

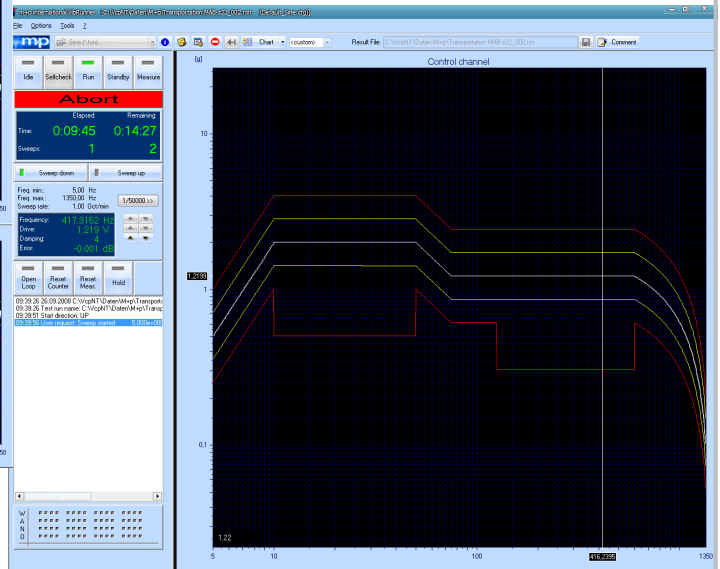
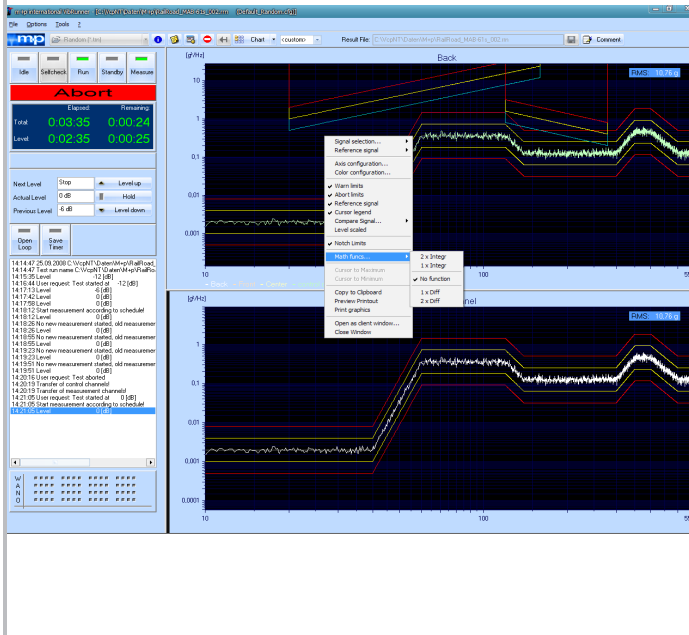
# VibControl

## Random Vibration Control & Sine Vibration Control

Random and Sine control modes are the two basic and most common excitation modes for Environmental Shaker testing. Random performs real-time closed-loop control of PSD profiles. Sine performs real-time closed-loop control of swept sine vibration.

### Key Features

- Random and Sine control fully compliant with DIN and MIL-STD 810 standards
- Support on electrodynamic and hydraulic shakers
- Frequency range up to 12.8 kHz (Random) or 20 kHz (Sine)
- All input channels available as control, watchdog and/or measurement channels
- Control strategy: average, maximum, minimum
- Notching/force limiting
- True multi-tasking without loss of real-time control
- Random: Resolution up to 3,200 spectral lines
- Random: Import of field measured profiles with up to 3,200 breakpoints
- Sine: Profile defined with up to 1,024 breakpoints
- Sine: Control on acceleration, velocity, displacement and force
- Seamless import/export of test results into applications such as MS Word, MS Excel, and m+p SO Analyzer
- Measuring and monitoring DC signals for functional testing



### Applications

- Random testing is commonly used in aerospace and military applications for duplicating such events as aircraft take-off, rocket launch, or transportation over rough terrain
- Sine testing is used for proving product reliability and for structural resonance search in all kind of applications such as automotive, electronics, aerospace, consumer products and military

## Control Modes

The Random control mode applies a random signal to the structure under test for a user-defined time and controlled to a user-defined PSD spectra. The random noise generated during this type of control tests is Gaussian random with or without amplitude sigma clipping. The reference PSD can have up to 3,200 lines of resolution in any selectable sampling frequency range. The spectrum can be entered manually, copied/pasted from the Microsoft Windows clipboard or imported from a dual column ASCII file. A test schedule of multiple levels relative to the full level PSD reference spectrum will be followed to assure safe and accurate control based on lower level information.

