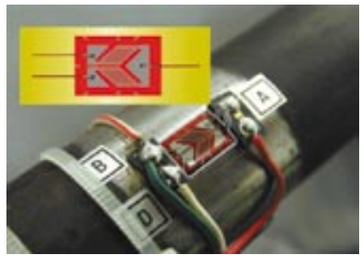


Miniature strain gauge fitted to the PCB of a cellular phone

High temperature weldable strain gauges fitted to an engine manifold.

Miniature strain gauge fitted in the valley of a gear tooth

Bolt strain gauge fitted into a bolt for axial measurements



Special chevron type strain gauge for torque measurement

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Product News

ELF Accelerometer

Dytran Instruments new series 7705A accelerometers, are a new generation of sensors that combine two technologies, which until now have only been used separately. Also referred to as the E.L.F. (Extended Low Frequency), the accelerometer contains both a piezoelectric and a variable capacitance element with respective filtering, whose outputs are electrically superimposed over one another.

The Dytran series 7705A feature a hybrid design, combining the most desirable features of piezoelectric sensors and variable capacitance accelerometers, which result in a flat frequency response from 0 to 10,000 Hz. The main principle of operation of the Dytran series 7705A is the instrumentation amplifier at the output buffer. The positive input is provided by the variable capacitance element and the negative input is provided by the piezoelectric element. Both the variable capacitance element and the piezoelectric element are filtered appropriately (low pass single pole and high pass single pole, respectively) to provide the corner frequency of both filters precisely matched at approximately 30 Hz. Both signals are also out of phase as they enter the instrumentation buffer. Accelerometers are powered through the power pin with a 5-28 VDC power and require 7-9 mA of current. Designed in a hermetically sealed, titanium housing, the series 7705A incorporates a 10-32 tapped mounting hole and a 4-pin M4.5 x 0.35 radial connector. Currently there are three models available, offering 20, 40 or 200g ranges, and typical applications would include flight testing, Health & Usage Monitoring Systems (HUMS), and ride quality.

Please ask for further details of this unique development, or supply details of any application you may have, so that we can advise on the best accelerometer solution.

Seven Channel Wireless Node

LORD MicroStrain Sensing Systems have introduced a new 16-bit resolution A/D version of their popular wireless multi-channel node. The V-Link-LXRS Wireless 7-Channel Analogue Input Sensor Node features 4 differential input channels with optional Wheatstone bridge completion, 3 single ended 0-3 volt input channels, and an internal temperature sensor channel.

The new 16-bit V-Link allows a typical accuracy of 0.1% of full scale, and supports a wide range of user-supplied Wheatstone bridge and analogue sensors including strain gauges, load cells, torque, pressure, acceleration, vibration, displacement, geophones and more, and enables measurement and monitoring in remote applications. The node can simultaneously log data to the internal memory 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, initialisation, 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 74 x 79 x 20mm (plus antenna) ABS housing, which also houses a 3.7V rechargeable lithium ion battery. External power can also be supplied if required. The V-Link is compatible with any of LORD MicroStrain's WSDA- Base or WSDA-1000 base stations, and applications would include rotating component monitoring, health monitoring of aircraft, structures and vehicles, and experimental test and measurement.

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

Strain Tranducer Meter

New to the Techni Measure range are the strain gauge transducer amplifiers from Synectic Electronics. Whilst there are many different models available, each offering their own particular application solution, of special note is the model SY031 which is a low cost, battery powered, 41/2 digit LCD meter, suitable for conditioning and display of signals from load cells or any strain gauge based transducer.

The model SY031 hand held strain gauge bridge meter is a simple, economical, portable instrument for measuring scaled loads on a variety of sensors. The meter is easy to calibrate by applying a known load, or employing the standard 100Kohm internal shunt calibration resistor, and holds up to 16 channels of calibration data in a non-volatile memory for easy use with different sensors. The meter also offers 160msec peak and trough hold, and with the RS-232 option can output readings at user programmable time intervals. Approximately 40 hours of battery life can be expected from the two AA batteries, and data entry is via the five button, membrane keypad. The standard sensor connector is a latching 4-pin DIN connector, but other options are available. The grey plastic (ABS) IP65 case measures 152 x 83 x 34 mm and comes supplied in a zipped vinyl case. Other bridge amplifiers in the Synectic range include several models similar to the illustrated SY038. This unit offers user selectable sensitivity to match any sensor, and has current or voltage output options. Easy fine set up is made with adjustable zero and span potentiometers, and the unit is housed in a DIN rail mount case measuring 72.5 x 62 x 18 mm.

We would be please to discuss any application where this meter could be used, and if you have any questions regarding load cell or other strain gauge based transducer amplification, we would be pleased to visit you to discuss solutions.

High Temperature Triaxial

Dytran Instruments have added to their range, a very small three-axis high temperature accelerometer. The Dytran model 3443C is a triaxial, charge mode vibration monitoring accelerometer, designed to reliably operate in temperatures up to 260°C. Weighing just 10 grams, the Dytran model 3443C features ceramic shear sensing elements mounted in a hermetically sealed, lightweight titanium housing.

This sensor is ideal for use in a variety of vibration monitoring applications including engine vibration studies, exhaust system analysis and industrial vibration monitoring, especially where mass loading is a concern, since this sensor weighs in at only 10 grams. The 3443C high temperature accelerometer is capable of operating under extreme temperatures, while at the same time providing the high levels of reliability, durability and accuracy that is offered with standard laboratory sensors. The sensor utilizes two 3.7mm diameter through holes for mounting, and two 6-32 threaded screws are supplied for this purpose. Three 10-32 radial connectors are provided for connecting low noise cable assemblies for the output signals. The charge sensitivity for this sensor is typically 2.7 pC/g, with a measurement range up to 1800g, and it has a 10kHz upper frequency range. The titanium housing measures just 21.5 x 12.7 x 7.6mm, and the X, Y, and Z connectors are clearly laser marked on the sensor.

For more information about the model 3443C, or other high temperature accelerometers, please contact us. We would be very pleased to discuss any application that you may have for high temperature vibration measurements.

Miniature IMU

The new 3DM-GX3-15 miniature Inertial Measurement Unit (IMU), is a lower cost introduction to the LORD MicroStrain 3DM-GX3 range of inertial sensors, and incorporates triaxial accelerometers and triaxial gyros, but without magnetometers. This unit has a USB or RS232 interface as standard.

The main feature of this new system is the small size and weight. Excluding the mounting tabs this sensor is 44mm long, 24mm wide and 11mm high, and weighs just 18 grams. Output modes from this system include acceleration, angular rate, delta angle and velocity, Euler angles and rotation matrix. All quantities are fully temperature compensated and corrected for sensor misalignment. The 3DM-GX3-15 offers improved performance under vibration, as sensors are sampled at 30kHz and digitally filtered and scaled into physical units. They have a user adjustable data rate up to 1000Hz, and a filter to eliminate gyro drift in the IMU output. A ±5g accelerometer range and ±300deg/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 inertial aiding of GPS, robotics, platform stabilisation, antenna and camera pointing, and biomechanics. The 3DM-GX3-15 is initially sold as a starter kit consisting of an IMU module, RS-232 or USB communication and power cable, software CD, user manual, and quick start guide.

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