

VR9500

REVOLUTION

INNOVATORS
IN VIBRATION
CONTROL



VIBRATION
RESEARCH
CORPORATION





VIBRATION RESEARCH

VIBRATION RESEARCH has a team of tested problem solvers available and is ready to respond to your concerns or special requirements. Contact us with your questions, or to discuss your requirements.

VIBRATION RESEARCH designs and manufactures leading edge vibration control systems for electro-dynamic and servo-hydraulic shakers. The Vibration Research VR9500 Revolution comes standard with a **3-year hardware warranty**.

VIBRATION RESEARCH software is designed for use with the popular and widely used Microsoft Windows® operating system. It is compatible with XP, Vista and Windows 7. A major advantage of this design is that there are no modifications required for your PC and no special skills needed to install and maintain the system. The payback is immediate.

VIBRATION RESEARCH was formed in 1995. Since inception, Vibration Research has been considered a pioneer in the industry and a leader in the field of vibration control, providing the customer with state-of-the-art technology. Our success is based on reliable, user friendly software packages for vibration control. Today, we continue to focus on this objective. Our reputation for quality and superior performance is the foundation of our effort to deliver the best control system for the money.

VIBRATION RESEARCH is located in Jenison, Michigan near Grand Rapids, less than 200 miles from Detroit and Chicago.

Phone: 616-669-3028 or Fax: 616-669-5337
Or visit www.vibrationresearch.com



VIBRATIONVIEW

SHAKER VIBRATION CONTROL SYSTEM

MICROSOFT WINDOWS INTERFACE

The VibrationVIEW controller runs on all varieties of the Microsoft Windows operating system. This allows customers to leverage their knowledge and accelerate the learning curve.

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, a percentage, or scaled for 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. Cursors can be used to locate peaks and highlight particular data points. Graph images and raw data can be copied to your favorite 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. 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.

EASY TEST ENTRY

Frequency/amplitude breakpoints are 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. Up to 1,024 separate frequency/amplitude breakpoints can be entered.



AVAILABLE SOFTWARE APPLICATIONS INCLUDE:

SINE | RESONANCE TRACK & DWELL | SHOCK | RANDOM | RANDOM ON RANDOM | RECORDER VIEW
FIELD DATA REPLICATION | SINE ON RANDOM | KURTOSION® | TRANSIENT CAPTURE | MULTI-AXIS

VIBRATIONVIEW

SHAKER VIBRATION CONTROL SYSTEM

SYSTEM CHECK

All VibrationVIEW software packages include a system check mode which 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 the disk for later retrieval. Data storage can be done manually or programmed to automatically save at user-defined intervals.

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 (also burst/abort capable). Up to 1,024 breakpoints can be entered for each channel, or the limit can be entered simply as an acceleration, velocity or displacement. In addition, minimum limits may be defined to boost the drive spectrum about limits so that abort breakpoint profiles can be assigned to each individual channel, and if that channel reaches the defined limit, the test will safely shut down.

MULTI-CHANNEL EXTREMAL

Used to allow more than one input channel for control in a control strategy where the highest, lowest or average accelerometer reading will be used for control of the test. This option is included standard with both RandomVIEW and SineVIEW on controllers running VibrationVIEW version 6 software and higher.

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.

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 full equalized level.

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.

CALIBRATION STANDARD

Calibrate the VR9500 Revolution system in your own calibration laboratory using your own calibration instruments with the automatic Calibration and Verification software and an Agilent 34401A or 34410A multimeter.

HARDWARE WARRANTY

Vibration Research Corporation 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.



VIBRATIONVIEW

SHAKER VIBRATION CONTROL SYSTEM

Vibration Research's hardware and software is easy to integrate with your PC. Simply connect the VR9500 Revolution to the PC using an Ethernet crossover cable and you are ready for testing! This eliminates all the accelerometer and drive cables going back to the control room. The Ethernet interface provides DC isolation between the VR9500 Revolution and the PC, which is great for eliminating 50/60 Hz noise problems.

HARDWARE SPECIFICATIONS

ANALOG CHANNELS 1 to 32 simultaneous channels. All 32 channels can be used for control or monitor. All are configurable single ended or differential with 200k Ω impedance. The VR9500 Revolution features a 200 kHz sample rate. Setup 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 Can be expanded from 1 to 32 total analog inputs by adding signal processing modules. Each module contains 4 inputs. Additional modules connect to the PC via a network switch.

PC CONFIGURATION XP/Vista/Windows 7 Operating system and an Ethernet port are the only requirements. Microsoft Word and Excel are recommended.

IMPEDENCE Single ended 100k Ω , differential 200k Ω .

RESOLUTION 24-bit

FRONT END SIGNAL PROCESSING BOX

Low-noise design with a dedicated high speed processor for signal processing. Front BNC connectors for 4 input connections. Front panel status LED's. Rear panel connectors include drive signal output and COLA output, connection to Ethernet port, 2 high speed interbox communications channels and a terminal block of digital I/O lines.

