Perfecting the Sine Test Module

Todays Presenter: Jade Vande Kamp

We will begin shortly!

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Meet VR

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Sine Testing

- General Overview
  - Key Parameters
  - Test Types
- Creating and Running Tests
  - Creating a Quick Test
  - Creating an Advanced Test
  - Key Graphs
- Additional Features

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Sine Testing - General

- What is a Sine Test?
  - Caution! Non Real World Vibration
- Use Cases
  - Engineering Evaluation
    - Find and Target Structural Resonances
    - Validate Finite Element Models
    - Product Performance and design
    - Fatigue Testing at Resonance
  - Production Testing
    - Pass/Fail – Based on a test specification

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Sine Testing - General

- Basic Sine Testing
  - Goal: Hold a constant G level and sweep through a range of frequencies
  - Observe the product response in multiple locations
  - Note any damage or resonance
- Limitations
  - Single Frequency Excitation
  - Difficult to correlate to end-use environment

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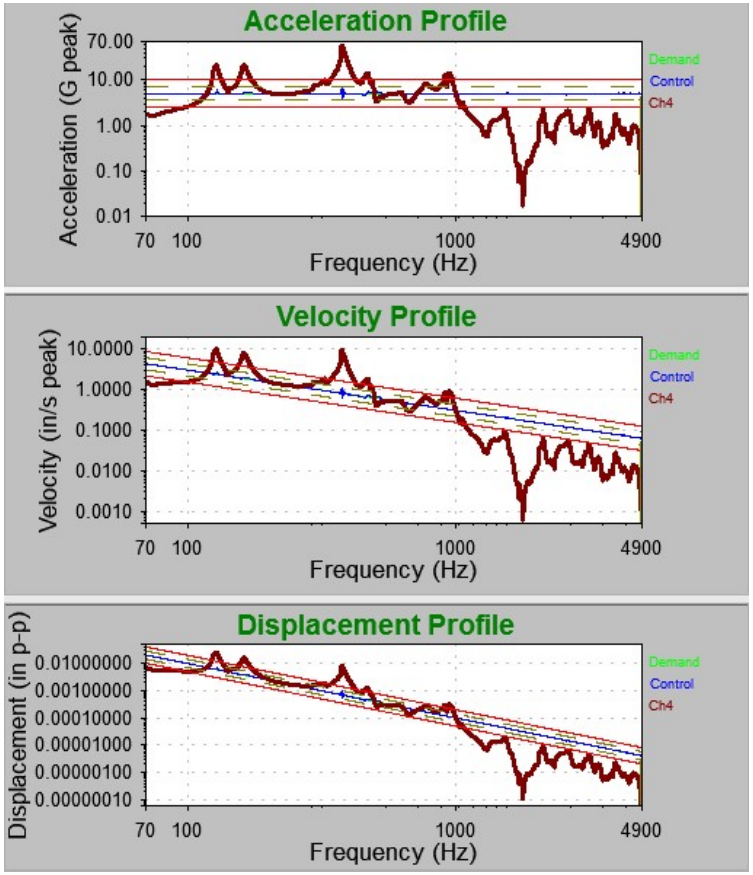
Sine Testing - Parameters

- Sine Testing Parameters
  - Acceleration
    - G's
  - Velocity
    - in/s or mm/s
  - Displacement
    - in or mm (pk to pk)
  - Frequency
    - Hz



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Sine Testing - Parameters

- If 2 of the parameters are known, the others can be calculated
  - Acceleration (A)
  - Velocity (V)
  - Displacement (D)
  - Frequency (F)

$D = \frac{V}{\pi F}$	$= \frac{GA}{2\pi^2 F^2}$	$= \frac{2V^2}{GA}$
$V = \pi FD$	$= \frac{GA}{2\pi F}$	$= \sqrt{\frac{GAD}{2}}$
$A = \frac{2\pi^2 F^2 D}{G}$	$= \frac{2\pi FV}{G}$	$= \frac{2V^2}{GD}$
$F = \sqrt{\frac{GA}{2\pi^2 D}}$	$= \frac{V}{\pi D}$	$= \frac{GA}{2\pi V}$

- All parameters are related, a change will result in a proportional change in the remaining parameters.

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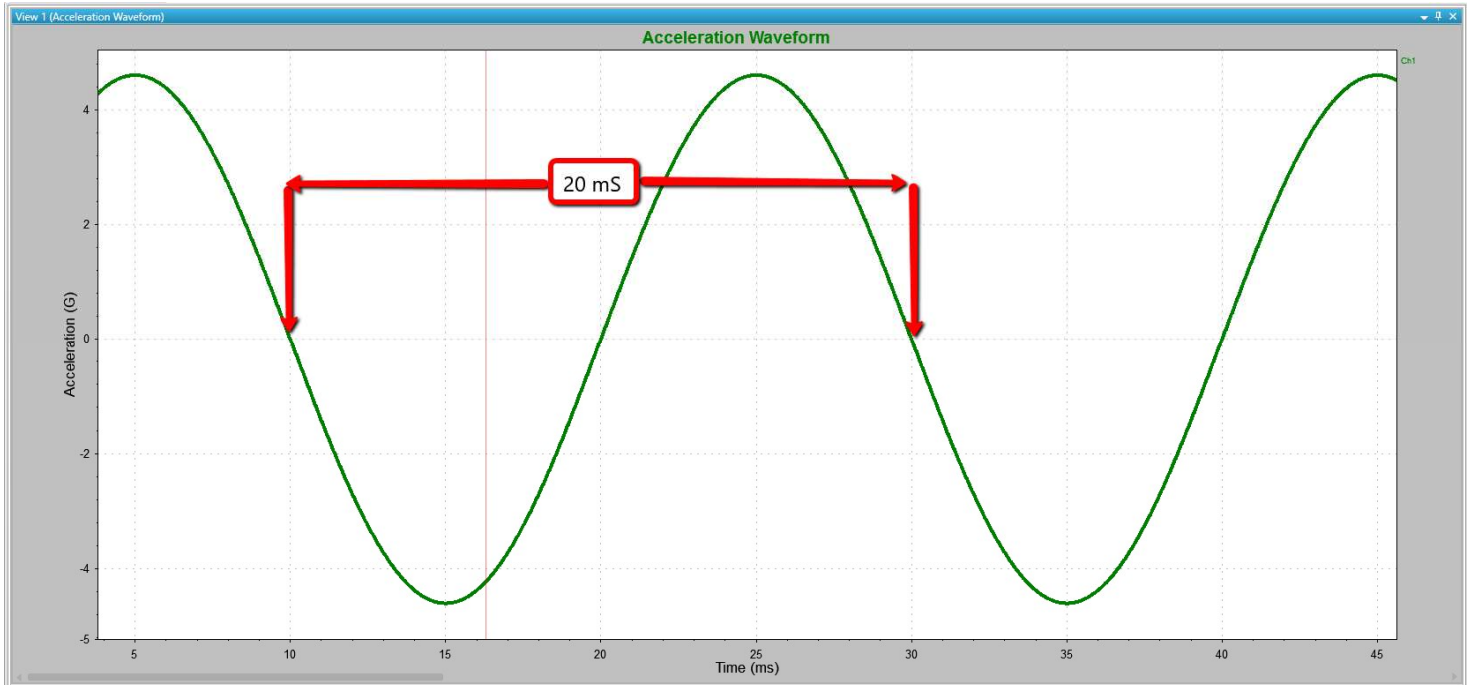
Sine Testing – Cycle Calculation

