VCS Swept Sine Testing

Create New Test

To create a new test, first open up EDM. On the VCS Start Page, select **Swept Sine** under the **Create a test** tab.

EDM Spider-VCS Start Page			? ×
CRYSTAL Engineerin	g Data Manage	ement Syste	m
• • • • • • • • • • • • • • • • • • •			11.1.0.15
Recent tests		Account logi	in
Open Test 1. RandomTest [Random]	Account Password:	Admin	
	🔲 Keep me logged in		Please login to VCS.
Create a test		Spider connection	n status
A Random	(No Spider found that match	nes with any in the lice	ense keys.)
Sine on Random Random on Random SROR Acoustic Control MIMO Random MESA RORSOR MDOF Random Swept Sine Resonance search and tracked dwell Multi Sine Sine Oscillator Sine Reduction			
Blade Fatique Test Resonance Search MIMO Sine MDOF Sine	Detect more Spiders		Do not show this start page
Classical Shock <u>Transient Time History Control</u> <u>SRS</u> <u>Earthquake</u> <u>Transient Random</u> <u>Sine Beat Seismic</u> <u>Crash Control</u> <u>MIMO Shock</u> <u>MIMO TTH</u> <u>MIMO SRS</u> <u>Time waveform replication</u> <u>MIMO TWR</u>			COCCO-80X/90X Madela Reserver. Dysamit Signal Analyse A,6,8/16 input Channels p* Chancels Wi-Fi & Chancels CAN-BUS

The New Test Wizard will now open up. From here, select Swept Sine again and then press Next.

? ×

New Test Wizard

Select test type This test will be applied to the configured default system

	Vibration	Control (VCS)	MIMO Vibration Control	All Templates
\diamond	Random	Swent sine control full version (Si	- Controll	
\diamond	Sine on Random Random on Random	Channels: 8 Frequency range: up to 46kHz The computation: Eachied	e controly	
\diamond	Swept Sine	Long waveform recording: Enabled Sine drive limiting: Enabled	ed	
\diamond	Resonance Search and Dwell	Step sine control: Enabled		
\bigcirc	Multi Sine	Advanced functions: • Resonance search and tracked d	well: Enabled	
\diamond	Sine Oscillator (Sweep Sine FRF)	If resonance search and tracked d	well is enabled, RSTD or RET tests	
\bigcirc	Shutdown System (with tracking filters)	use the tabs of the left to create		
\diamond	Classical Shock			
\odot	Transient Time History			
\diamond	Crash Control			
\bigcirc	Sine Beat Seismic			
Θ	Transient Random	Advanced notching/limiting fur	ction with predictive adjustment, use random pretest	
\diamond	Shock Response Spectrum Synthesis	Advanced notching/limiting fur	ction with predictive adjustment, without random pretest	
	**	Use hydraulic shaker table with	large displacement	
				< Back Next > Cancel

Finally, give the test a name and select the Spider system that will be used to run the test. Once all is complete, press **Create**.

New Test Wi	zard			?	×
Fill in the l Note: you	pasic information for t will be able to search fo	h is test r this test by "Test name" or "Test description".			
Create a nev	v Swept Sine test: Sine				
Test name:	\$ineTest		Append the sequence number		
Test descrip	tion:				
	defenda liberarian ef ab e				
 Use the 	default libraries of the	previous test of the same type. If default libraries were not app	lied before the manufacturing settings will be used.		
O Create	test by using a template	L			
Select	Template name	Description			
	SYS 2597504				
Spider syste	C:\Users\Drew\D	ocuments/EDM/demo/SineTect	Channel		
Test directo		ocuments/com/demo/sine iest	unoose		
Create ne	w run tolder for each ru	in			
			< Back	Create test Can	cel

Test Configuration

The test will now need to be configured to run. This includes inputting information regarding the shaker, creating the schedule for the test to follow, and determining the parameters for the frequency analysis. To access the **Test Configuration** menu, press the **Config** button that can be found on the right side of the screen.



