

VR9500

# Take Control

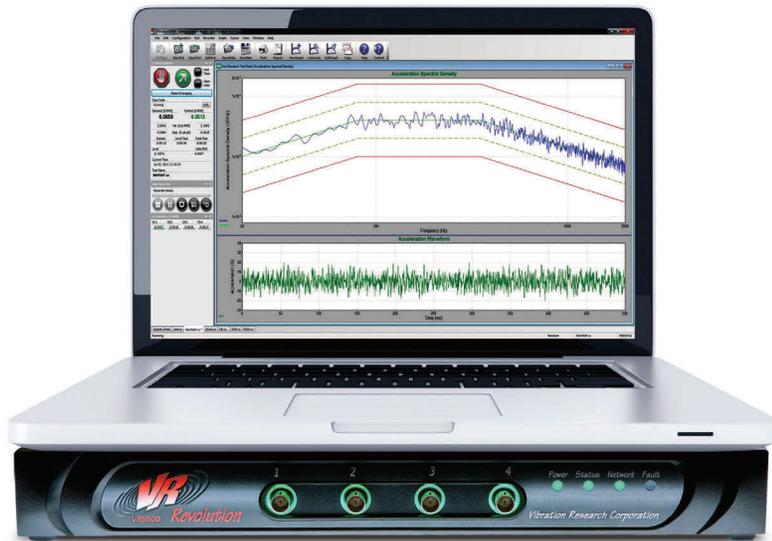
...with the industry's best controller.



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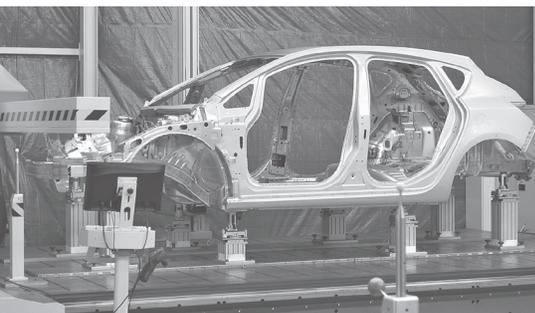
## Vibration Research

Since the company formed in 1995, Vibration Research has been considered a pioneer and leader in the field of vibration control by providing customers with state-of-the-art technology.

Our success is based on designing and engineering the industry's best controller. Our reputation for quality and superior performance is foundational in our delivery of a user-friendly, reliable product.

Our team includes engineers and technicians experienced in the field of vibration testing, and has provided solutions to end users in the automotive, aerospace, defense, shipping, packaging, and medical fields, among others.

We pride ourselves on delivering superior customer service. Our team is ready to respond at any time to your questions or special requirements. Call us at 616-669-3028 to discuss how we can provide the right solution for you.



# VR9500



## Advantages

### PROVEN AND RELIABLE

#### Guaranteed Satisfaction and Reliability

Vibration Research controllers are specially designed and engineered for a high degree of reliability.

- All controllers have a three-year warranty that protects your investment and your testing environment.
- Every controller is individually tested before shipping.
- Controllers utilize a common hardware platform and built-in hardware self-diagnostics, making troubleshooting a snap.
- Vibration Research control systems do not require any special boards or special drivers in your PC. Use any PC in your lab or connect to your laptop. Simply plug in the Ethernet cable and begin testing.
- We listen to you. Ninety percent of our improvements are customer suggestions.

### USER FRIENDLY

#### Drag and Drop

With drag and drop capabilities, the VR9500 allows you to quickly load any test into Microsoft® Word or Microsoft Excel.

#### Ethernet Connection

Ethernet connection provides important advantages over USB or PCI-based systems:

- Ground loop isolation
- Cable length up to 100 meters
- No drivers to install

#### PC and Windows Integration

The VR9500 integrates seamlessly with your PC and Windows operating system, enabling you to leverage your knowledge and accelerate your learning curve. Simply connect the VR9500, load the VibrationVIEW software and you are ready to test.

#### Rack Mountable

The VR9500 is mountable in your amplifier rack, eliminating the need for long accelerometer and drive cables. Only a single Ethernet cable runs from the controller to the PC.

#### Reporting

All VR9500 systems include our full reporting package. Reports are highly presentable and sophisticated and can be created automatically as the final step in your test sequence. Use one of our report templates or create your own custom report with your company information and logo.

#### Templates

User-editable templates automatically enter important data and information into published reports such as technician, customer, time and date, test parameters and more.

#### 128 Available Inputs

The VR9500 is scalable from one to 128 channels. The modular design uses four-channel blocks that can be easily rack mounted or stacked on a desk.

#### Economic Solution

Each four-channel module can be used independently on separate shakers or linked into a single stack for those jobs that require a higher channel count. This economic solution can mean a substantial cost savings. Additional outputs and software may be required to control more than one shaker.

#### Web and Email Option

Allows for remote test initiation, monitoring and shut down from anywhere in the world.

#### Remote Interface

Gives you the freedom to use any tablet, phone, or mobile device to monitor and control your vibration test in front of your shaker or from anywhere in the world.

#### Shaker Compatibility

VibrationVIEW works with any electrodynamic, servo-hydraulic or servo-electric shaker and includes single axis, dual-axis, dual-phase, three-axis, multi-loop and seismic control options.

#### Easy Integration

Applications such as Microsoft Excel, LabVIEW, Matlab and more can easily interface by way of Active-X functions.

## ADVANCED FUNCTIONALITY

### Unparalleled Analysis

Our latest software release has even more analysis capabilities including cross spectrum, transfer functions, coherence and the ability to apply math functions to any graph trace.

### Test and Level Scheduling

Tests can be scheduled to run a user-defined length of time and the spectrum level can be scaled by a specified dB level, percentage or a specified RMS acceleration. Tests can be programmed to run for various periods at different intensity levels and amplitude levels can be changed while the test is running.

### Graphs

All packages share a common, easy-to-use graphing system. Graphs can be auto-scaled or zoomed. Graph images and raw data can be copied to any word processor or spreadsheet.