- Frequency of a sine wave is calculated by dividing 1 second by the time of the cycle



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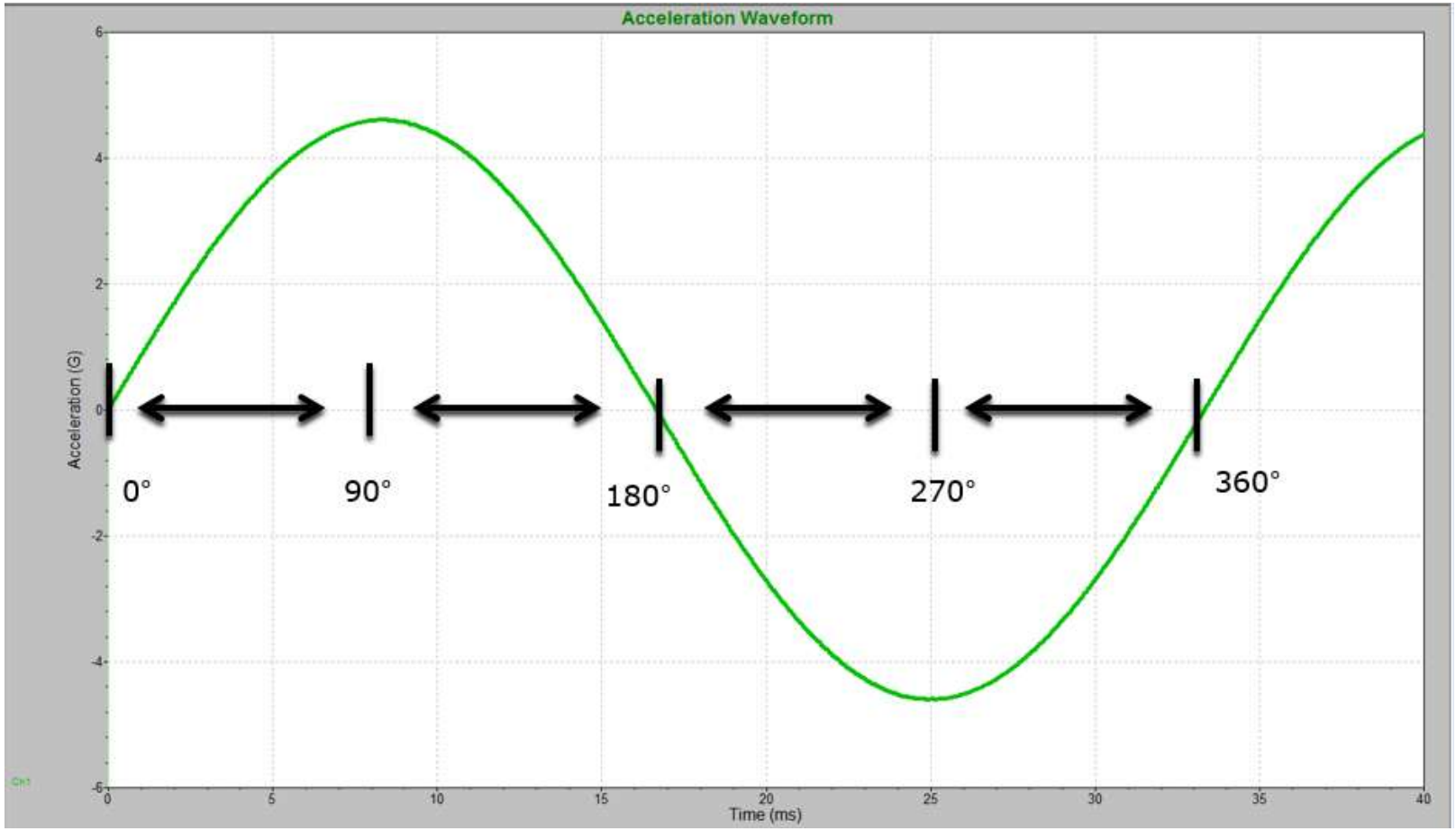
Sine Testing – Phase