Shaker Parameters

Click on **Edit Parameters** and enter the information from the shaker specifications. This is important for the safety of the shaker and testing unit.

vcs:sine

Shaker Limits				? ×
Shaker details				
Manufacturer	Anonymous		Shaker name Default Shaker	
Force and acce	leration			
Random Max.	Force RMS (LBF)	100.022	Random Max. Acc. RMS (g)	16.66667
Sine Max. Force	e Peak (LBF)	2205.866	Sine Max. Acc. Peak (g)	75
Shock Max. Fo	rce Peak (LBF)	100.022	Shock Max. Acc. Peak (g)	50 🗘
Displacement -				
Max. positive d	displacement (mm)	6.35	Max. negative displacement (mm)	6.35 ≑
General setting	gs			
Max. drive volt	tage peak (V)	10-	Max. velocity (m/s)	1.778
Min. drive freq	uency (Hz)	1 -	Max. drive frequency (Hz)	2500 🗘
Shaker orientat	tion	Vertical 🔹		
Shaker moving	mass —			
Armature mass	; (Ib)	0.4409245	Header expander (Ib) 🧵	0
Slip table (lb)	н	0 *	Drive bar (lb) \leftrightarrow	0
Cale acc u	cing force			
Note: the Park	and Mars can be entered in	the chalker parameters page	Actual acceleration limits used in each t	tect will be re-adjusted by
following factor	n n	the shaker parameters page.	Actual acceleration limits used in each	lest will be re-adjusted by
Actual Acc. = Max. drive fre	Min(Shaker param. force / (A guency should not be set to	Armature mass + Payload mas to high, the recommended ra	ss + other mass), Shaker param. acc.) nge within 10240 Hz.	
				OK <u>C</u> ancel

Test Parameters

The **Test parameters** section in the **Test Configuration** window has settings for the analysis parameters, abort sensitivities and control strategy.

G Test Configurations for SineTest [[Swept Sine]						?	×	
Shaker parameters «	Shaker information								
Shaker parameters									
Test parameters	Manufacturer Anonymous								
Test profile	Shaker name	Default	Shaker						
Check against shaker	Payload mass		0.22046	Б					
Run schedule	Eisture marr			ii Tas					
Limit channels	rixture mass		0	1 10					
Event actions	Actual shaker limits used in t	his test							
File directory	Eorra pask		2205.0	1.00					
Save/Recording setup	Force peak		2205.9	LDF	•				
Output settings	Acceleration peak		75	9	S				
	Max. velocity		1.778	m/s	0				
	Max. positive displacement		6.35	mm	0				
	Max. negative displacement		6.35	mm	0				
	Shaker orientation		Vertical						
	Max. drive voltage peak		10	٧					
	Min. drive frequency		1	Hz					
	Max. drive frequency		2500	Hz					
	Shaker moving mass		0.44092	lb					
	Note: The parameters listed above are for reference only. Click "Edit parameters" to view or edit shaker parameters. The acceleration limit is adjusted by the following factor: Actual Acc. = Min(Shaker param. Force / (Armature mass + Payload mass + other mass), Shaker param. Acc.) Max. drive frequency should not be set too high, the recommended range within 10240 Hz.								
	Edit parameters								
	Load from library Save to libra	ary Impo	ort manufacturer shak	oer lis	t Export manufacturer shake	r list Import default librar	r		
Config. library						QK	Can	cel	

Control Strategy: Determines whether one or multiple control channels are used, and how the composite control signal is generated (if multiple channels are used).

Single channel	•
Single channel	
Weighted average	
Maximum	
Minimum	

Sweep Type: *Linear* or *Logarithmic*. When the Sweep Type is Linear, the Sweeping Speed is in the unit of *Hz/Min* (Hertz per minute); When the Sweep Type is Logarithmic, the Sweep Speed can be defined in unit of *Octave/Min* or *Decade/Min*.