### Data Plots

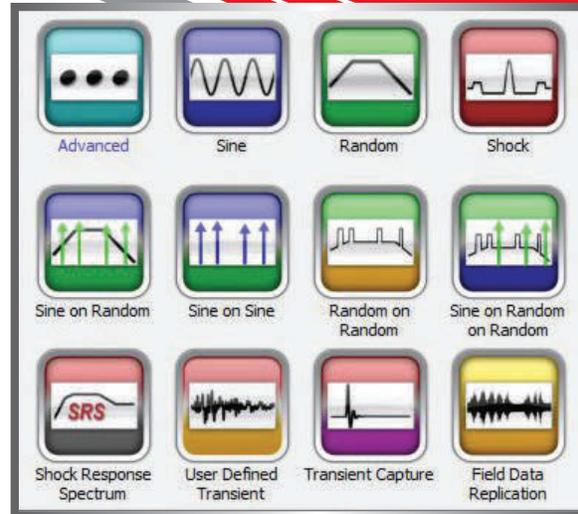
Many graphical display options are available including acceleration spectral density, output voltage spectral density and channel-to-channel transmissibility. Cursors can be used to locate peaks and highlight particular data points.

### Easy Test Entry

Frequency/amplitude breakpoints are in an easy-to-read table form. You can select to control constant or ramped acceleration, velocity or displacement. Automatically calculate and enter the frequency of intersection between any combination of constant acceleration, velocity or displacement lines. Up to 1,024 separate frequency/amplitude breakpoints can be entered.

### System Check

All VibrationVIEW software packages include a system check mode that provides manually controllable sine wave output and oscilloscope and spectrum analysis plots of the accelerometer inputs. This test mode is used to calibrate the system and verify operation of the controller, amplifier, shaker and accelerometers.



### Test Sequence

A test sequence provides the capability to automatically execute a sequence of tests. All of the tests may be the same type of application or you can switch modes as part of the test sequence.

### Data Storage

All of the test data can be stored to any disk, including network drives, for later retrieval. Data storage can be done manually or programmed to automatically save at user-defined intervals.

### Configurable Safety Limits

To protect your test article and shaker system, configurable acceleration limits, line limits and drive limits can be set by any user. The control input is also verified against shaker acceleration and displacement limits.

### Tracking Filters

Each input channel has the ability to enable/disable tracking filters. This allows you to remove harmonics and out-of-band noise from the measurements. The tracking filter bandwidth and signal averaging is user configurable.

### Hardware Features

The VR9500 Revolution control system uses state-of-the-art hardware:

- < -100dB THD+N 24-bit dynamic range
- Control Sine, Random or Shock Vibration to 50,000Hz
- Use an incredible 26,000 spectral lines – an industry maximum
- 24-bit dynamic range
- > 100dB random dynamic range
- > 130dB sine dynamic range
- > 140dBFS spurious-free dynamic range

## Support

At Vibration Research, we believe ongoing support is just as important as the initial installation. We include a three-year hardware warranty with every system. In addition, we include one year of unlimited factory support in order to make sure you are getting everything you need from your vibration control system. Our software provides context-sensitive help, which is a great place to explore the many features of our software.

We have also incorporated a very helpful tool into our software to assist with any support issues related to difficulty completing tests. In the help menu of VibrationVIEW is a selection titled “help with recent tests.” The last 50 tests run with VibrationVIEW are listed, and, with a simple selection, you can email to us or upload through our secure website, the complete data file for the test for which you would like assistance.

### We also provide additional support and training options

- Specific monthly web seminars
- One-on-one web training
- On-site training and support
- Two-day training seminars
- Vibration Research online web forums

### Upgrades and Support Agreements

We understand that technology changes. At Vibration Research, we strive to be part of that change. Our team of dedicated software engineers is driven to advance the vibration testing community by continually updating VibrationVIEW software, staying in step with current software trends, providing innovative solutions to your vibration testing requirements, and creating new software features and functionality to meet real-world testing concerns. The purpose of the Upgrades and Support Agreements is to provide you with the latest software developments, enhancements and technical support for your VR8500 and VR9500 series vibration controllers. In an effort to continue to provide you with the very best products and service, we encourage you to renew your Upgrades and Support Agreements.

### Papers

Vibration Research strives to expand the skills and understanding of the vibration testing community. To that end, we publish papers and technical notes that are interesting and relevant to today’s vibration test engineers. A listing of some of our published articles are below and can be found on our website. Keep checking for additions to this listing.

- Does your Controller Square with Chi?
- How Well Does 3 Approximate Infinity – Understanding 3 Sigma Clipping in Random Shake Tests
- Statistical Properties of Random
- Fulfilling the MIL-STD-1540D-Tolerance
- KURTOSION – Getting the Kurtosis into the Resonances
- Examining the Dynamic Range of Your Controller
- The Missing Knob on Your Random Vibration Controller
- The Third Dimension of Random Vibration Control
- Kurtosis – The Missing Dashboard Knob
- Test Your Product Using Sine or Random?
- What Is Random?
- Ask the IEST Testing Experts
- A Comparison of Simultaneous and Sequential Single-Axis Durability Testing
- Multi-Axis Vibration Reduces Test Time

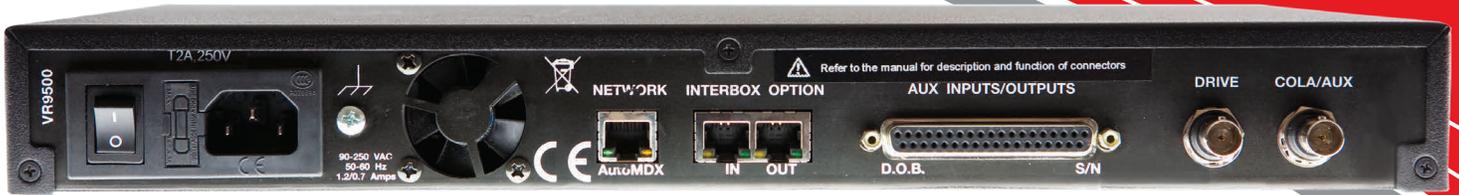
### Videos

Vibration Research has recorded videos that provide the user with detailed information on how to set up and execute a variety of tests and reports utilizing the VR9500. These videos can be found on our website along with additional videos which the end user may find helpful. New videos are added regularly so keep checking back.