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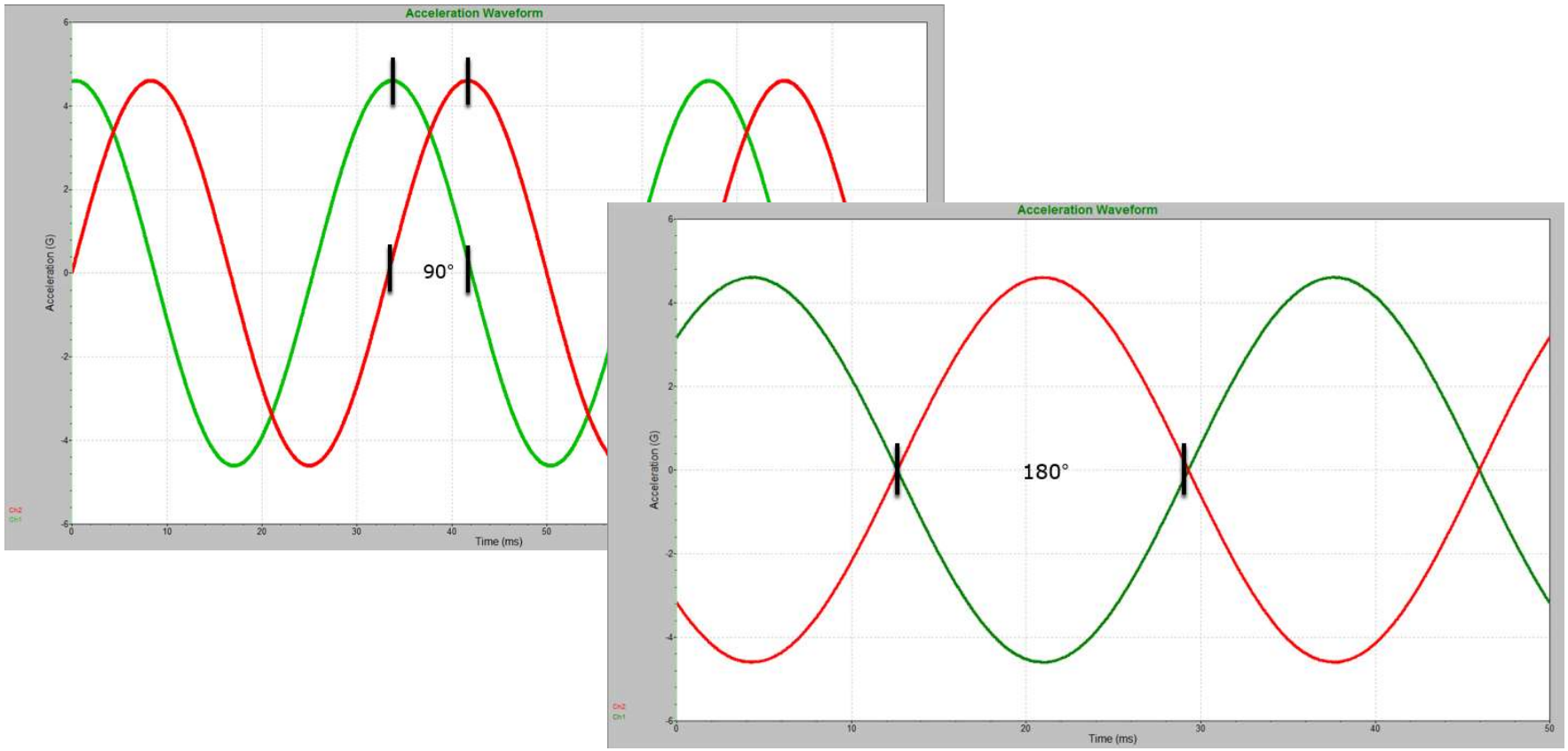
Sine Testing – Phase Relationship



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Sine Testing – Types of Tests

- Fixed Frequency (Dwell)
  - Constant Frequency and G, held for a specified amount of time or cycles
- Swept Frequency
  - Constant G level moving at a given sweep rate between frequencies for a specified number of sweeps or time
- Stepped Frequency
  - Constant G Level at differing fixed frequencies

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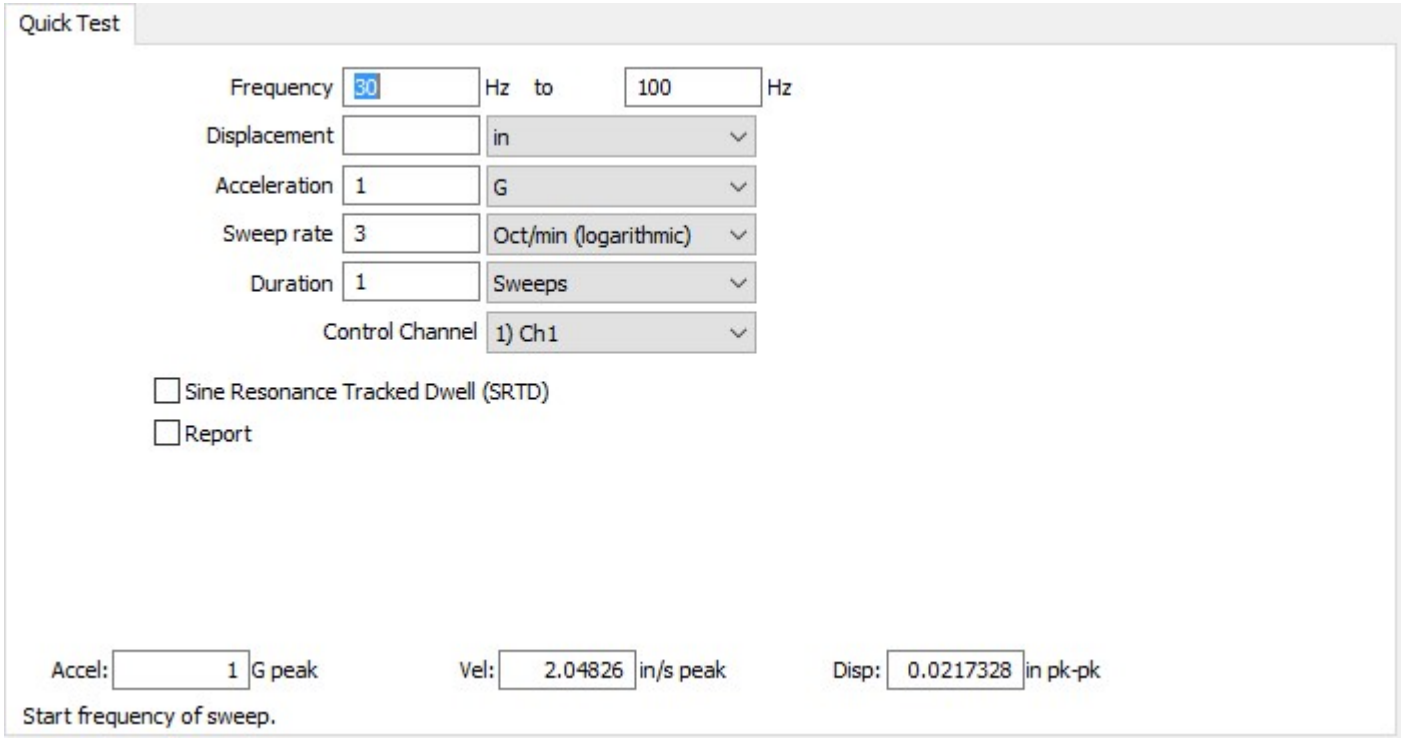
Sine Testing – Quick Test