DIGITAL INPUT/OUTPUT Rear pluggable terminal block enables the digital level signals – 8 inputs and 8 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)

INPUT RANGES +/- 1V, +/- 10V, +/- 20V

OUTPUT RANGES +/- 1V, +/- 10V

PHASE MATCH BETWEEN CHANNELS

Within +/- 1 degree from DC to 10,000 HZ

SIGNAL-TO-NOISE RATIO > 100 dB

TOTAL HARMONIC DISTORTION < -105 dB

FREQUENCY RANGE Sine, Random, Shock, and F.D.R. control up to 4,990 Hz. (High Frequency Option extends the limits to 50 kHz). An export license is required for Random and F.D.R. High Frequency software.

DYNAMIC RANGE 135 dB input signal separation

CHANNEL CROSS-TALK < 110 dB

FILTERING An analog multiple pole filter plus a digital filter

DIMENSIONS

Width 15 1/16", **Depth** 10 1/2", **Height** 1 3/4"

WEIGHT 7.5 lbs.

OPERATING TEMP RANGE Calibrated up to 23°C (+/- 5°C), functional 50°C maximum.

SAMPLE RATE Up to 200 kHz

VIBRATIONVIEW

SHAKER VIBRATION CONTROL SYSTEM

Active X – VR9604

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

Web Server & E-mail – VR9603

With the Web Server & E-mail software option your system status can be easily monitored from anywhere in the company, or anywhere in the world. E-mails can be sent to report your system's status and the web pages can be edited to give them the look of your company. This easily eliminates expensive down-time. Simply send the E-mails to your cell phone or pager.

Alternate Units – VR9605

Standard feature in all VR9500 Revolution systems. If you need to monitor and measure things like sound pressure, micro strain, and many other engineering units, this feature allows you to change the inputs and graphs to your desired engineering units.

Shaker Monitor & Analog DC Inputs – VR9602

The 8 inputs on the back of the VR9500 Revolution can be configured as analog DC Monitor Inputs (digital inputs and digital output functions included). This allows the user to monitor, plot graphs, and store data from up to 8 analog signals, including shaker current and voltage. Software allows scaling to your desired units. +/-10 volt range. Also features high and low trip points, which can be set by the user. This is a good way to monitor the shaker's armature voltage, armature current, field voltage, and field current. Includes Wired Remote Control (VR9601) option.

Wired Remote Control – VR9601

The Wired Remote Control option enables you to interface your controller to other systems, allowing starting and stopping of tests by way of a TTL type input signal. A typical application would be interfacing to an environmental chamber control system. It also allows binary encoded test selection, so different tests can be selected with a simple TTL interface.

File Viewer (1 User) – VR9608

This is a software license to enable the controller software functions for creating test profiles as well as data recall and manipulation on a computer that is not connected to the VR9500 Revolution controller. The VR9500 Revolution control system saves data as the test is running. Without this option you can look at the native data files and generate reports from the control computer only.

OTHER FEATURES

On-line help

Consistent management of user-defined engineering units

On-line graphics

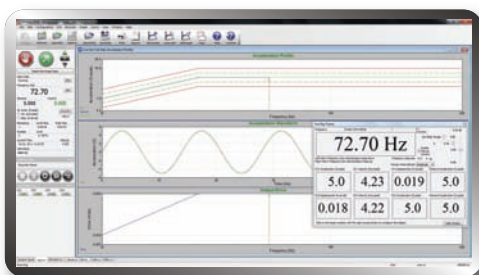
Test documentation of setup parameters and signals can be generated through Microsoft Word as printed media or a disk file via a single click

Test sequencing for automated execution of tests requiring more than one test mode



SINEVIEW

SINE VIBRATION
CONTROL
SOFTWARE
VR9100



TECHNICAL SPECIFICATIONS

TEST DURATION Can be entered in terms of length of time, number of sine wave cycles or number of sweeps.

SWEEP TYPE Linear from 0 – 6,000 Hz/min or logarithmic from 0 – 100 octaves/min. Sweep rate can be changed while test is running.

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

MANUAL CONTROL The frequency sweep and amplitude level can be manually controlled with the mouse.

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

LARGE NUMERICAL READOUT A configurable large numeric readout displays the current test frequency and channel amplitudes.

MULTI-CHANNEL EXTREMAL Allows more than one input channel for control in a control strategy where the maximum, minimum or an average of channels will be used for control.

INDEPENDENT CHANNEL NOTCHING Assigns maximum limiting breakpoint profiles to individual channels.

NUMBER OF TEST SCHEDULE LEVELS 2,000 test schedule levels.

TRANSDUCER CONTROL OPTIONS Mixed transducer types - control using Acceleration, Velocity, Displacement or combination of transducers.

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 available with optional analyzer software module VR9607.

AVAILABLE OPTIONS

High Frequency For Sine – VR9103

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

Sine Resonance Phase Track & Dwell Control (SRTD) – VR9105

Automatically generate a table of the top 10 resonance points on your product. The relationship between 2 channels is compared. Also, tracked dwell function is enabled, allowing the controller to automatically vary the frequency to track the resonance.