### Web Seminars

Vibration Research regularly offers one-hour web seminars. Each month a new topic is presented. Attendees are welcome to ask questions and we encourage active participation. Watch our website to see the date and time of the next web seminar and plan to attend.

Visit us at [www.vibrationresearch.com](http://www.vibrationresearch.com) to access papers, videos and additional training information.



## Hardware

### Front End Signal Processing Box

Low-noise design with a dedicated high-speed processor for signal processing. Front BNC connectors for four input connections. Front panel status LEDs. Rear panel connectors include drive signal output and COLA output, connection to Ethernet port, two high-speed interbox communications channels and a terminal block of digital I/O lines.

### Analog Channels

One to 128 simultaneous channels. All 128 channels can be used for control or monitor. All are configurable single ended or differential with 200k impedance. The VR9500 Revolution features a 200kHz sample rate. Set-up allows per channel selection of transducer sensitivity, coupling (AC or DC), accelerometer constant current supply (4mA), TEDS transducer interface, and a unique DC offset that allows measurement to true DC with constant current type accelerometers. Custom units can be defined for other sensor types. 200v tolerant fuse-protected inputs protect your controller from transients.

### Input Channel Expansion

System can be expanded from one to 128 total analog inputs by adding signal processing modules. Each module contains four inputs. Additional modules connect to the PC via a network switch.

### PC Configuration

XP/Vista/Windows 8 operating system and an Ethernet port are the only requirements. Microsoft Word and Excel are recommended.

### Digital Inputs/Outputs

Rear, pluggable terminal block enables the digital level signals – eight inputs and eight outputs – to be interfaced with your product and other systems. Used for remote start/stop/pause/continue and other functions such as close/open contact loop, manual/auto schedule, and enable/disable I/O aborts and start/stop recording.

### Output Channels

One analog output (drive) standard; COLA output is standard with SineVIEW.

### Electronics Per Channel

Differential amplifier. Configurable as differential, single ended, AC or DC, analog and digital, anti-aliasing filters, and 24-bit analog to digital converter (ADC).

### Tracking Filters

Each input channel has the ability to enable/disable tracking filters. This allows the user to remove harmonics and out-of-band noise from the measurements. The tracking filter bandwidth and signal averaging is user configurable.

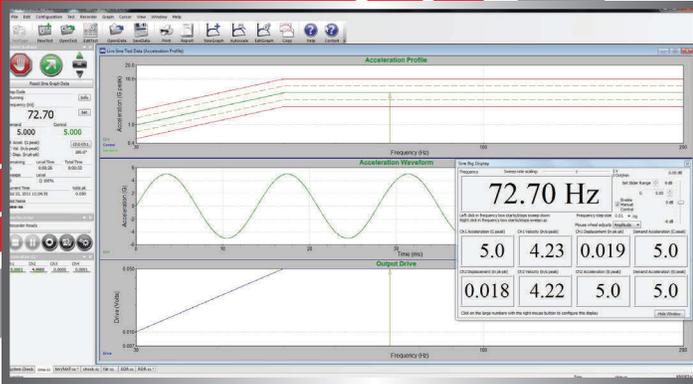
### Equalization

The controller automatically equalizes the response of the shaker/fixture/product prior to running the test. The equalization can be memorized and stored with the test to quickly start a test at a fully equalized level.

### Hardware Warranty

Vibration Research warrants the controller hardware to be free of defects in materials and workmanship for a period of three years from the date of purchase. This warranty covers hardware failure under normal conditions and does not cover damage due to customer neglect or mistreatment.

# VR9100



## SineVIEW

Searching for those resonances has never been easier than with our Sine testing module. Sine performs closed-loop control of fixed and swept sine vibration. The digital control algorithm provides time and frequency calculations using floating point math calculations, resulting in frequency changes as small as 1 millionth of a Hertz to produce a smooth and continuous sweep. Pretest self-check is available with Analyzer Function software option VR9607.

### FEATURES

#### Easy Test Entry

Enter frequency/amplitude breakpoints in an easy-to-read table form. Operator can select to control constant or ramped acceleration, velocity or displacement. Automatically calculate and enter the frequency of intersection between any combination of constant acceleration, velocity or displacement lines. Over 1,000 separate frequency/amplitude breakpoints can be entered.

#### Sweep Type

Either linear (Hz/minute or minutes/sweep) or logarithmic (octave/minute, decade/minute, minutes/sweep) sweeps can be specified. Sweep rate can be changed in the test while running.

#### Test Duration

Test duration can be entered in terms of length of time, number of sine wave cycles or number of sweeps.

#### Tone Tests

Sequences of fixed-frequency tones of a specified acceleration, velocity or displacement can be run. Looping functions allow easy entry of repeating tone sequences.

#### Control Channels

The control signal can be a single input channel, or configured from two to 128 input channels with either multi-channel averaging or multi-channel extremal control.

#### Frequency Range

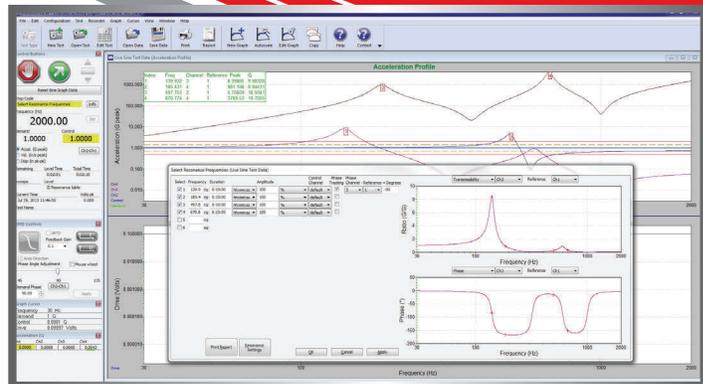
Standard frequency range is DC-4,990Hz. The frequency range can be extended up to 50,000Hz with the High Frequency VR9103 option.

#### Configurable Safety Limits

The controller can be configured to abort if the controlled acceleration goes above or below the desired level by an operator-configured number of dB. Abort limits can also be enabled for individual monitoring channels. Drive limits can be configured to protect from overdriving your shaker in case of failed accelerometers.

#### Tracking Filters

Input channels have individually selectable tracking filters to remove harmonics and out-of-band noise from the measurements. The tracking filter bandwidth and signal averaging is user configurable.