The Sine control mode applies a sinusoidal signal to the specimen under test sweeping in a user-defined frequency range, at a defined sweep rate for a number of sweeps or total test time. Here a continuous frequency sweep is generated, measured, analyzed and controlled. The amplitudes at the excitation frequencies are defined in a reference spectrum with a, v, d or force values. The reference spectrum can be entered manually and copied/pasted from the Microsoft Windows clipboard. The total number of breakpoints of the reference spectrum exceeds 1,024. The reference spectrum editor provides for easy cross-over frequency calculation (e.g. constant displacement into constant velocity for shaker performance tests) based on fixed amplitudes criteria of different dimensions. The response of each channel can be analyzed using four amplitude estimators (Filter, Average, RMS or Peak) or combination for advanced analysis. For maximum flexibility of the Sine control test, a sweep table is available for programmed sweep rate, sweep mode, sweep direction and compression speed changes during an ongoing test.

## Input Channels

All input channels in both modes of excitation can be allocated as control, watchdog, measurement or any combination. A measurement channel just measures the response and does not influence the control at all. A watchdog channel checks for not to exceed response amplitudes for system shutdown (tolerance) or for not to exceed response amplitudes for drive signal reduction (notching/limiting). The tolerance watchdog channel checks its response versus tolerance amplitudes. The notch watchdog channel checks its response versus a notch spectrum, broadband or narrowband. A control channel is always in the control loop and its response is always fed into the control algorithm defined with control strategy average, maximum or minimum.

The Sine control mode allows for re-calculation of the notch spectra based on the response at the notch channels of previously ran sine tests at lower levels than the final test. This feature guarantees minimal notch profile overshoot, hence protecting the specimen under test at the critical notch frequencies. The Sine control mode also allows for on-line measurement and notching of overturning moment responses based on the response of force transducer and their location relative to the structure under test. This momentum control is achieved using virtual channels with a definition of the x, y coordinates of the force transducers.

- All input channels as control, watchdog, measurement or any combination
- Control on all input channels with average, maximum and minimum control strategy
- Notching (limiting) profiles may be defined for each watchdog channel individually
- Minimal notch profile overshoot

## Test Set-Up & Test Run

The test set-up for both modes is very intuitive and easy to use. The set-up is split up into four separate parts: reference spectrum editor, shaker/specimen information, level schedule and channel information including notch profiles. Typical set up parameters like reference spectrum, notch spectra, channel descriptions, channel sensitivities and channel EU (Engineering Unit) can easily be copied and pasted from any application, m+p VibControl software (for easy transfer of information from other tests and/or modes of excitation) using the Microsoft Windows Clipboard. Also complete column copy and paste of data series is supported.

While the test is running, all information important to the closed-loop control can be seen at a glance for fast and direct monitoring. Routine testing is done by simple automatic controls. Advanced manual controls for diagnostic test applications may be disabled for production use. A comprehensive system selfcheck is performed prior to running the test to ensure that sensors and drive signals are in place avoiding potentially dangerous and damaging situations. A date and time stamped test log is created showing details of the selfcheck and every test event. The test safety is assured with open loop detect, alarm/abort profile checks, overall grms control checks, drive level limit, individual channel grms high/low limits. An optional digital I/O interface allows to connect the VibUtil tool for test sequencing and to control climatic chambers.

- Broadband Random Set-Up**
  - Frequency ranges from 0-50 Hz to 0-12.8 kHz in 9 steps
  - Resolution from 200 to 3,200 lines in 5 steps
  - Selectable units for acceleration, velocity and displacement

- Automatic re-calculation with units changed
- Profile defined in PSD ( $g^2/Hz$ ) up to 3,200 breakpoints with import from ASCII file
- Amplitude and/or slope entry with auto-calculation of end points
- Independent alarm and abort profiles with overall **grms** limits on each channel
- User-defined DOF averaging from 1 to unlimited
- User-defined level schedule with pre-test, unlimited steps and looping
- User-defined measurement schedule for data storage during test
- Sigma clipping selectable from 1.42 to 8
- Manual measure, reset, level up/down, open loop during test (functions can be disabled)

#### **Swept and Stationary Sine Set-Up**

- Frequency ranges from 0.1 Hz to 20 kHz; up to 50 kHz with additional hardware
- Sweep profile defined with up to 1,024 breakpoints
- Measurement filters: RMS, peak, averaged or digital tracking filter
- Breakpoint defined by acceleration, velocity, displacement or force