Constant Output Level Adapter (COLA) – VR9104

Turns on the auxiliary output on the rear of the VR9500 Revolution unit, and sends out a selectable voltage sine, square or pulsed reference signal at the frequency of the currently running sine wave. Also allows the frequency or phase to slip off the fundamental frequency, so bending action on a part can be observed with a stroboscope.

Accelerometer Calibration Verification Package – 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.

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.

TECHNICAL SPECIFICATIONS

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

Loop Time: Inner control loop: 10 mS typical

Degrees of Freedom: User adjustable from 2 – 1,000

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

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

Units: English, SI, Metric, mixed, user specified.

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 looping, enter form, save report, record, view report, start, stop and many more.

Abort/Alarm: High and low profile limits specified either universally or independently at each breakpoint in dB or % with respect to reference. RMS high and low limits calculated automatically from profiles or specified by user.

Profile View: Profile graphics shown and updated as profile is created. Automatic listing of RMS Acceleration, Velocity and Displacement values for profile. Profile operating levels are compared to the shaker parameter table.

Spectrum Lines: 50 – 26,000 Lines

Sample Rate: 100 – 200,000 Hz

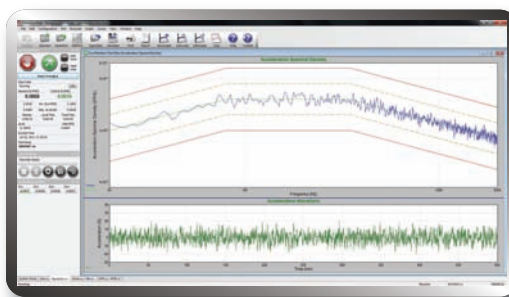
Frequency Resolution: As fine as 0.1 Hz

Closed Loop Dynamic Range: 100 dB typical

Number of Test Schedule Levels: 2,000

RANDOMVIEW

RANDOM VIBRATION CONTROL SOFTWARE VR9200



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 electro-dynamic, and servo-hydraulic or servo-electric shakers. Pretest self-check available with optional analyzer software module VR9607.

AVAILABLE OPTIONS

VR9207

Random-on-Random

Run controlled spectrum random tests with swept random "tones" superimposed on a random background.

VR9204

Random Import

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

VR9206

Sine-on-Random

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

VR9203

High Frequency For Random

Extends upper frequency for Random control from 4,990 Hz to 50,000 Hz, requires an export license.

VR9205

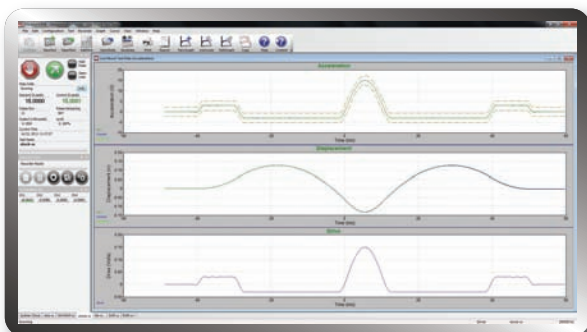
Kurtosion®

Kurtosis control. See Kurtosion® page 15.

SHOCKVIEW

CLASSICAL SHOCK PULSE SOFTWARE VR9300

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.



AVAILABLE OPTIONS

VR9301 Earthquake/Transient Waveforms Control

Runs a user defined time transient. Also used to run earthquake tests, like the Belcore standard earthquake time transient tests.

VR9302 Shock Response Spectra Control (SRS)

Runs a shock pulse defined by a frequency vs G peak table. Many different waveforms synthesis generation techniques included.

VR9304 Shock Transient Capture

Define trigger level, slope, position, and capture duration, and the VR9500 Revolution will trigger to capture a transient event when the external inputs match the defined conditions.

VR9303 High Frequency For Shock

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

TECHNICAL SPECIFICATIONS

Sample Rate: Up to 200,000 Hz with High Frequency option. Does not require export license.

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

Filtering: User specifies desired frequency and a filter type for low/high pass filtering applied to the input channels. Filters can be enabled/disabled individually per channel simultaneously with the ability to change filter parameters during post processing. Filter corner frequencies can be set individually per channel. Both filtered and unfiltered data can be plotted.

Delay Between Pulses: User defined from 0 – 1,000 seconds.

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 full equalized level.

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 amplitude settings are a percentage of the demand peak acceleration.

Abort Limits: Set to MIL-STD 810 requirements and/or a percentage of demand waveform amplitude.

Profile View: Profile graphics shown and updated as a test profile is created. Profile operating levels are compared to the shaker parameter table.

F.D.R. VIEW

FIELD DATA REPLICATION SOFTWARE VR9400

F.D.R.VIEW (or F.D.R.) provides the capability to replicate your field acceleration measurements and reproduce them on the shaker in the test lab. Utilizing real-time adaptive control, F.D.R. simulates the recorded time history measurements on your shaker.