### Data Storage

All of the test data can be stored to any disk, including network drives, for later retrieval. Data storage can be done manually, or programmed to automatically save at user-defined intervals.

### Multi-Channel Extremal

Allows more than one input channel for control in a control strategy where the highest, lowest or an average of accelerometer readings will be used for control of the test.

### Manual Control

The frequency sweep and amplitude level can be manually controlled through the mouse.

### Reference Output-COLA

The second output channel supplies a one-volt constant amplitude reference signal. The phase of this signal relative to the main output can be fixed at any phase or set to shift at a configurable rate. This signal may be used to trigger a strobe light or other measurement device requiring triggering lock with the output signal.

### Data plots

A multitude of graphical display options are available, including peak acceleration, peak velocity, peak-to-peak displacement, output drive, channel-to-channel transmissibility and phase as a function of either frequency or time. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.

### Independent Channel Notching Profiles

Assigns maximum limiting breakpoint profiles to individual channels. The drive output will be limited (or 'notched') if necessary to keep the input amplitude for that channel below the defined profile.

## Featured Options

### Accelerometer Calibration Verification VR9106

Provides an easy interface to calculate accelerometer sensitivity. This will allow the user to perform a sine sweep, control a reference accelerometer and produce a calibration report suitable for record keeping. Automatically calculates the accelerometer sensitivity at the chosen reference frequency.

### Sine Resonance Track and Dwell Control (SRTD) VR9105

Transmissibility peaks can be automatically detected from a sine sweep, and then dwell tests run at the detected resonance frequencies for a specified time duration or number of sine wave cycles. In a sine dwell test, the controller can automatically track the resonance frequency to keep the output on resonance even when fatigue damage causes the resonance frequency to shift. With our advanced tools you can manually track a resonance even in a non-linear system.

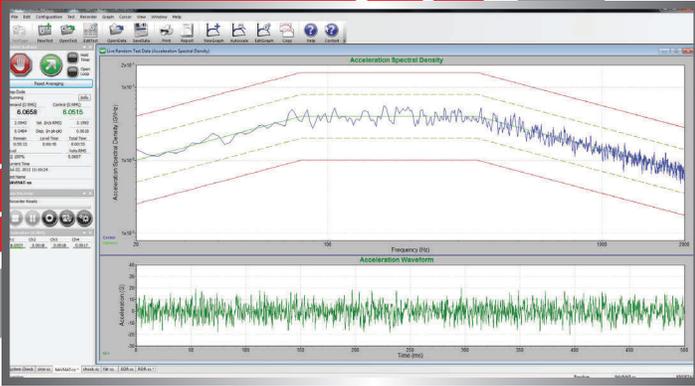
### High Frequency for Sine VR9103

Extends upper frequency for Sine control from 4,990Hz to 50,000Hz (does not require an export license).

### Step Test Mode VR9107

Frequency Stepping Test: Cycle on/off for user-specified time at discrete frequencies. Linear or logarithmic frequency step rates can be used. Stepped frequency sine tests such as those used in MIL-STD-167 are supported.

# VR9200



## RandomVIEW

Random vibration testing provides a more closely matched vibration to your end-use environment. With our RandomVIEW vibration test module you get the highest possible control with ease of use.

Random performs real-time, closed-loop control of PSD profiles. All inputs are simultaneous, which means there is an A/D assigned to each input (not multiplexed). The inputs continuously take data, and there are no “unsampled” periods. Highly evolved control algorithms will control electrodynamic, and servo-hydraulic or servo-electric shakers. A pretest self-check is available with Analyzer Functions software option VR9607.

### FEATURES

#### Easy Test Entry

Frequency/amplitude breakpoints are entered in an easy-to-read tabular form using either frequency and amplitude breakpoints or by entering one endpoint and the desired dB/octave slope. Over 1,000 separate frequency/amplitude breakpoints can be entered.

#### Lines

The controller comes standard with 50 to 26,000 user-selectable lines of control to provide the frequency resolution required for testing. You can analyze up to 50,000Hz with the High Frequency VR9203 option, without sacrificing resolution.

#### Frequency Range

The standard frequency range is DC-4,990Hz. The frequency range can be extended up to 50,000Hz with the High Frequency VR9203 option. (Note - this option requires an export license for end users outside the U.S.)

#### Control Channels

The control signal can be a single input channel, or configured from two to 128 input channels with either multi-channel averaging or multi-channel notching.

#### Multiple Shakers

One to four control loops can be run simultaneously to independently control up to four shakers with four individually configurable and statistically independent waveforms.

#### Test and Level Scheduling

Tests can be scheduled to run a user-defined length of time and the spectrum level can be scaled by a specified dB level, percentage or a specified RMS acceleration. Level schedules can be entered to run various durations at different acceleration levels. Levels can be changed while the test is running.

#### Multi-Channel Extremal

Allows more than one input channel for control in a control strategy where the highest, lowest or an average of accelerometer readings will be used for control of the test.

#### Independent Channel Notching Profiles

Assign maximum limiting breakpoint profiles to individual channels. The drive output will be limited (or notched) if necessary to keep the input spectrum for that channel below the defined profile. Up to 1,024 breakpoints can be entered for each channel, or the limit can be entered simply as a dB level relative to the demand profile. In addition, minimum limits may be defined to boost the drive output if a channel is below a defined profile. The notching profiles may also be used as spectrum abort limits, so that abort limit breakpoint profiles can be assigned to each individual channel, and if that channel reaches the defined limit the test will safely shut down.

#### Configurable Safety Limits

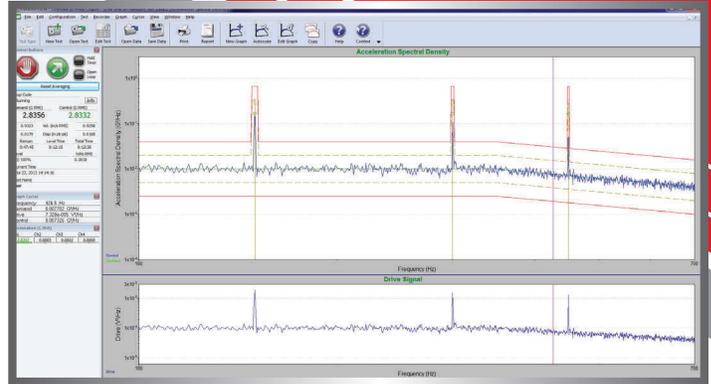
To protect your test article and shaker system, configurable acceleration limits, line limits and drive limits can be set by the user. The control input is also verified against shaker acceleration and displacement limits.