- Quick Test Setup
  - New Test → Sine



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Sine Testing – Quick Test

- Quick Test Parameters
  - Frequency – Enter the Frequency value
  - Displacement AND/OR Acceleration must be entered
  - Sweep Rate
  - Duration
  - Control Channel
  - SRTD
  - Report

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Sine Testing – Battery Spec

- Parameters provided by specification
  - The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 2000 Hz and back to 7 Hz traversed in 15 min
  - This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the DUT. One of the directions of vibration must be perpendicular to the terminal face
  - The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 G is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8G occurs (approximately 50 Hz). A peak acceleration of 8G is then maintained until the frequency is increased to 2000 Hz.

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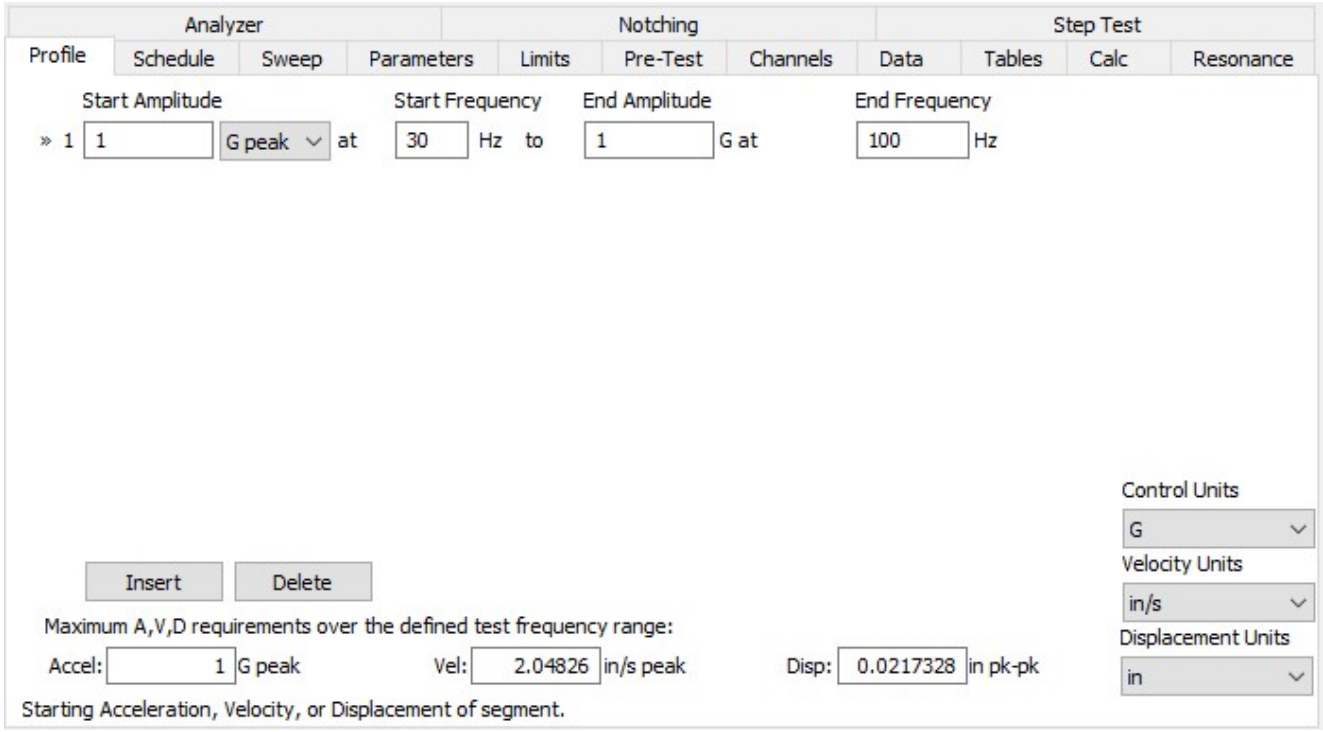
Sine Testing – Advanced Test

- Advanced Test Setup
  - New Test → Sine → Advanced



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Sine Testing – Advanced Test

- Profile Tab

	Start Amplitude			Start Frequency		End Amplitude		End Frequency	
1	1	G peak	at	30	Hz to	1	G at	100	Hz
2	1	G peak	at	100	Hz to	1	G at	200	Hz
3	1	G peak	at	200	Hz to	1	G at	500	Hz
» 4	1	G peak	at	500	Hz to	1	G at	1000	Hz

Insert Delete

Maximum A,V,D requirements over the defined test frequency range:

Accel: 1 G peak Vel: 2.04826 in/s peak Disp: 0.0217328 in pk-pk

Control Units: G

Velocity Units: in/s

Displacement Units: in

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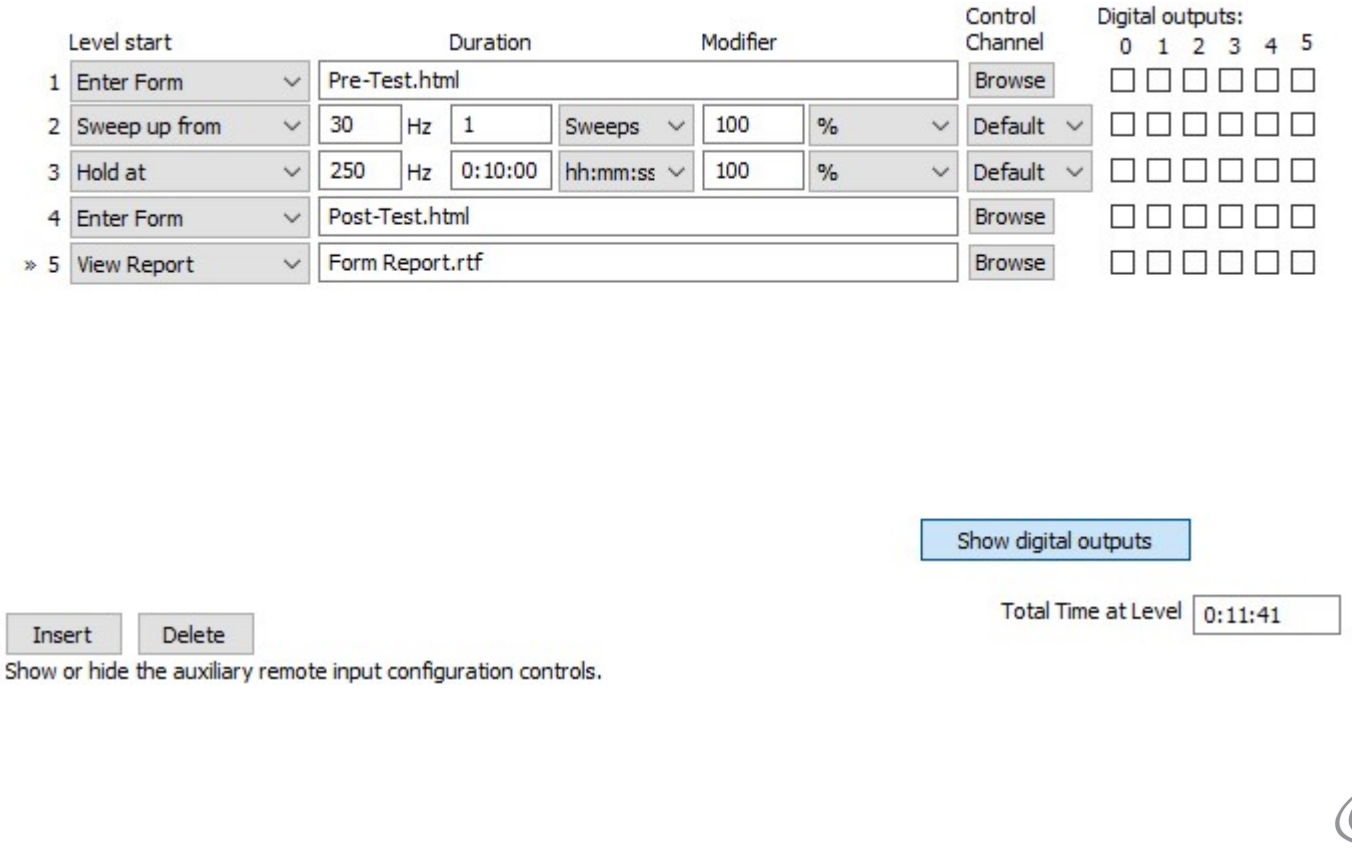
Sine Testing – Advanced Test

- Schedule Tab



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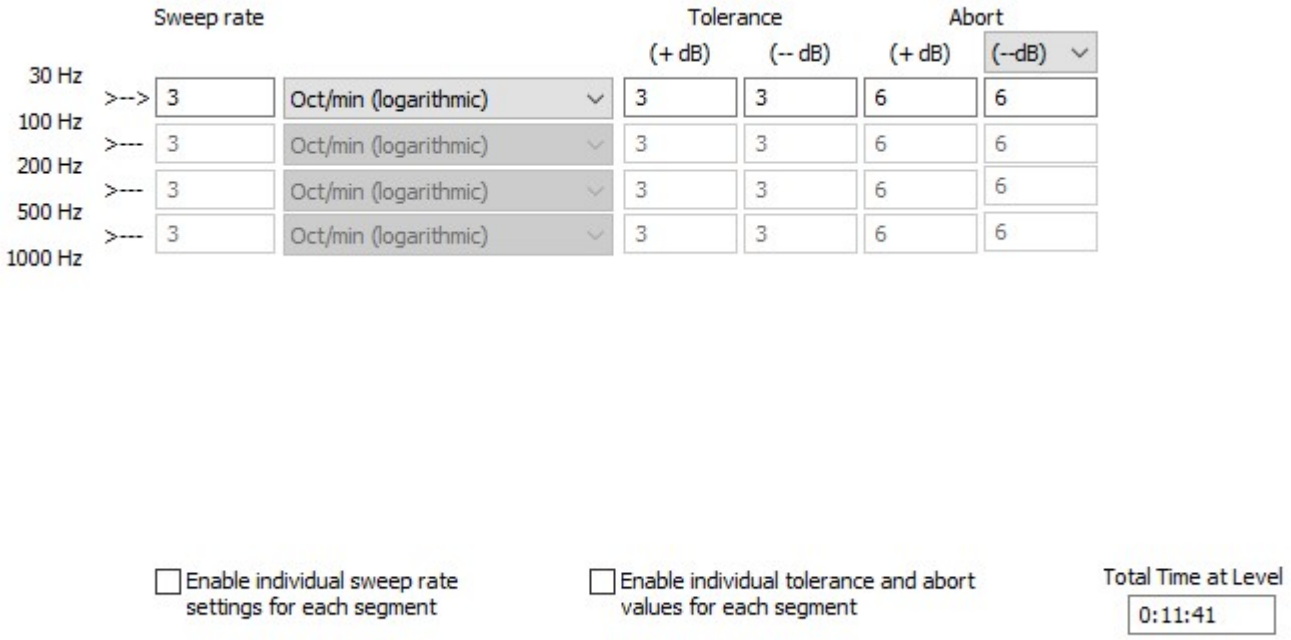
Sine Testing – Advanced Test