TECHNICAL SPECIFICATIONS

DATA IMPORT

Import waveforms from data recorders using an analog input, or input digital wave .uff, .rpc or text files. Waveforms can be up to 45 hours long at a 26,000 Hz sampling rate or up to 1 year long at a 100 Hz sampling rate or any combined sample rate and test durations in between.

EQUALIZATION

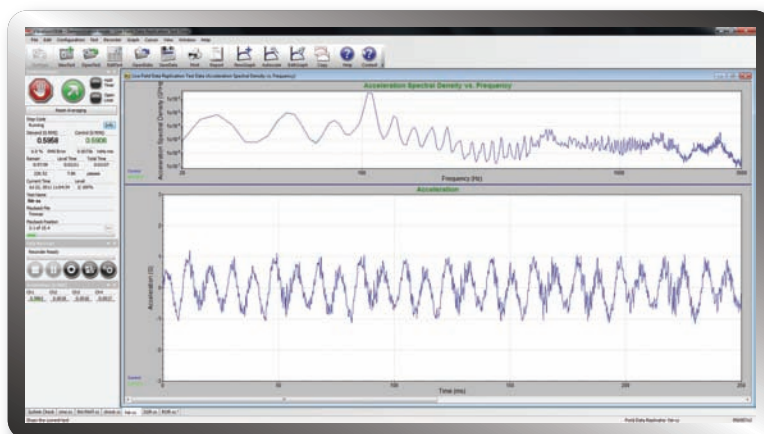
The controller automatically equalizes the response of the shaker/fixture/product prior to running the test. This equalization can be memorized and stored with the test to quickly start a test at a full equalized level. The frequency range of the output signal is configurable, and a frequency band can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

MULTIPLE SHAKERS

From 1 to 4 control loops can be run simultaneously to independently control up to 4 shakers with 4 separate waveforms.

EDITVIEW

This package links with F.D.R.VIEW, RecorderVIEW, and Random Import. EditVIEW provides a handy tool to examine and edit your acceleration and other signal waveforms. This feature is standard with F.D.R. and RecorderVIEW.



AVAILABLE OPTIONS

VR9401 Field Data Replicator Reference Output

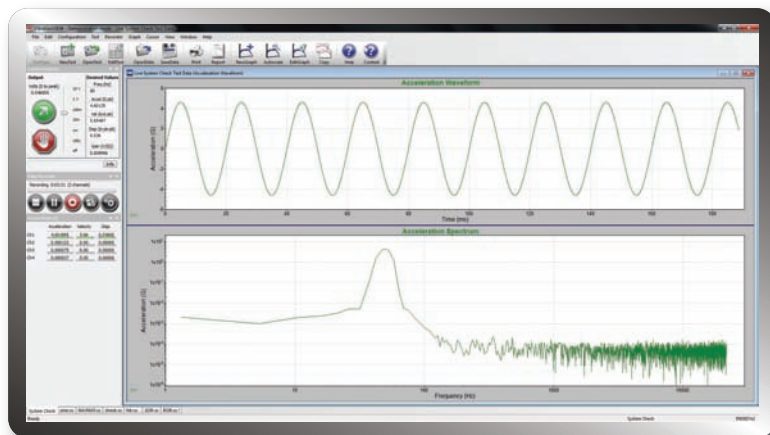
Play any uncompensated reference waveform fully synchronized with the control waveform. This is useful for providing reference waveforms to a spectrum analyzer for external verification of results, for providing a pre-recorded trigger signal (e.g. tachometer, cylinder firing, etc.) synchronized to the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

VR9403 High Frequency For F.D.R.

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

RECORDER VIEW

WAVEFORM RECORDER
SOFTWARE VR9600



AVAILABLE OPTIONS

VR9400 Field Data Replication Software

Vibration Research Corporation's pioneering software package which allows the replication of the frequency, phase and amplitude of the waveform found on your product in actual operation.

VR9204 Integration with Random Import

Automatically generates a random test spectrum from time waveform data. The input data can be analog or digital. This is a good option to use with Field Data Replication, as it gives additional pass/fail tools for your test regiment.

VR9209 Fatigue Analysis and Profile Generation (Requires RandomVIEW VR9200 and includes Random Import VR9204)

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.

Record your field acceleration measurements digitally directly to your PC's hard drive. No need to buy extra equipment to collect your data. The VR9500 Revolution controller hardware connects easily to a notebook computer to make a portable data acquisition system.

TECHNICAL SPECIFICATIONS

Channels 1 – 32 simultaneous channels

Voltage Range +/- 1 V, +/- 10 V, +/- 20 V peak

Resolution 24-bit

Sensor Power Constant current supply (4mA) standard, can be enabled or disabled as needed.

Sensitivity User selectable mV/G accelerometer sensitivity, or use any input unit when combined with the Alternate Units feature.

Sample Rate 100 Hz to 200,000 Hz

Dynamic Range 120 dB typical

Signal-to-noise Ratio: >100 dB (from DC to 10,000 Hz measured with half-full-scale sine waves).

Interchannel Isolation >110 dB

Data Format Binary file format, data samples stored with 32-bit floating point numbers.

