SignalStar Vibration Control Test Systems

What are SignalCalc and SignalStar?

SignalCalc is a family of products which includes :

- all four of the Data Physics Dynamic Signal Analyzers, ACE, SignalCalc 430, SignalCalc 620 and SignalCalc Mobilizer
- two vibration controllers, the SignalCalc 550 and the SignalCalc 350.

SignalStar is another family of products which includes :

- two state of the art Vibration Controllers – the single-axis SignalStar Vector and the multi-axis SignalStar Matrix.

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What is a Vibration Controller?

A Vibration Controller is a hardware/software product that generates one or more analog drive signals that are applied to a customers amplifier / shaker / test device for the purpose of creating a specified vibration environment at one or more points on a test device.

The vibration created must match some specified Reference Signal description.
This process requires two major activities :

- estimation of the transfer function of the amplifier / shaker / test device combination
- pre-distorting the drive signal according to the inverse of this transfer function. The pre-distortion step is ideally a continuous mathematical convolution operation, although some controllers approximate it by overlapping discontinuous blocks with windows.

Closed loop control is used because the behavior of the systems controlled is typically non-linear and non-stationary, and usually both the test object and shaker require some sort of protection against excessive force, displacement, or acceleration as the various system resonances are excited.

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What is continuous convolution, and why should I care?

The most general description of the output y(t) of any Linear System is given by the mathematical integral of h(t)x(t-T) dT, often written as h(t)*x(t), where h(t) is the impulse response of the system, x(t) is the input to the system, and "*" is the convolution operator. We can use this terminology to describe the activity of vibration control by considering the amplifier / shaker / test object to be our "system". Then vibration control is seen to involve two separate steps: the first is to determine h(t) and the second is to calculate the drive x(t) = hInverse(t)*r(t). It is easy to see that this particular drive signal x(t) will cause the system response y(t) to be equal to h(t) * hInverse(t) * r(t). Since h (t)*hInverse(t) equals 1, the control signal y(t) will match the reference signal r(t), just as desired. Note that no windowing is required (unlike the time domain randomization approximation approach), thus no blurring of the drive frequency spectrum occurs. This has two benefits: the controller can maintain control of much higher-Q resonances, and can adapt much more quickly to changes in the system.

What Reference Signals can a Data Physics Vibration Controller use?

All kinds, including Power Spectral Densities PSD(f), sine amplitude profiles A(f), classical shocks such as half-sine and trapezoid, Shock Response Spectra SRS(f) and time waveforms r(t). Mixed Mode Applications (e.g. Sine on Random, SOR, or

Random on Random, ROR) use a combination of these references. All of these applications include the ability to follow a level schedule. Multi-axis references include the ability to specify cross-axis properties, such as correlation, coherence and phase.

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What is Multi-Axis control?

A complete description of a vibration environment involves simultaneous motion in more than one direction. In fact, the most general description of motion of a body at a point in space, involves 6 independently specified motions (called mechanical Degrees of Freedom, DOF): X, Y, Z, ThetaX, ThetaY and ThetaZ. A full road simulation of a vehicle involves 6 DOF excitation at each wheel.

Other applications of Multi-Axis control include :

- ganging multiple shakers to excite a very large test object
- and phased excitation of multiple shakers to isolate Normal Modes within the system response.

The SignalStar Matrix vibration controller offers complete Single and Multi-Axis control.

How many channels can I use?

This depends on the hardware platform associated with the product :

- for the SignalStar Matrix vibration controller and he SignalCalc 620 DSA, the Agilent VXI platform scales to an unlimited number of channels.
- The SignalCalc SignalStar Vector vibration controller and Mobilyzer DSA support up to 16 input channels and 8 sources.
- The ultra-portable SignalCalc ACE DSA supports 2 input channels and 2 sources.

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Who is Agilent and what happened to your HP VXI modules?

The Hewlett Packard Company recently split into two separate operating companies to provide better focused service delivery. Computers, printers, and peripherals continue under the Hewlett Packard banner while the instruments that built the company to its preeminent position are now marketed under the new Agilent brand. Agilent manufactures, sells and services all of the fine HP instruments developed before the name change and continues to improve and evolve these offerings.

Agilent is our choice for the highest quality VXI measurement modules and mainframes used in the SignalCalc 620 analyzer and SignalCalc Matrix controller. We are proud of our continued Channel Partner relationship with Agilent and the fine HP engineers and technicians who have been our old friends for years.

Can I perform a 30g 11msec halfsine shock on my shaker which has only a 1 inch total displacement range?

Yes, our standard compensation scheme (Minimum Displacement) when used with MIL810 tolerance limits will allow you to perform this test using only about 0.7 IDA.

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What type of shakers can be used with DP Vibration Controllers?

DP Vibration Controllers run on all types of shakers, including electrodynamic and hydraulic shakers, very small and very large shakers, single-axis and multi-axis shakers. Our controllers are equally at home with 3lbf modal shakers and 30 Ton exciters. We have recently introduced our own line of shakers and can now supply the entire system for your test. Click here to learn more about DP shakers.

If you cannot find your answer please click here to fill our Technical Support Request Form. Your questions and suggestions are welcome.