#### Data Storage

All of the test data can be stored to any disk, including network drives, for later retrieval. Data storage can be done manually, or programmed to automatically save at user-defined intervals.

#### Data Plots

Many graphical display options are available, including acceleration spectral density, output voltage spectral density and channel-to-channel transmissibility. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.



## Featured Options

### RANDOM-ON-RANDOM (RoR) VR9207

Run controlled, random spectrum tests with swept random “tones” superimposed on a random background.

- One – 32 narrow spectral bands can be superimposed on the background random spectrum.
- Sweep back and forth between frequencies at a user-programmable rate and amplitudes.
- Amplitude, bandwidth and frequency sweep are all user programmable.
- Up to 50 separate frequency/amplitude breakpoints per narrow band can be entered.
- 50 – 26,000 lines of control.

### SINE-ON-RANDOM (SoR) VR9206

Run mixed-mode tests with sine tones superimposed on a random background.

- One – 32 true floating-point precision sine tones can be superimposed on the background random spectrum.
- Sweep back and forth between frequencies at a user-programmable rate.
- Amplitude, bandwidth and frequency sweep are all user programmable.
- Up to 50 separate frequency/amplitude breakpoints per sine tone can be entered.
- 200 – 6,500 lines of control.

### SINE-AND-RANDOM-ON-RANDOM, (S&RoR) VR9208

Runs random sweeping “tones” and real sine tones simultaneously on top of background random. Included standard when Random, Sine-on-Random, and Random-on-Random are purchased.

### SINE-ON-SINE VR9206

Run mixed-mode tests with sine tones superimposed on a sine background.

- One – 32 true floating-point precision sine tones can be superimposed on the background random spectrum.
- Sweep back and forth between frequencies at a user programmable rate.
- Amplitude and frequency sweep parameters are user programmable.
- Up to 50 separate frequency/amplitude breakpoints can be entered.

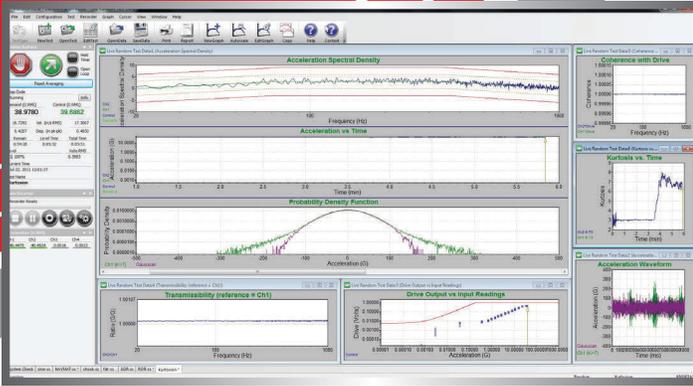
### RANDOM IMPORT VR9204

Import analog or digital time data to automatically generate a profile. Imports PSD data also.

### HIGH FREQUENCY FOR RANDOM VR9203

Extends upper frequency for random control from 4,990Hz to 50,000Hz. (Requires an export license for users outside the U.S.)

# VR9205



## Innovative RandomVIEW Products

# Kurtosion

Kurtosis is a measurement of the size of a distribution's "tails," or in other words, more data points at the extreme values from the mean (peakedness).

### FEATURES

#### More Time at Peak Levels

Where is the most damage potential of your product? Typically at PEAK acceleration levels. When the kurtosis of the signal is increased, the time spent at peak levels is increased, making your test better reflect what is happening in the real world. Some have called this "shock on random," but it is really random with a more realistic probability distribution.

#### Not Gaussian

Traditional random control uses a Gaussian distribution, which is highly concentrated near the mean value. This means most of the time the traditional random test acceleration is close to zero. In most real-world environments, there is significantly more time spent at the peak levels than what is produced by the traditional random test.

#### More Realistic Probability Distributions

By controlling both the RMS and kurtosis of the random waveform, you get more control over the probability distribution, allowing a closer match between the real world and your test lab.

#### Full Random Spectrum

The spectrum is defined and fully controlled just like in traditional random tests with no change as a result of adjusting the kurtosis level.

#### Full RMS Control

With kurtosis control, acceleration is moved from the mean toward peak levels, resulting in no change of GRMS.

#### Full Dynamic Range

The kurtosis of the acceleration is controlled without any reduction in dynamic range.

#### Kurtosion Defined

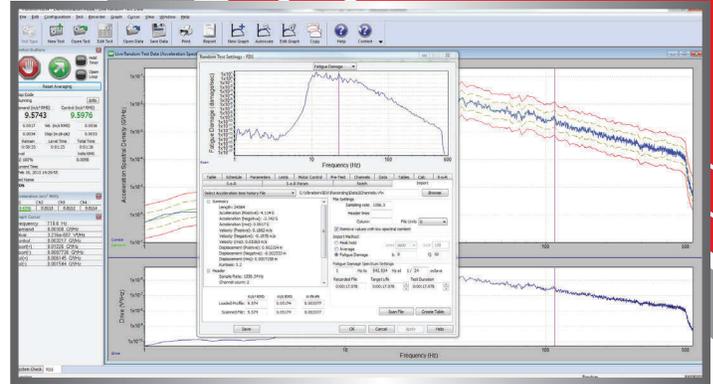
The action or process of controlling a signal in which the kurtosis of the signal achieves a desired result, as in "applying kurtosis."

#### U.S. and European Patent

Waveform. GRMS. Kurtosion. Our patented control now adds a third dimension to your random vibration testing.

#### Includes Random Import (VR9204)

Compare multiple methods of generating a random profile.



## Innovative RandomVIEW Products

# Fatigue Damage Spectrum (FDS)

Measure your product's fatigue and calculate its lifespan. For years people have used methods to calculate the lifespan of a product based on the material s/n curve. Rain flow analysis techniques from your product are applied to the actual measured vibration, equivalent fatigue is quantified and time to failure is calculated. Commonly used life acceleration techniques are applied to shorten test time.