- Sweep Tab



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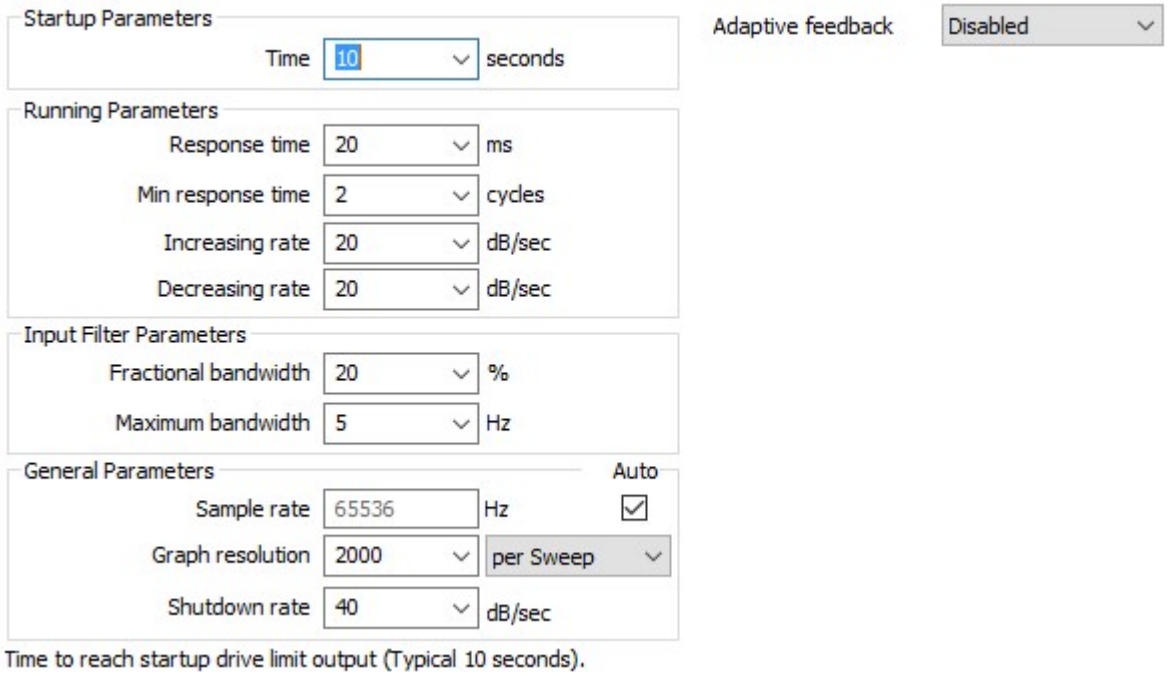
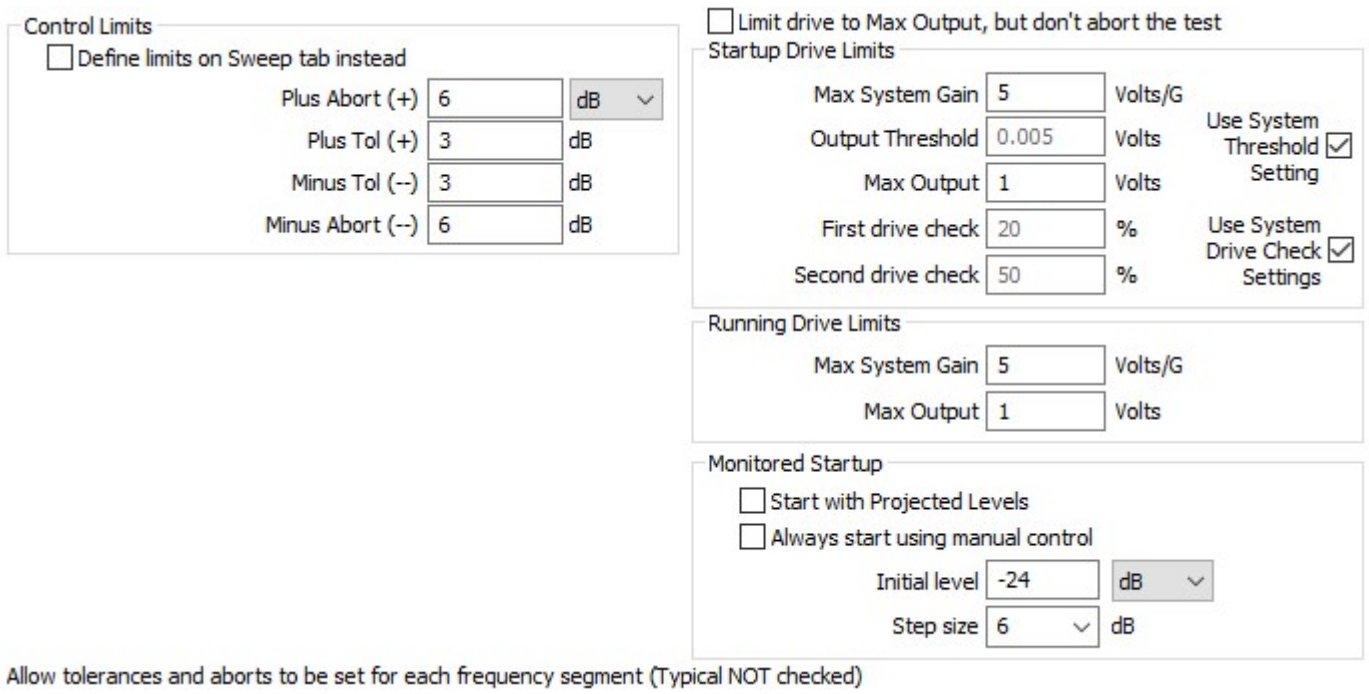
Sine Testing – Advanced Test