Maximum Samples 4 billion per channel.

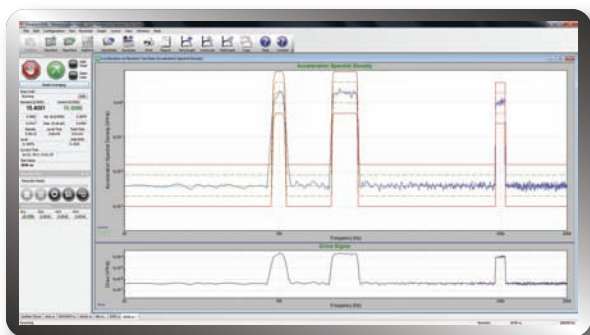
Import Formats Convert from Windows .wav files, .vfw files, ASCII text (.txt) files, RPC and Universal File Format (.uff) files.

Export Formats Convert to .uff files or ASCII text (.txt) files.

MIXED-MODE TESTING

RANDOM-ON-RANDOM VR9207

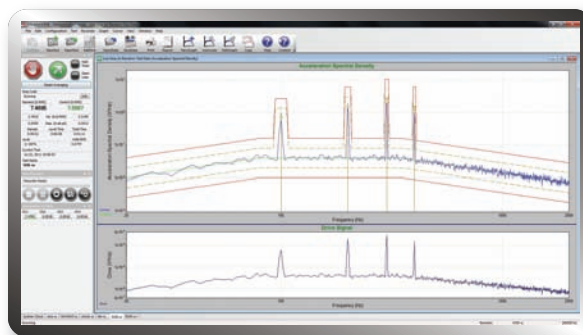
Run controlled spectrum random tests with swept random "tones" superimposed on a random background.



- 1 – 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 VR9206

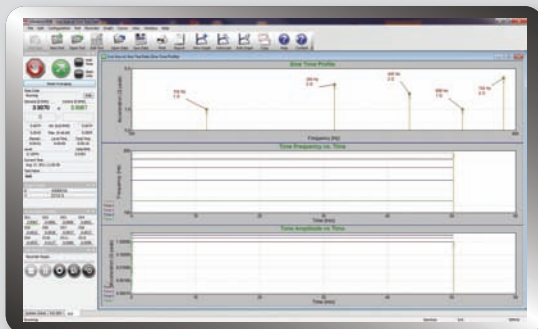
Run mixed-mode tests with sine tones superimposed on a random background.



- 1 – 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 per sine tone can be entered.
- 200 – 6,500 lines of control.

SINE-ON-SINE

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



- 1 – 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.

EARTHQUAKE | SEISMIC

Run a shock pulse defined by a frequency vs. G-peak table. Many different waveform synthesis generation techniques are included. ShockVIEW is required to run the tests. Software necessary to generate reports specific to IEEE-344 earthquake testing is included.

EARTHQUAKE VIBRATIONVIEW CONTROL SYSTEM – VR93-E344

3 Single Processing Control Units with 12 Analog Inputs, 3 Analog Outputs (Drive) enabled. Includes (VR9100) SineVIEW for one drive output, (VR9300) ShockVIEW for three drive outputs, (VR9302) S.R.S.VIEW for three drive outputs, (VR9301) User Defined Transient Waveforms control for three drive outputs, (VR-IEEE-344) IEEE Earthquake Package for one drive output, (VR9606) Math Traces & Calculator option for one drive output and (VR9600) RecorderVIEW for one drive output.

SRS GENERATION

Supports many waveform generation techniques including linear and exponential chirp, wavsyn, burst random, linear and exponential chirp on burst random, enveloped random, burst sine, or iterate from user waveform.

MANUAL WAVELET MANIPULATION

Manually adjust all the parameters of the underlying wavelets, or allow VibrationVIEW to automatically create and run without user intervention.

DATA PLOTS

SRS Pseudo Velocity and SRS Acceleration plots. Acceleration for primary (+), primary (-), or Maxi-Maxi. Data and text annotations can be easily placed on the graphs, with data values updated as the live data changes.

MULTI-AXIS CONTROL

Multi-Axis control capabilities for tripod and other applications.

IEEE344 FEATURES

Input Filtering for measurement of zero period acceleration (IEEE344 – Annex A)

Multiple damping plots (IEEE344 – Annex A)

Sine Beat/Dwell/Sweep Fragility Testing (IEEE344 – Annex C)

Peak Stress Cycle Counting (IEEE344 – Annex D)

Coherence Plots (IEEE344 – Annex E)

Correlation Plots (IEEE344 – Annex E)

Waterfall Plots (IEEE344 – Annex E)

SRS ANALYSIS

SRS Package adds SRS plots to shock and transient capture test modes.