### FEATURES

#### Custom Frequency Axis

Normally, random import is calculated linearly based on number of lines. The FDS is calculated on a custom logarithmic frequency axis. You can set the frequency axis spacing and the start/end frequency on the user interface. User is in control of how many points and which points to calculate.

#### Time Domain Calculation

Calculation through time domain, not frequency domain to account for kurtosis you will likely see in the real world. The Fatigue Damage Spectrum is based on the response of single degree of freedom systems rather than FFTs.

#### Display Imported File Statistics

Displays peak acceleration, velocity and displacement as well as the kurtosis of the time history file. This provides a quick and easy way to determine the statistics of a waveform.

#### Configurable Process Parameters

The user can define the slope of the s/n curve (beta) and quality factor (Q).

### Reduce Test Time

User sets test item target life based on product specifications, as well as test duration. The software automatically calculates ratios that will produce the same amount of fatigue damage in shorter test time.

### Analysis to Control

With one mouse click, bring your new random breakpoints into a control profile. Go from a time waveform to a breakpoint profile and start controlling on that profile all in one program.

### Includes Random Import (VR9204)

Compare multiple methods of generating a random profile.

## Featured Options

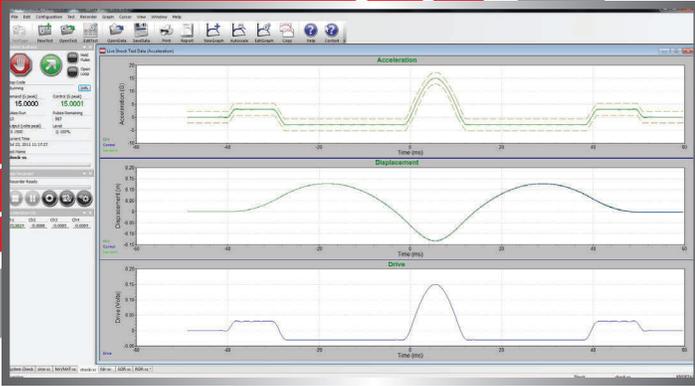
### VR-OBSV

Measure waveforms with the ObserVR and import into a random profile.

### RECORDER VIEW VR9600

Measure waveforms with the VR9500 and RecorderVIEW and import into a random profile.

# VR9300



## ShockVIEW

Classical shock performs closed loop control of transient waveforms. The entire transient period is sampled simultaneously and gap free. The needed drive is calculated between each pulse. All of the classical types are supported. There are several methods of optimizing the displacement requirements of a given pulse.

### FEATURES

#### Standard Pulse Shapes

Select from half-sine, haversine, initial-peak sawtooth, terminal-peak sawtooth, triangle, trapezoid and square pulse shapes.

#### Control Channels

The control signal can be a single input channel or an average of two to four different input channels.

#### Test and Level Scheduling

Repeat a pulse from one to more than two billion times, with a configurable repetition rate. Tests can be configured to run pulses at different amplitude levels.

#### Configurable Safety Limits

To protect your test article and shaker system, configurable acceleration and drive limits can be set by the user. The control input is also verified against shaker force, velocity and displacement ratings.

#### Equalization

The controller automatically equalizes the response of the shaker/fixture/product prior to running the test. This equalization can be memorized and stored with the test to quickly start a test at a fully equalized level.

#### Data Storage

All of the test data can be stored to any disk, including network drives, for later retrieval. Data storage can be done manually, or programmed to automatically save at user-defined intervals.

#### Data Plots

Many graphical display options are available, including acceleration, velocity, displacement, output voltage, acceleration and drive spectra. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.

## Featured Options

### TRANSIENT WAVEFORMS CONTROL (EARTHQUAKE/SEISMIC) VR9301

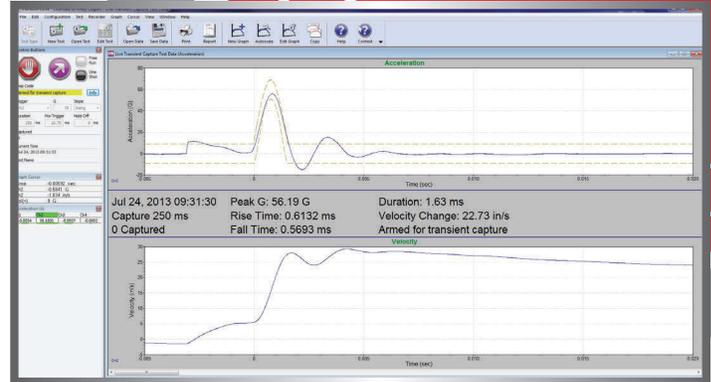
Runs a user-defined time transient. Also used to run earthquake tests with the standard Bellcore earthquake time transients included.

- Used to import a time domain, user-specified transient with many file formats including txt, uff and csv among others.
- Import up to 65,000 data points with custom support for up to 500,000 data points.
- Easily create sine beat, chirp, user-defined and random waveforms for playback and control.
- Analyze with SRS package and general Shock.
- Run earthquake tests similar to the Bellcore standards along with any other earthquake time history.
- Meets all IEEE-344 required plotting and calculation standards (VR-IEEE-344).

### SHOCK TRANSIENT CAPTURE VR9304

Capture a transient waveform for post processing. Use alone for data acquisition or with SRS for Shock Response Spectra analysis.

- Provides a simple interface to record transient events. Select a trigger level, slope, channel and duration.
- Trigger the capture on the capture channel or use an independent channel as a dedicated trigger.
- Use the open loop sine chirp or random output to drive a modal shaker.
- Specify and display an SRS spectrum. Analyze SRS of each pulse as it is captured.
- Many graphical display options are available, including acceleration, velocity, displacement and acceleration spectra. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.