Measurement Strategy: Defines how the sine waves are measured. The selections are: Filter, RMS, Mean and Peak. In a perfect world when the sine signals have no distortion, all the measurement strategies will generate the same results. When signals are distorted, the controller will generate different drive magnitude by selecting different Measurement Strategy.

Filter: Only measures the energy in control frequency, ignores harmonics. This tends to underestimate the control measurement and over-test the system. When Filter is selected, the measurement only takes the component at fundamental frequency into consideration while the energy out of band is ignored. The center of the filter follows the current sweeping frequency and Filter type and Bandwidth determine how the filter bandwidth is changing and the bandwidth, therefore, the filter is called tracking filter. When the filter type is *Proportional Filter*, the bandwidth is changing proportionally to the current sweeping frequency. When the filter type is *Fixed Filter*, the bandwidth is fixed regardless of the current sweeping frequency.

RMS: Calculates the total energy, including harmonics, by taking RMS in time domain (which is equivalent to RMS in frequency domain by Parseval's Theorem). During this, the RMS calculation is scaled by 1.4x to be consistent with other measurement strategies. The "frame size" of the RMS is inversely proportional to width of tracking filter.

Peak: Calculates the total energy, including harmonics, by taking Peak in time domain. This tends to over-estimate the control measurement, and under-test the system, because it is possible for many sine components to peak at the same time which results in an inflated estimate.

Mean: Similar to RMS, except we take absolute value of all points in time domain and then calculate the mean.

Measurement strategy:	Filter 🔹
	Filter
	RMS
Filter type	Mean
Proportional Filter	Peak

Test Profile

The test profile is defined in the Test Profile section of the Test Configuration window. A graphical preview of the profile plot is displayed above, with a breakpoint table below for entering the profile. CSV import / export is also supported as an alternative to profile editing.

G Test Configurations for SineTest	[Swept Si	ine]								?	×
Test profile «	Peak	1 g Scale	profile		🔲 Sho	w shaker limits				Acc/Vel/Dis	pl +
Shaker parameters Test parameters Test profile	1	LppMag g							,		
Check against shaker Run schedule Limit channels Event actions	0.1	4.5	s 10 100 Delete mw Annend mw Clear table Fill v Import/Evont profile v Edit Table v V svis LogMag								y (Hz) = 2200
Save/Recording setup	Insert r	w Delete row Append row Clear table Fill * Import/Export profile * Edit Table * Y axis LogMag *									
Output settings	 1 2 3 	Frequency Hz 5 15.7609 2000	Acceleration 9 0.100642 1	Velocity m/s 0.0314159 0.0990284	Displacement mm (pk-pk) 2 2 0.000124203	Segment type Log-Lo V Const V	High abort dB 6 6	High alarm dB 3 3 3	Low alarm dB -3 -3 -3	Low abort dB -6 -6 -6	
	Limits 1 To calc	format dB ulate the cross om library] [Sa	-over point aut] Tole	rances Enter *?" in any	break point lin	е.				
Config. library •									<u>0</u> K	Çar	cel

Breakpoint Table: Breakpoints can be added via **Insert row**, **Delete row** and **Append row**. Use **Clear table** to clear out all rows except for the first and last row.

Ins	Insert row Delete row Append row Clear table Fill + Import/Export profile + Edit Table + Y axis LogMag +										
		Frequency Hz	Acceleration 9	Velocity m/s	Displacement mm (pk-pk)	Segment type	High abort dB	High alarm dB	Low alarm dB	Low abort dB	
Þ.	1	5	0.100642	0.0314159	2		6	3	-3	-6	
						Log-Lo 🗸					
	2	15.7609	1	0.0990284	2		6	3	-3	-6	
						Const V					
	3	2000	1	0.00078	0.000124203		6	3	-3	-6	

Breakpoint Calculation: In the profile editor, EDM can calculate the crossover point given a specified slope and point value. If a '?' is entered as a Frequency or Amplitude value, EDM will interpolate that value given the slope before and after that point.