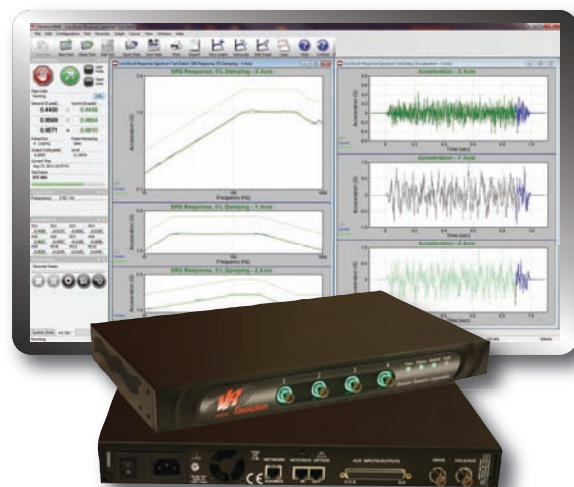
EARTHQUAKE/TRANSIENT WAVEFORMS CONTROL

(REQUIRES CLASSICAL SHOCK) – VR9301

Runs a user defined time transient. Also used to run earthquake tests, like the Belcore standard earthquake time transient tests.

VRC THREE AXIS GEOMETRY TRANSLATION HARDWARE – VR93-GE0BOX

Required for Tri-pod shaker systems. Includes Geometry Limit Checking.

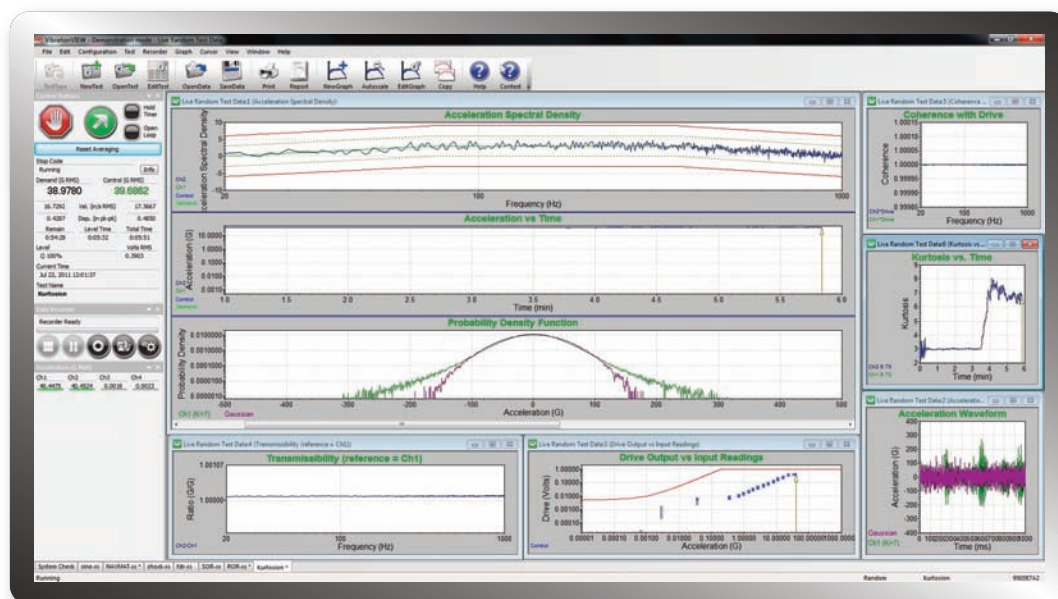


KURTOSION® VR9205

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).

Present day methods of random testing assume Gaussian (Kurtosis = 3) distribution of random data. In some cases, the real world vibration is Gaussian, but in many cases the field data represents a non-Gaussian distribution. Therefore, we suggest engineers analyze the real world data and control the kurtosis level in their laboratory random vibration tests to match the kurtosis level of the real world data (Random Import - VR9204 includes the ability to measure the kurtosis of time waveform data).

Traditional Gaussian random tests almost never give 7-sigma peaks, but these 7-sigma peak acceleration levels do occur in the field! Crank up the kurtosis using the Kurtosion® feature from Vibration Research, and you can get 7-sigma peaks as often as one per second. You can match both the RMS and peak acceleration levels of your field data while running a random test!



Higher kurtosis value dictates the amount of time spent at or near the peak levels.

Provide the desired peak accelerations which cause the real-life product failures that are presently being missed by the current random vibration testing techniques.

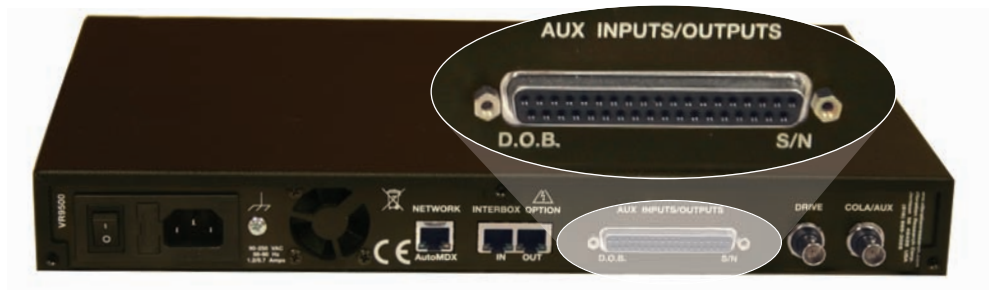
By adding a third control parameter – a kurtosis control parameter – one could control the amount of time the random vibration test runs at higher RMS values.

