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Technical Note: Ball Drop Fixture

Introduction

The **PhoenixKonnect** software application interfaces with **MECALC's ALI²⁵** data acquisition modules supporting sample rates up to 5.0 MSa/sec with full anti-aliasing protection. This level of performance is vital to accurately measure fast shock events and responses from undamped accelerometers with resonance at high frequencies.

*MECALC DecaQ-06 Mainframe
with ALI²⁵ Data Acquisition Modules*

The purpose of this technical note is to illustrate **PhoenixKonnect's** configuration and data collection using the "Ball Drop" fixture instrumented with undamped Endevco Piezoresistive 727-20K accelerometers.

"Ball Drop" Fixture Instrumented With PR Accel

PhoenixKonnect Application

Transducer Definition

The transducer form defines the operational parameters of sensors associated with ALI[25] input channels. For the Endevco PR Accel, the key parameters are:

- Setup Method: Autonull to remove DC offset
- Sensitivity: Translate Volts to Engineering Units
- Calibration Due: Ensures the sensor is within calibration period
- Operation Mode: Enables Excitation Voltage Output
- Excitation: Sets Excitation Level

Transducer Definition for Endevco 727-20K Accel

Control Panel

The "Setup Control" tab defines the length of the test, pre-trigger length and effective sample rate. The "Trigger" tab defines the event-trigger parameters. Here, a real-time threshold of 5% of full scale will mark time zero when the signal rises above the noise floor.

PhoenixKonnect Application

Record Length and Effective Sample Rate Configuration

Real Time Trigger Threshold of 5%

Signal Directory

The signal directory associates transducers to channels and defines the requested "full scale" of the measurement. **PhoenixKonnect** configures the hardware with the optimum amplifier gain.

	Ref	Mod	Chan	Status	XDCR	Full Scale	Amp FS (mv)
✔	1	IP 205	1	READY	EN2712	10000 G	175.50
✔	2	IP 205	2	READY	EN2711	10000 G	175.35
	3	IP 205	3	DISABLED	VOLT	5000 mV	
	4	IP 205	4	DISABLED	VOLT	5000 mV	

Test Plan for Ball Drop

PhoenixKonnect Application

Data Collection Results

A video of the ball-drop sequence can be viewed at https://youtu.be/CGa00zrB0pc.

The graph below depicts the response of the impact. The top trace plots the unfiltered event. Both high frequency (resonance) and low frequency responses are evident. The bottom trace plots the event with a 10KHz low pass filter applied – removing the ringing effect.

For accurate measurement of magnitudes at the frequency of interest, it is imperative to capture the high frequency effects at a sample rate that meets the Nyquist criteria. Otherwise, signal aliasing folds down into the frequency of interest and corrupts both magnitude and phase of the measurement.
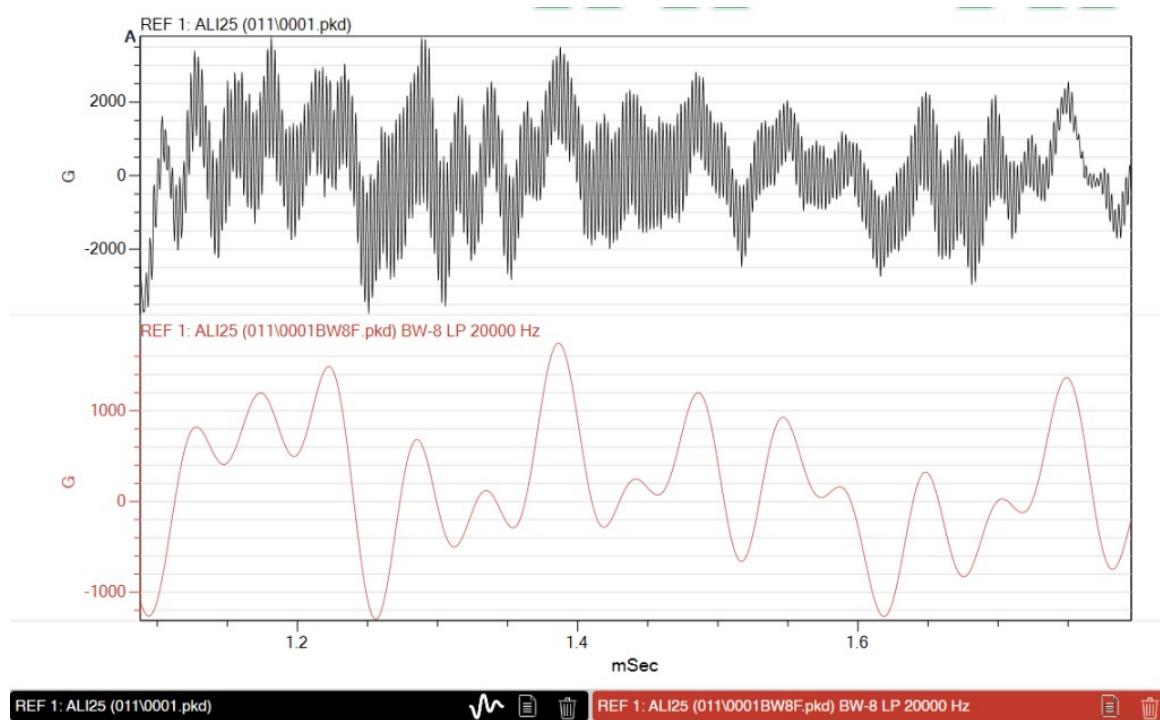

*Traces Showing Undamped Response (with Ringing)
and Filtered Response*

FFT Analysis

A fast-fourier transform of the time domain data demonstrates two distinctive sets of frequencies – responses under 20KHz and a distinct response at the sensor's resonant frequency around 380KHz.