- Parameters Tab



Sine Testing – Advanced Test

- Limits Tab



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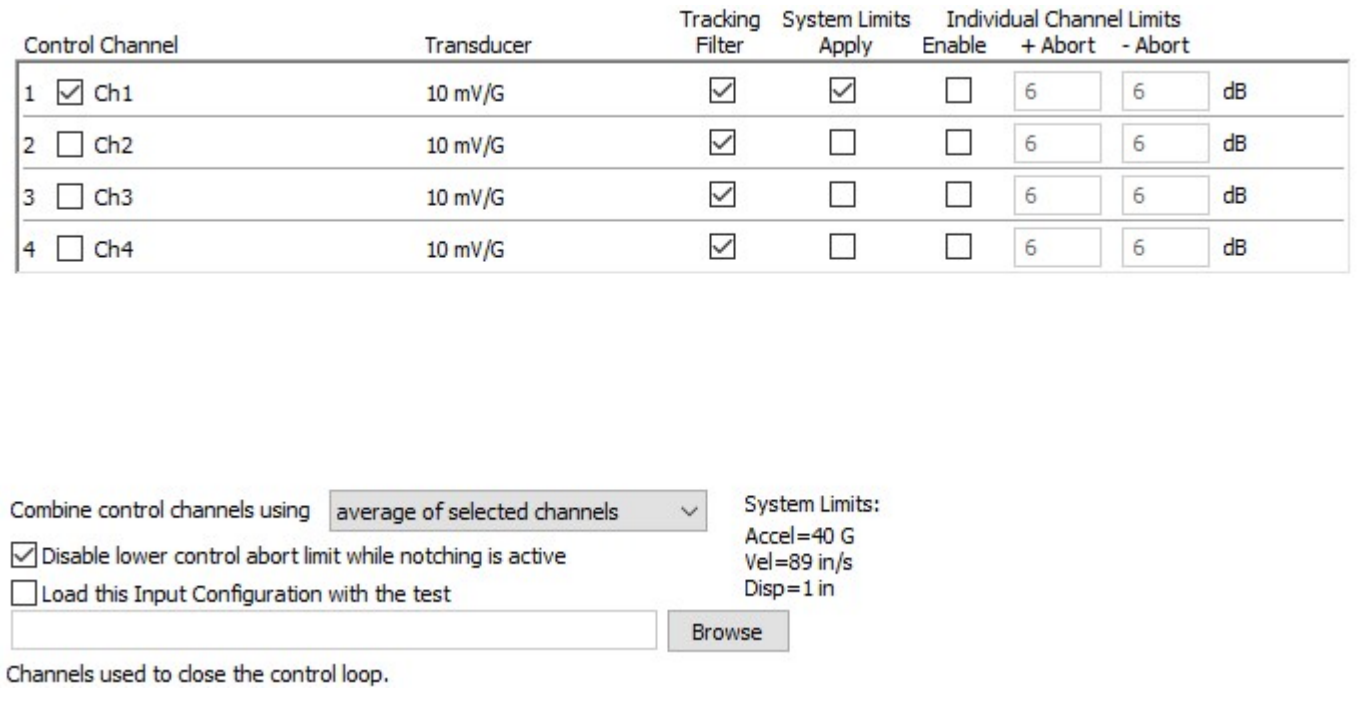
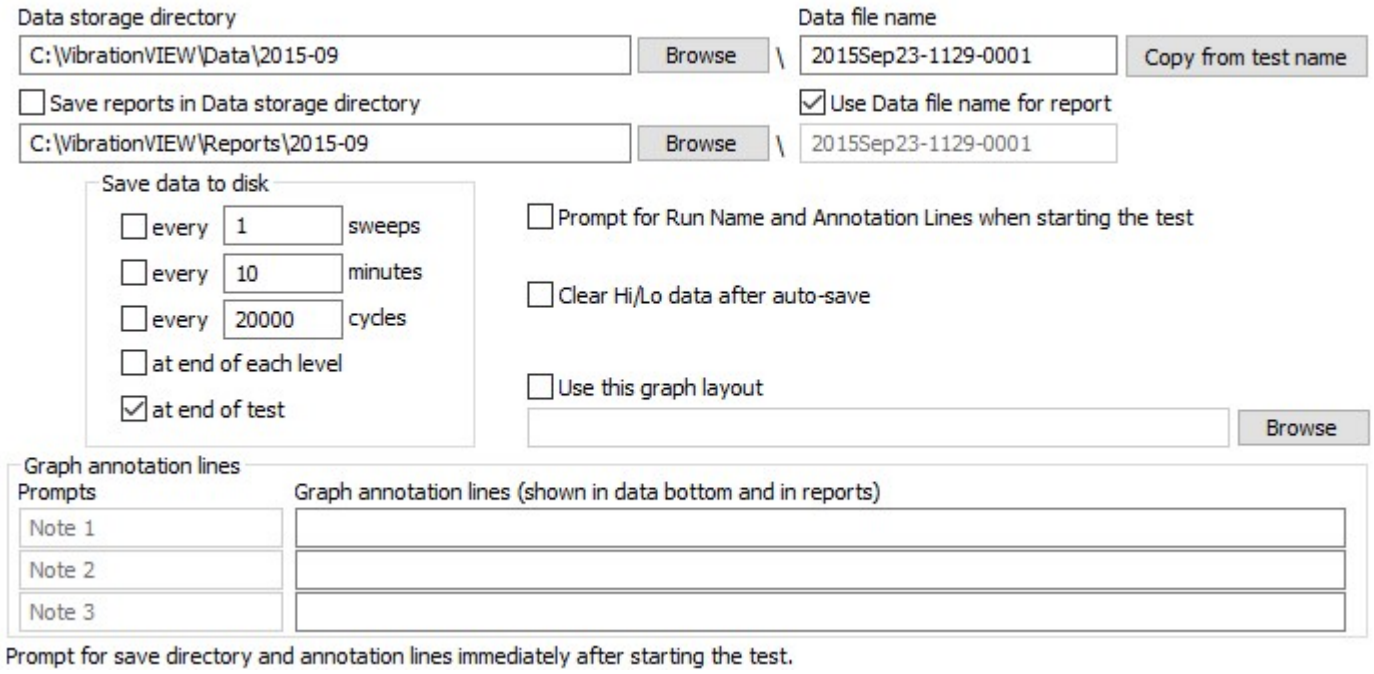
Sine Testing – Advanced Test