Kurtosion® reduces the amount of time needed to perform necessary tests when kurtosis is increased above the standard $k=3$.

SHAKER MONITOR and ANALOG DC INPUTS VR9602



The 8 inputs on the rear of the VR9500 Revolution unit can be set up as Analog DC Inputs. This allows the user to monitor, log, and graph data from up to 8 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. *(Armature and field current and voltage readings require additional input conditioning equipment - please consult factory for details)*



ADDITIONAL SOFTWARE OPTIONS

Shock Transient Capture (Requires ShockVIEW) –

VR9304 – Define trigger level, slope, position, and capture duration, and the VR9500 Revolution will trigger to capture a transient event when the external inputs match the defined trigger conditions. The captured transient event will be displayed with the full set of shock plots, including SRS analysis, and can be stored to disk for later analysis. 524,000 samples per measurement.

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 F.D.R. 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.

Sine-and-Random-on-Random, S&RoR control module (Requires SoR, RoR, and Random) – 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.

Calibration & Verification software Annual License –

VR95-CAL – One (1) year license to run automated calibration verification and generate calibration verification reports. (Requires equipment contained in the VR95-AC Calibration Equipment Package)

Calibration & Verification software Permanent License

– VR95-CALP – Permanent license to run automated calibration verification and generate calibration verification reports. (Requires equipment contained in the VR95-AC Calibration Equipment Package.)

VR-DT311A – Digital Strobe light with external input to be used with Constant Level Sine Output with Slip Sync function (COLA).

Accelerometer Calibration Verification (Requires SineVIEW) – VR9106

– Accelerometer calibration verification. Use this option to verify calibration on all your accelerometers. It provides an easy interface to calculate accelerometer sensitivity. This will allow the user to perform a sine sweep, controlling on a reference accelerometer, and produce a calibration report suitable for calibration record keeping. Automatically calculates the accelerometer sensitivity at the chosen frequency. Requires at least 2 input channels, SineView, a reference accelerometer, and a shaker system.

SUPPORT

At Vibration Research we believe on-going support is just as important as the initial installation. We include a **3 Year hardware warranty** with every system. In addition we include 1 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.

Recently run tests			
Random test	Apr 07/2010 16:48	Stop Button Pressed	
Random test	Apr 07/2010 16:47	Test Parameters Changed	
Sine test	Apr 03/2010 20:03	Stop Button Pressed (2)	
Sine test	Apr 03/2010 20:03	Stop Button Pressed	
Sine test	Mar 31/2010 15:53	End of Sweep Test	
Sine test	Mar 31/2010 15:19	End of Sweep Test	
Sine test	Mar 31/2010 09:48	End of Sweep Test	
Random test	Mar 31/2010 09:46	Stop Button Pressed	
Random test	Mar 31/2010 09:44	End of Test	
Random test	Mar 31/2010 09:32	End of Test	
Sine test	Mar 29/2010 12:55	End of Sweep Test	
Shock test	Mar 25/2010 14:37	End of Test	
Sine test	Mar 25/2010 14:29	End of Sweep Test	
Shock test	Mar 25/2010 13:41	End of Test	
Shock test	Mar 25/2010 13:40	End of Test	
Shock test	Mar 25/2010 13:39	End of Test	
Sine test	Mar 25/2010 10:30	End of Sweep Test	
Sine test	Mar 24/2010 20:42	Max Start Drive Voltage	
Sine test	Mar 24/2010 20:42	Max Run Drive Voltage	
Sine test	Mar 24/2010 20:31	Max Run Drive Voltage	



3 Year Warranty!

SUPPORT & TRAINING OPTIONS

Specific Monthly Web Seminars

One - on - One Web Training

On Site Training and Support (Fee)

2 Day Training Seminars (Fee)

Vibration Research Online Web Forums

Go to www.vibrationresearch.com/training.html to find further information on training classes.

Go to www.vibrationresearch.com/forums to sign up for additional information.

We are always glad to assist you with test profile setup, questions, report design and any other customization you might need. We look forward to the opportunity to assist you.

Email: support@vibrationresearch.com

or Email directly to anyone at Vibration Research

Phone: 01(616)669-3028 | Skype: vibration.research

Go Green and Save Money

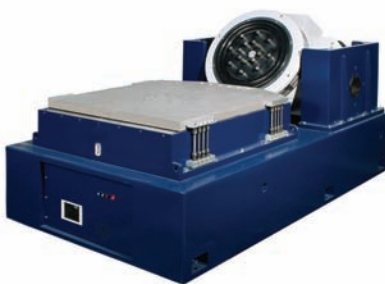
The world is “going green” and at Vibration Research Corporation we want to help you achieve your “green” goals and save you money at the same time by reducing your energy bills. We can help you with our Wired Remote Control option (VR9601).