- Constant acceleration, displacement or velocity slopes with auto-calculation of cross-over frequencies
- Independent alarm and abort profile table plus overall g limits
- Unlimited user-selectable sweep rate in Oct/min, Hz/min or Dec/min
- Fixed frequency dwell function (sweep hold)
- User sweep rate table varies rate and direction by frequency bands
- User-defined numbers of sweeps, rate, sweep time or test time, others calculated
- User-defined measurement storage rate (store every n sweeps up/down)
- Measurement channel can be any signal type incl. DC for display and correlation with sweep data
- User-defined start-up time and limit plus rampdown time
- Test duration unlimited
- Manual sweep direction, hold, rest, open loop, level up/down, frequency controls during test (functions can be disabled)

## **Add-On Modules for Sine Testing**

Thanks to its modular design, VibControl can be upgraded to other tasks related to Sine testing: For instance, channel control can switch from a displacement transducer which is used for sine tests beginning at very low frequencies to an accelerometer at a defined higher frequency. The Sine Dwell option lets the sweep remain on one or several selected resonances for a user-defined period. The Sine Data Reduction function measures and analyzes taped swept sine data online using the COLA signal, making it a powerful tool to increase the channel count.

#### **Sine Dwell Set-Up (incl. Resonance Search, Tracking and Phase Lock)**

- Specifications as per Swept Sine
- Dwell schedule table allows 50 dwell points to be defined
- Each dwell can be a fixed frequency, fixed phase, peak amplitude search and track or defined phase search and track
- Each dwell independently defines control (ref) and measurement channels
- Dwell at each point for user-selectable seconds, minutes or cycles
- User-controlled measurement data storage rate

#### **Sine Displacement and Velocity Control**

- For sine testing starting at very low frequencies, displacement transducers can be used
- At a defined frequency, the control changes automatically from displacement transducer to accelerometer transducer

#### **Sine Data Reduction**

- Track and online analysis of taped swept sine data using the COLA signal
- Evaluation and storage of the taped signals on a second vibration control system during the test run

## **Post-Processing & Reporting**

VibControl's post-testing includes extensive data handling, analysis, single and multiple data graphing and custom report formatting including company logo or other custom styles. These together with advanced cursor functions, peak search, mathematical functions and transfer function analysis mean high-quality reports are completed easily and quickly. The Multiplot function extends the post-test analysis even further with the ability to display and plot data from different test types, several test runs or multiple test specimens in a single window. Data filtering is available to quickly select the most relevant data from all that was stored during the test. Data and graphics can be copied and pasted to MS Office applications. For even more advanced analysis and reporting functionality, all VibControl test results can be directly exported to m+p international's SO Analyzer e-Reporter package.

### Post-Processing

- Transfer function: Relating the behavior of control and measurement channels in the test run
- Mathematical functions: Converting the measured acceleration signal into velocity and displacement, or vice versa
- Peak value analysis: Peak values will be marked automatically in the graphics and listed with their numerical data in a table. Q-factor calculation in sine
- Graphical and Numerical Measurement and Reference Data Analysis:
  - Control and response spectra with reference, alarm, abort and notch limits
  - Error
  - Drive
  - FFT amplitude and phase in sine and random
  - Coherence in random
- Printouts
  - Multiplot: Displaying and printing several traces

in one graphic

- Autoplot: Automatically printing a preselected series of graphics
- Printing a list of preselected test parameters
- Printing directly to MS Word using a customer defined template

### Reporting

- Interface to m+p international's SO Analyzer e-Reporter software for comprehensive analysis and reporting
- One-click printing to a Word document of all or a selection of result data
- Copy and paste of all or a selection of result data to Excel for matrix analysis
- Export of all or a selection of result data in Universal File Format
- Export of complete binary result file into ASCII file

## General Information

### Operating System

- Microsoft Windows XP/Vista

### Ordering Information

- VC-RAN Random
- VC-RNO Random Notching
- VC-SIN Sine
- VC-SNO Sine Notching
- VC-SRD Sine Resonance Search & Dwell
- VC-SRE Sine Reduction
- VC-SRT Sine Reduction – Throughput
- VC-RRE Random Reduction
- VC-RRT Random Reduction – Throughput
- VC-DCO Displacement Control

### Optional VibControl Software Modules

- VC-CLS Shock Classical
- VC-SRS Shock SRS

- VC-EXP External Pulse
- VC-SOR Sine-on-Random
- VC-ROR Random-on-Random
- VC-TRC Transient Capture
- VC-TRT Transient Capture – Throughput
- VC-RLD Time Domain Replication (e.g. Road Load)
- VC-CRT Crash Test
- VC-ACO Acoustic Control
- VC-MOC Momentum Control
- VC-HFS High-Frequency Sine
- VC-APP Advanced Post-Processing
- VC-SVU VibUtil
- VC-AVU Advanced VibUtil
- VC-RSC Multi-Monitor
- VC-VBM Visual Basic Module
- VC-NOF VibCo Pilot (No Frontend Licence)
- VC-CAL VibCalibrate

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Product Information

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