- Channels Tab



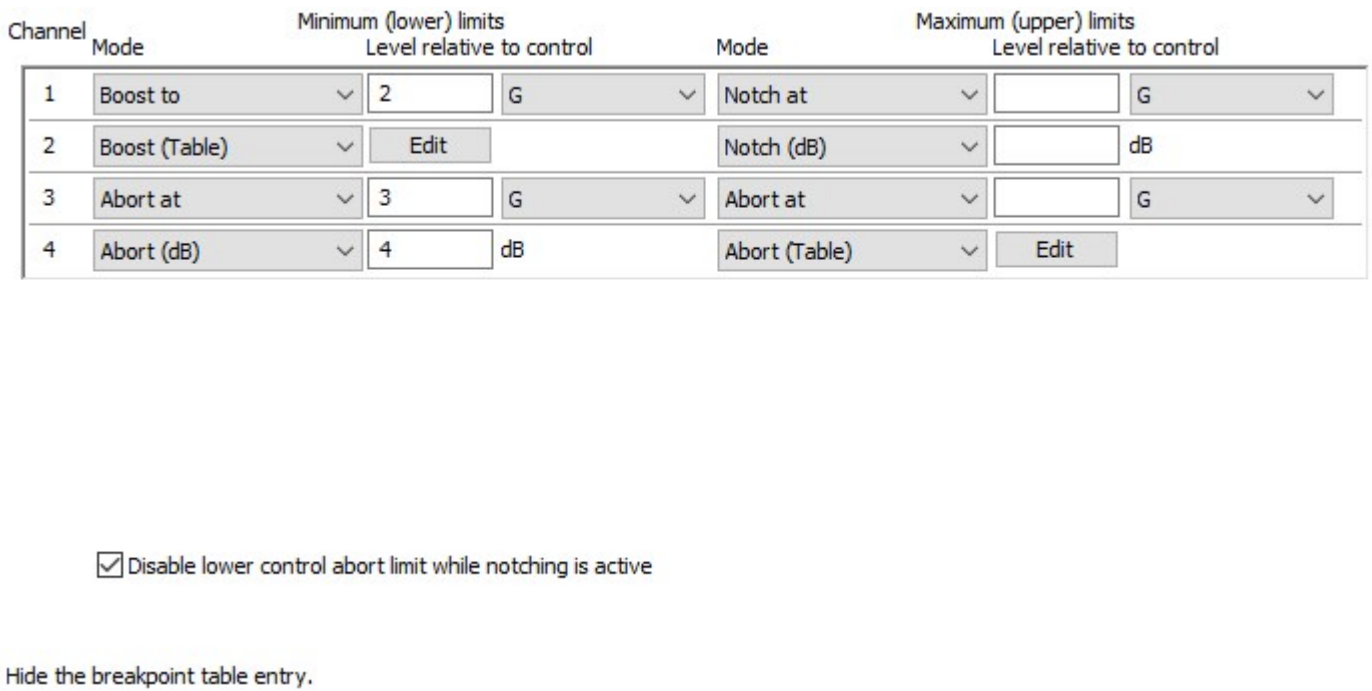
Sine Testing – Advanced Test

- Data Tab



Sine Testing – Advanced Test

- Notching Tab



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Sine Testing – Graphs

- Key Graphs:
  - Acceleration vs. Frequency
  - Velocity vs. Frequency
  - Displacement vs. Frequency
  - Output Drive vs. Frequency
  - Transmissibility
  - Time History Plots
  - Drive vs. Input

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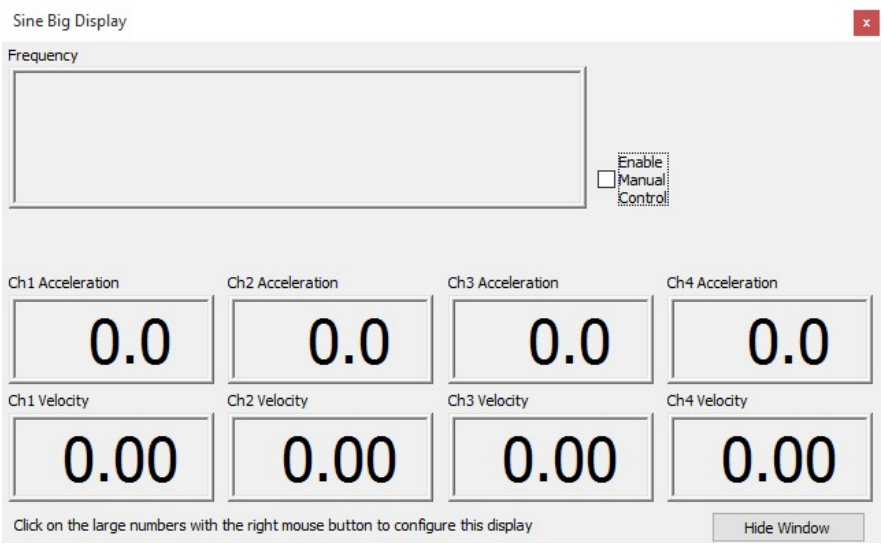
Sine Testing – Big Display

- Click on the View Tab → Select Sine Big Display
  - Enable manual control
  - After clicking on G-Level or Sweep Rate use the scroll wheel to adjust the rate
  - Right clicking on the bottom displays allow for selection of channels and functions



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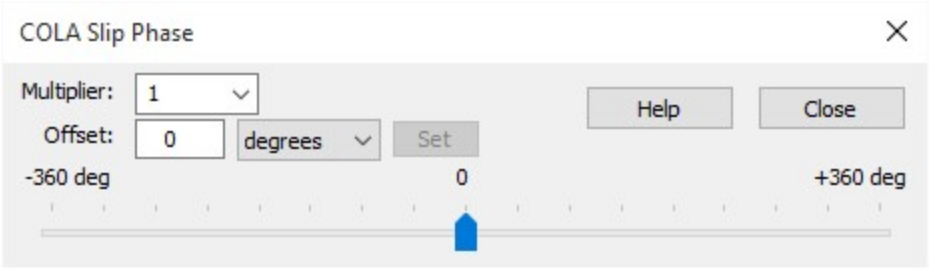
Sine Testing – Strobe Light

- View → Sine COLA Slip
  - COLA output gives a ref sine wave at 1V pk (user configurable) to synchronize your strobe signal.



Sine Testing – Conclusion

- Introduction to Sine Testing
- Creating Tests
  - Quick Test Setup
  - Advanced Test Setup (Battery Specification)
  - Key Graphs
  - Notching
- Sine Big Display
- Using a Strobe Light

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Thank You for Attending!

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