It is very common for a test to finish after normal business hours and after everyone in the lab has gone home. And even though the test is complete, your shaker, amplifier and blower remain powered on and consume energy. Additionally, since your equipment remains on and generating heat, your air conditioner continues to work hard to cool your facility. To make matters worse your blower expels the conditioned air which is like blowing money out the window.

The VR9601 Wired Remote Control option can be used to shut down your shaker, amplifier and blower as a scheduled function upon the completion of any test.



Don't **blow**
your **money!**



If you look at the following example you can see that the VR9601 Wired Remote Control option can pay for itself in a short period of time.

Average hours/Month vibration equipment remains on after completion of test (less than 1 weekend)	40 hours
Typical hourly energy consumption of idle equipment (including the cost of air conditioning)	25 kw
Typical cost per kWh	\$0.10 USD
Typical monthly energy cost of idle equipment	\$100.00 USD
List price for VR9601	\$650.00 USD
Simple payback	6.5 Months

EDUCATIONAL OPPORTUNITIES

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

WEB SEMINARS

Vibration Research regularly offers 1 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 to access the papers, videos and additional training information.

VIBRATION RESEARCH SUPPORT & TECHNICAL TEAM



John Van Baren
President/Founder

John graduated from the University of Michigan and after 15 years of engineering shakers, amplifiers and controllers for another company, he saw an opportunity to start something new and innovative and formed Vibration Research Corporation. John has used his skills to create revolutionary control systems and continues to direct VRC. Since inception John has stressed the importance of reliable, easy to use control systems and continuous development of leading edge hardware and software.



Phil Van Baren
VP Chief Software Engineer

While working on his Ph.D. in Control Theory at the University of Michigan Phil joined Vibration Research in 1998 and immediately began developing software for the VR7500. Phil continues to be the chief author of VRC control software and directs the software development team. Phil demands reliable software coding while keeping an eye on the future and developing some of the latest vibration testing control software. Phil also holds the patent on kurtosis controlled random testing.



Curt Fredricks
CFO/Business Development



Matt Millard
Director of Sales & Marketing



Mark Chomiczewski
International Sales Manager



Jordan Van Baren
Sales Engineer



Wayne Jean
Sales Engineer



Cathy Postmus
Sales Support Manager



Dan Van Baren
Manager Software Development



Andy Cogbill
Support Engineer



Jon Drnek
Software Specialist



David Vande Bunte
Software Specialist



Rachel Warner
Staff Accountant



Alicia Haven
Office Administrator

SPECIFICATIONS

INPUTS

Input Channels: 1 – 32 input channels

Output Channels: 1 – 2 output channels per control box, +/- 1V, +/- 10V

Voltage Range: +/-1 V, +/-10 V, +/-20 V peak

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

Protected: 200 V peak tolerant inputs

Noise Floor: <70nV/√Hz

OUTPUTS

Analog channels: One drive channel standard. One COLA output standard with purchase of SineVIEW.

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 50,000 Hz output frequency (200,000 samples per

second). Frequency use above 4,990 Hz for Random and F.D.R. requires export license.

Resolution: 24-bit.

Total Harmonic Distortion: < -105 dB

VR9500 REVOLUTION

Features: On-line help, consistent management of user-defined engineering units, on-line graphics, and test documentation of both setup parameters and signals through Microsoft Word as printed media or disk files via single click on icon. Test sequencing for automated testing to a mission profile.

Reporting: Extremely robust and easy to use reporting package is standard with all VR9500 Revolution control systems. All forms and reports are customizable to your requirements.

Digital input and output – Rear pluggable terminal block enables the digital level signals – 8 inputs and 8 outputs to be interfaced with your

product and other systems. Used for remote start/stop/pause/continue and other functions such as close/open control loop, manual/auto schedule, and enable/disable aborts.

Power Failure: Transient free shutdown.

Engineering units: English, SI, Metric, mixed, user-defined.

Front End Signal Processing Unit: Low noise design with a dedicated high speed processor for signal processing. Front BNC connectors for 4 transducer connections. Front panel status LEDs. Rear panel connectors drive output and COLA output, connection to Ethernet port, and a terminal block of digital I/O lines.

Dimensions

Width 15 1/16",

Depth 10 1/2",

Height 1 3/4"

Weight 7.5 lbs.

Operating Temp Range

Calibrated up to 23°C (+/- 5°C), functional 50°C maximum.

SINE

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

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: ≥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 & 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 0.000001 Hz.
Loop Time: 5 msec typical
Manual Control: Limits both the drive output and the control signal on startup to a user controlled level. Normal test operation will commence only after the limited startup is verified by the user.

RANDOM

Frequency Range: DC to 50,000 Hz, user selectable. Up to 4,990 Hz standard; High frequency option extends to 50,000 Hz (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: 100 dB 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 startup to a user controlled level. Normal test operation will commence only after the limited startup 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: 2 – 1,000 degrees of freedom.

SHOCK

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

Pulse Duration: From 1 mS to 60 seconds.

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

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

Loop Transfer Function: Automatic calculation during pre-test or, for no pre-test startup, 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.





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See us on
You Tube