		Frequency Hz	Acceleration 9	Velocity m/s		Displaceme mm (pk-pk	nt)	Segment type		
	1	5	0.100642	0.0314159		2				
								Const. Acc. Ampl.	~	/
1	2	15.7609	?	0.0990284		2				
								Const. Ampl.	~	
	3	2000	1	0.00078038	38	0.000124203				
		Frequency Hz	Acceleration g	Velocity m/s	D	isplacement nm (pk-pk)	Se	gment type		
	1	5	0.100642	0.0314159	2					
							Co	nst. Acc. Ampl.	\sim	
	2	15.7609	0.100642	0.00996641	0.	201283				
Þ.							Lo	g-Log Const. Slope	\sim	
	3	2000	1	0.000780388	0.	000124203				

Check Against Shaker

This tab gives the user an indication of the percentage of the shaker performance would be required during full level test, using the defined profile. The profile and alarm/abort signals are plotted above, while the peak values per current profile and the shaker limits are listed underneath. The percentage

value of Profile/Shaker limits provides the user the information about what level the shaker will work per current profile.

G Test Configurations for SineTest	[Swept Sine]					?	×
Check against shaker «	Peak: 1 g Scale profile	🛅 S	how shaker limits		Acc/\	/el/Displ	-
Shaker parameters	LogMag g		1		-		
Test parameters							1
Test profile	1 -					_	
Check against shaker							
Run schedule	0.1						1
Limit channels	0.01				, n	equency ()	(z) =
Event actions	4.5 10		100		1000	2	200
File directory	L		4 ······ 4	0 (1 (2))	_		=
Save/Recording setup	Physical quantity	Max. profile value	Shaker limits	Profile/Shaker limits			
Output settings	Acceleration (g)	1 (Peak)	75 (Peak)	1.3%			
	Peak Velocity(m/s)	0.031416	1.778 (Peak)	1.8%			
	Peak-Peak Displacement(mm)	2	12.7 (Pk-Pk)	15.7%			
	Peak Force(LBF)	0.66139	2205.9 (Peak)	0.0%			
	Load from library Save to library						
Config. library •				<u>0</u> K		Cancel	

Run Schedule

The Run Schedule sets the sequence of test stages that will be executed when the test is run.



Sweep Entry: The Sweep entry types can be either a fixed frequency range at a fixed sweeping speed, or over a fixed time. Fill in the fields Time per sweep or Sweep speed according to the display: the other field will be shown with the calculated value. Selecting Test Profile (up) will begin from the lowest frequency and go towards the highest frequency, as defined by the Test Profile. Selecting Test Profile (down) will begin from the highest frequency and go towards the lowest frequency. Choosing Custom will allow to manually pick and decide the start and stop frequencies.

Sweep Entry							>	×
Level (%):	100.00							
Sweep range —								
• Test profile (up)	Test profile (down) OCustom						
Left frequency (Hz)	5	Right frequency	(Hz):	2000 🔹				
Start frequency (Hz): 5	Initial sweep dire	ection: Up	*				
Sweep rate								
Time per sweep	Sweep speed							
Time per sweep:	0000: 08:	38 (HH:MM:SS)	Sweep speed:		1 🗘 ((Oct/Min)		
Sweep#:	2		Total time:	0000:	17:	17 (HH:MM:SS)		
Total sine cycles:	345381.2							
Hold sweep after	r target level reached.							
						<u>0</u> K	<u>C</u> ance	

Input Channels

The input channels will now need to be set up. All sensors will to be properly configured before testing. The **Input Channels** menu can be found through **Setup** \rightarrow **Input Channels**.



Channel Type

Control vs. Monitor. When running a test, there will need to be at least one control sensor. The

control sensor is used to monitor the actual vibration levels that the shaker is producing. It then sends this data to the controller so that it maintains the targeted profile. This sensor should be mounted somewhere on the shaker/slip table itself, not the Device Under Test (DUT). Monitor sensors will show the levels that the DUT itself is experiencing.