### SHOCK RESPONSE SPECTRA (SRS) CONTROL VR9302

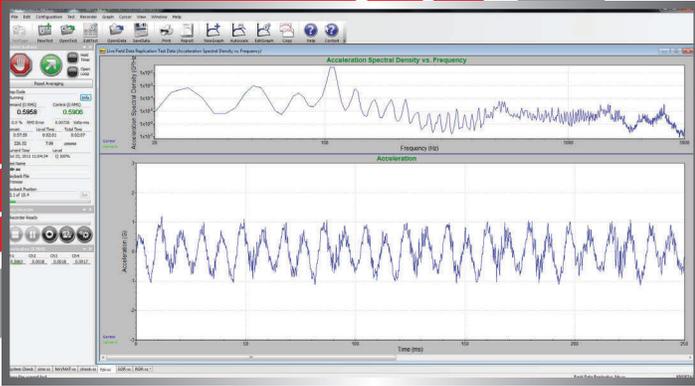
Perform Shock Response Spectra (SRS) analysis. Run a shock pulse defined by a frequency versus G peak table. A variety of waveform synthesis generation techniques are included.

- Frequency/amplitude breakpoints of the background random acceleration spectrum are entered in an easy-to-read tabular form using frequency and amplitude breakpoints. Two hundred separate frequency/amplitude breakpoints can be entered.
- Adds Shock Response Spectra plots to shock and transient capture test modes.
- Supports many generation techniques including linear and exponential chirp, wavesyn, burst random, linear and exponential chirp on burst random, enveloped random, burst sine or iterate from user waveform.
- Manually adjust all the parameters of the underlying wavelets, or allow VibrationVIEW to automatically create and run without intervention.
- SRS Pseudo Velocity and SRS Acceleration plots. Acceleration for primary (+), primary (-) or Maxi-Maxi. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.

### HIGH FREQUENCY FOR SHOCK VR9303

Extends upper frequency for control and analysis to 50,000Hz (does not require export license).

# VR9400



## Field Data Replication (FDRVIEW)

Take your field acceleration measurements and reproduce them on your shaker in your test lab. There is no need to try to approximate your field environment through the approximations inherent in the standard random, sine or shock tests. FDRVIEW (or FDR) provides the capability to replicate your field acceleration measurements and reproduce them on the shaker in the test lab. Utilizing real-time adaptive control, FDR simulates the recorded time history measurements on your shaker.

### FEATURES

#### Data Import

Import waveforms from data recorders using an analog input, or import from digital wave or text files. Waveforms can be up to 45 hours long at a 26,000Hz sampling rate (with High Frequency VR9403 option), or up to one year long at a 100Hz sampling rate.

#### Multiple Shakers

From one to four control loops can be run simultaneously to independently control up to four shakers with four separate waveforms.

#### Test and Level Scheduling

The test can be set to reproduce the waveform for a specified duration. The waveform can be scaled up or down by any factor to get the test intensity you desire. Tests can be programmed to run for various periods at different intensity levels. The amplitude can be changed while the test is running.

#### Equalization

The controller automatically equalizes the response of the shaker/fixture/product prior to running the test. This equalization can be memorized and stored with the test to quickly start a test at a fully equalized level. The frequency range of the output signal is configurable, and a frequency band can even be notched out of the signal.

#### Lines

The controller comes standard with 50 to 6500 lines of control to provide you with the frequency resolution required for your test.

#### Data Storage

All of the test data can be stored to any disk, including network drives, for later retrieval. Data storage can be done manually, or programmed to automatically save at user-defined intervals.

#### Data Plots

Many graphical display options are available, including acceleration and drive voltage versus time or frequency, and channel-to-channel transmissibility. Graphs can be easily auto-scaled or zoomed, and cursors displayed. Data and text annotations can be easily placed on the graphs, with data values updated live as the data changes.

#### Frequency Range

The standard frequency range is DC-4,990Hz. The frequency range can be extended up to 50,000Hz with the High Frequency VR9203 option. (Note - this option requires an export license for end users outside the U.S.)

#### Notch Filter

Apply a notch filter while the test is running.

## Featured Options

### FIELD DATA REPLICATOR REFERENCE (OUTPUT) VR9401

Play any uncompensated reference waveform fully synchronized with the control waveform. Useful for providing reference waveforms to a spectrum analyzer for external verification of results. Also useful for providing a pre-recorded trigger signal (e.g., tachometer, cylinder firing, etc.) synchronized to the vibration, or for synchronizing additional environmental factors (e.g., motor RPM, temperature, etc.) with the recorded vibration.

### HIGH FREQUENCY FOR FIELD DATA REPLICATION VR9403

Extends sample rate for FDR control up to 20,000Hz for control at 65,536Hz sample rate (requires export license).

## RecorderVIEW

Digitally record your field acceleration measurements directly to your PC's hard drive.

### FEATURES

#### Long Waveforms

Collect waveforms up to four billion samples per channel. Waveforms can be over 22 hours long at a 52,000Hz sampling rate, over 100 hours long at a 10,000Hz sampling rate, and over one year long at a 100Hz sampling rate.

#### Complete Integration with Field Data Replication

Use the test wizard in the (Optional) VR9400 Field Data Replication software to proceed directly from field measurements to a test reproducing these measurements in your lab. No additional calibration or translation steps are required. Simply record the data and immediately run it on the shaker in your test lab.

#### Includes EditVIEW

For editing your collected data, useful when the data has long "quiet" periods that are not wanted in the final data file.



### INTEGRATED SOLUTIONS

#### Field Data Replication VR9400

Allows the replication of the frequency, phase and amplitude of the waveform found on your product in actual operation.

#### Fatigue Damage Spectrum VR9209

The Fatigue Damage Spectrum (FDS) is an effective tool that can show the damage a product will experience at a particular frequency and the effect Kurtosis Control has on a random vibration test.

## Lab Solutions

### Simultaneous Control and Collection

The VR9500 can be used simultaneously as both a vibration controller and a data recorder. Input channels used for control or monitoring can be recorded to the hard drive while the controller is running a test, allowing you to independently verify your control channel, store complete waveform time history of your test for later analysis or archive your tests. There is no need to buy an additional data recorder to monitor your unit under test.

### Remote Interface

Gives you the freedom to use any tablet, phone or mobile device to monitor and control your vibration test in front of your shaker or from anywhere in the world.

### Active X

Control your test and examine parameters from LabVIEW, Basic, ME-Scope and other programs.

## Portable Solutions

### ObserVR

#### Portable Data Acquisition and Analysis Reporter

Go from Field-to-Lab-to-Report with the ObserVR using the familiar VibrationVIEW software interface.