*FFT Showing Low and High Frequency Responses*
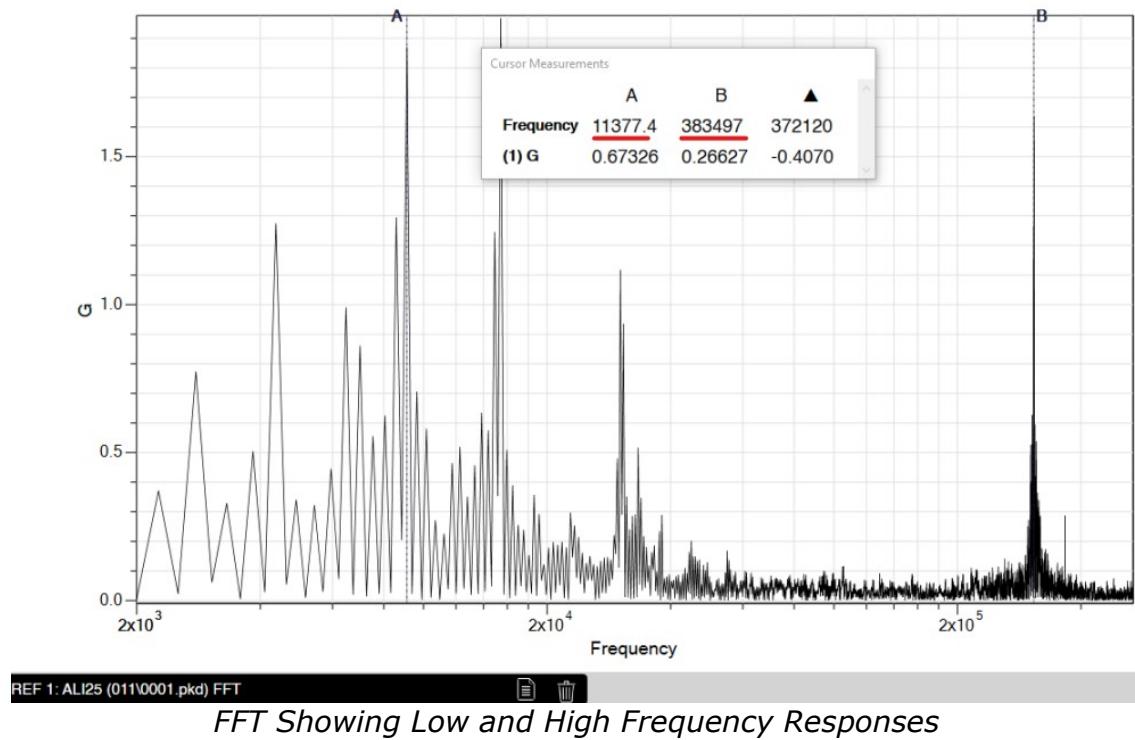
CINE Video

PhoenixKonnect supports an interface that synchronizes transient data with a video file of the event. In the snapshot shown below, an MP4 video was recorded at a rate of 790 frames per second. "Time zero" of the transient event is synchronized with the impact of the ball striking the beam. A TTL trigger signal from the ALI25 activates an LED visually tagging the video frame at time zero.

The UI interface supports playback and single-step of the video frames enabling the viewer to associate live action with the measured responses.

PhoenixKonnect Application
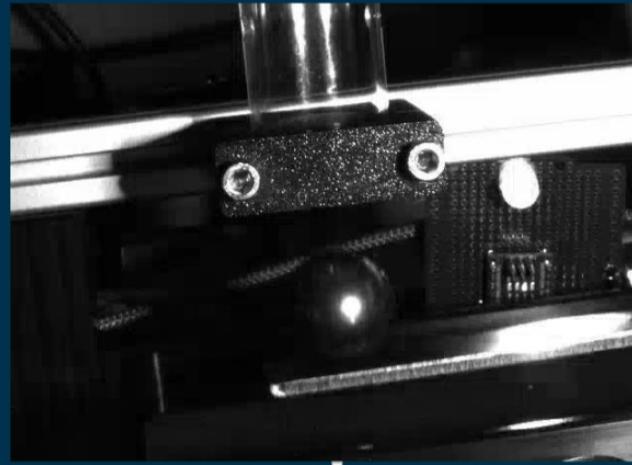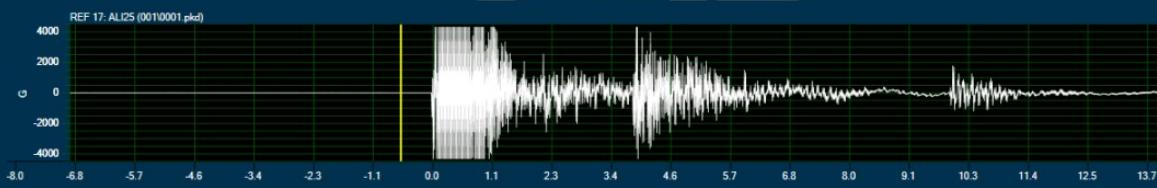
MP4 Video Synchronized With the Strike Event

Conclusion

The **PhoenixKonnect** application and **MECALC ALI^{25}** modules accurately capture events that embody a full spectrum of frequency responses. Employing fast slew rates and anti-aliasing protections, the system instills confidence by providing accurate measurements unaffected by out-of-band energies.

PhoenixKonnect Application