On/Off	Channel type	Location ID
🔽 On	Control 🗸	Ch1
🔽 On	Monitor 🗸	Ch2
Off	Monitor 🗸 🗸	Ch3
Off	Monitor 🗸 🗸	Ch4
Off	Monitor 🗸 🗸	Ch5
Off	Monitor 🗸 🗸	Ch6
Off	Monitor	Ch7
Off	Monitor	Ch8

Measurement Quantity

Defines the physical unit that will be measured by the sensor connected to the channel.

Measurement quantity Acceleration Acceleration Velocity Displacement Pressure Force Voltage Current Sound Pressure Time Frequency Angular Acceleratio Angular Velocity MASS Angle Moment Strain Temperature Resistance Humidity

Sensitivity

Sets the proportionality factor for the measurement (millivolts per engineering unit) given as a parameter of the sensor.**Input Mode**

There are five modes in which the inputs can operate:

DC-Differential- In the DC-Differential mode, neither of the input connections is referenced to the local ground. The input is taken as the potential difference between the two input terminals, and any potential in common with both terminals is canceled out. The Common Mode Voltage (CMV) will be rejected as long as the overall input voltage level does not saturate the input gain stage. Beware that very high CMV will cause clipping and may damage the input circuitry. Signals with a nonzero mean (DC component) can be measured in this mode.

DC-Single End- In single-ended mode, one of the input terminals is grounded and the input is taken as the potential difference of the center terminal with respect to this ground. Use this mode when the input needs to be grounded to reduce EMI noise or static buildup. Do not use this mode when the signal source is ground referenced or ground loop interference may result. This mode also allows signals with a non-zero mean to be measured.

AC-Differential- AC-Differential is a differential input mode that applies a low-frequency high-pass (DC-

blocking) analog filter to the input. It rejects common mode signals and DC components in the input signal. Use this when DC and low-frequency AC voltage measurements are not required or when a DC bias voltage is present. The analog high-pass filter has a cutoff frequency of -3dB at 0.3 Hz, and -0.1dB at 0.7 Hz for the IEPE input mode.

AC-Single End- AC-Single End grounds one of the input terminals and enables the DC-blocking analog filter. Use this mode for non-ground referenced sources where measuring the DC or low-frequency components are not required. It shares the same high-pass filter as that of AC-Differential.

IEPE (ICP)- All Crystal Instruments products support IEPE (Integral Electronic PiezoElectric) constant current output type input channels. IEPE refers to a class of transducers that are packaged with built-in voltage amplifiers powered by a constant current. These circuits are powered by a 4 mA constant current source at roughly 21 Volts.

Charge- Some sensors provide a high-impedance charge output. Usually, these are high-sensitivity piezoelectric units that lack a built-in voltage mode amplifier (i.e. IEPE), allowing them to be used in high-temperature environments. The Spider-81 front-end module has a built-in charge amplifier that allows the system to read the output of these sensors

Sensitivity	Input mode	
100 (mV/g)	IEPE 🗸 🗸	
100 (mV/g)	IEPE 🗸 🗸	
100 (mV/g)	IEPE	
100 (mV/g)	DC-Single End	
100 (mV/g)	AC-Differential	
100 (mV/g)	In-Line Charge Convert External Charge Amplifi External Charge Amplifi AC-Single End	
100 (mV/g)		
100 (mV/g)		

Running the Test

Now that all of the parameters for the test have been setup, the test is ready to run. Here are the final steps to start the test.

- 1. Press the **Connect** button to connect to the controller.
- 2. Press the **Run** button.
- 3. The **Spider Check List** will now appear. Here you can check the settings of the test and verify that all is set up properly. Press **Start** once this has been verified.
- 4. The Pre-Test will now begin. This will verify that the control loop is properly established and provide data that the control loop needs.
- 5. The test is now running

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Last update: 2024/05/23 19:04