- USB connection
- Streams data to the laptop/PC's hard drive
- Four simultaneous A/D channels for high resolution
- IEPE inputs accepted and powered with a 4mA current source
- Up to 52,000Hz sampling rate per channel
- Includes Analyzer software capabilities
- Works with RecorderVIEW, Random Import, Fatigue Damage Spectrum (FDS), Shock Transient Capture and Shock Response Spectra (SRS)

# Software Specifications

## SINE

**Frequency Range:** DC to 50,000Hz. Up to 4,990Hz standard; High frequency option extends to 50,000Hz. Sample frequency 10,000 to 200,000Hz.

**Sweep Rate:** Linear from zero to 6,000 Hz/min or logarithmic from zero to 100 octaves/min.

**Control Methods:** Single channel, average, minimum, maximum or manual.

**Control Dynamic Range:**  $\geq 130$ dB.

**Level Types:** Sweep from frequency A to frequency B, sweep back and forth through profile, constant frequency, wait for operator intervention, wait for timed interval, resonance table generation and dwell frequency selection (optional), level looping (with nesting up to 10 levels), phase tracking to hold resonance frequency.

**Breakpoints:** Up to 1,024 amplitudes of A, V, or D, constant or slope changes at defined frequencies.

**Drive Frequency Resolution:** As fine as 0.000001Hz.

**Loop Time:** 5 msec typical.

**Manual Control:** Limits both the drive output and the control signal on start-up to a user-controlled level. Normal test operation will commence only after the limited start-up is verified by the user.

## RANDOM

**Frequency Range:** DC to 50,000Hz, user selectable. Up to 4,990Hz standard; High frequency option extends to 50,000Hz (requires export license).

**Spectrum Lines:** 50 – 26,000 lines.

**Measurement Strategies:** Input channels can run individually, or combined by minimum, maximum or average.

**Control Dynamic Range:** 100dB typical.

**Breakpoints:** Up to 1,024 frequency /amplitude breakpoints with slope (dB/octave) automatic calculations or manually set slope values between frequencies.

**Profile View:** The desired profile is graphed and updated as you build it. The test maximum peak acceleration, peak velocity and peak-to-peak displacement values are displayed. Values are highlighted in red if they exceed the shaker parameter values selected.

**Drive Clipping:** Clipping modes include digital, analog and silent clipping. Can be set at any level between 1 sigma up.

**Manual Control:** Limits both the drive output and the control signal on start-up to a user-controlled level. Normal test operation will commence only after the limited start-up is verified by the user.

**Test Documentation:** Extensive reporting capabilities.

**Level Types:** Scale entered profile by % level, by dB level or to an RMS acceleration level. Wait for operator intervention, wait for a timed interval, level loop (with nested looping up to 10 levels), auto reporting and more.

**Number of Levels:** 2,000 levels.

**Degrees of Freedom:** Two – 1,000 degrees of freedom.

## SHOCK

**Classical Pulse Types:** Half-sine, haversine, initial and terminal peak sawtooth, triangle, rectangle and trapezoid.

**Pulse Duration:** From 1mS to 60 seconds.

**Sample Rate:** 100Hz to 200,000Hz. (High frequency option required above 4,990Hz.)

**Frame Size:** 128 to 524,000 points or automatically optimized.

**Loop Transfer Function:** Automatic calculation during pretest or, for no pretest start-up, recall a drive from disk.

**Pulse Compensation:** Both pre-pulse and post-pulse compensation is performed. Double-sided for minimum displacement and full use of shaker stroke. Choice of smoothed or rectangular compensation pulses. Pre-pulse and post-pulse amplitudes settings are a percentage of the demand peak acceleration.

**Engineering Units:** English, SI, Metric, mixed, user-defined.

**Filtering:** User specifies desired frequency for low pass filtering applied to the demand waveform, output drive signal, and input channels.

**Delay Between Pulses:** User set from 0 to 1,000 seconds.

All specifications are subject to change without notice.

**Math Traces Option – VR9606:** This option provides the ability to define math functions based on graph traces, test parameters and/or test results, and plot the result of the calculations as additional graph traces. In addition, calculators may also be defined to evaluate a function continuously during the test, and plot time history of the result. Each calculator can also have upper and lower limits assigned to stop the test based on the calculation result.

**Analyzer Functions Option – VR9607:** Provides Coherence, Cross-Spectrum and Transfer Function plots in both Random and FDR test modes, FFT Spectrum plots in Sine test mode, and scatter plots (channel-vs-channel) in all test modes. In addition, this option provides a configurable function generator for outputting user-defined voltage waveforms.

# General Specifications

## INPUTS

**Output Channels:** One – two output channels per control box, +/- 1v, +/- 10v.

**Voltage Range:** +/-1v, +/-10v, +/-20v peak.

**Dynamic Range:** 135dB spurious free dynamic range input signal separation.

**Protected:** 200v peak tolerant inputs.

**Noise Floor:** <70nV/√Hz.

## OUTPUTS

**Drive Channel:** 24-bit digital to analog converted (DAC), digital and analog anti-imaging filter, emergency stop shutdown circuit and power failure transient prevention shutdown circuitry.

**Filtering:** Analog multiple pole filter plus a digital filter.

**Frequency Range:** Capability of up to 50,000Hz output frequency (200,000 samples per second). Frequency use above 4,990Hz for Random and FDR requires export license.

**Resolution:** 24-bit.

**Total Harmonic Distortion:** < -105dB.

## SHAKER MONITOR AND ANALOG DC INPUTS – VR9602

The eight inputs on the rear of the VR9500 controller can be set up as analog DC inputs. This allows the user to monitor, log and graph data from up to eight analog signals such as armature and field current and voltage. The inputs have a +/- 10 volts range which can be scaled to any user-defined units such as RMS amps or RMS volts. Other features include user-defined high and low trip points to automatically abort tests on a fault condition. This is a good way to monitor and log the shaker's armature voltage, armature current, field voltage and field current for all of your tests.

**Power Failure:** Transient free shutdown.

**Engineering Units:** English, SI, Metric, mixed, user-defined.

**Operating Temp Range:** Calibrated up to 23°C (+/- 5°C), functional 50°C maximum.

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