

# VIBRATION TESTING



# Vibration Control



Photo courtesy of Airbus Defence and Space, Germany

## YOUR BENEFITS

- Full range of excitation modes available
- Compliant with all relevant industrial standards (MIL-STD 810, DIN EN 60068, et al.)
- All current Microsoft Windows (32-/64-bit) operating systems supported
- Scalable software and hardware from 4 to 256 channels with the same user interface and functionality
- Vibration monitoring for maximum protection of specimen and equipment
- Time domain displays and data storage for all excitation modes
- Notching/Force Limiting for sine and random minimizes overtesting
- Multi-monitor support for high channel counts
- Automated and customizable report generation
- Test schedules and external hardware control with digital I/O
- Selectable user interface languages

The m+p VibControl products for advanced vibration and shock testing from four to hundreds of input channels are used by many of the leading environmental test laboratories throughout the world. End users appreciate the simple operation, extensive analysis and reporting functions, and powerful upgrade possibilities, as well as the excellent stability and high quality of the systems.

In cooperation with renowned partners, m+p international provides complete vibration test systems including shaker and accessories as well as combined climatic and vibration test stands.



Vibration testing of a PC

## Future-Proof Software and Hardware

Thanks to the modular design of software and hardware, m+p VibControl can be configured and expanded at any time to tackle other measurement tasks and higher channel counts. Software add-ons are possible for all test modes, including special post-processing functions, automatic test sequencing, etc.

m+p international regularly adds enhancements to its m+p VibControl software. These software revisions ensure that you always benefit from the latest technology, helping to increase testing efficiency.

Our state-of-the-art, high-precision measurement hardware ensures long-term support and system longevity. What if you want to replace the measurement front-end you have used for many years with the latest hardware technology? No problem, we will equip your existing m+p vibration controller with the newest generation of m+p hardware without making changes to the familiar user interface.

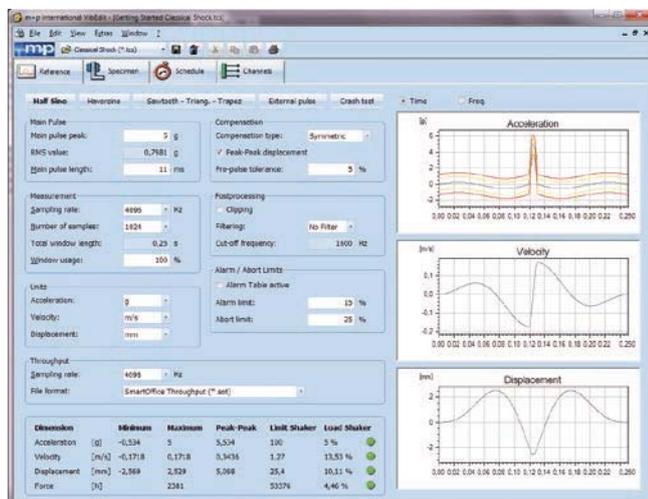


m+p measurement hardware from 4 to hundreds of input channels

**Common User Interface**

All m+p VibControl systems are controlled by the same proven Microsoft Windows-based software. A single interface with the same look and feel means that test specifications can be transferred from engineering to production without change or error and test data can be compared directly between one system and another. Common reporting formats improve communication and data can easily be shared over a network and accessed from anywhere.

This makes intra- and inter-company data sharing simple and straightforward and improves productivity. Since the user interface is common across the whole platform, features typically integrated in high-end systems (e.g. notching in sine and random test mode) are also available for low-channel count system configurations.



Single interface from four to high-channel count vibration control systems simplifies communication and data sharing

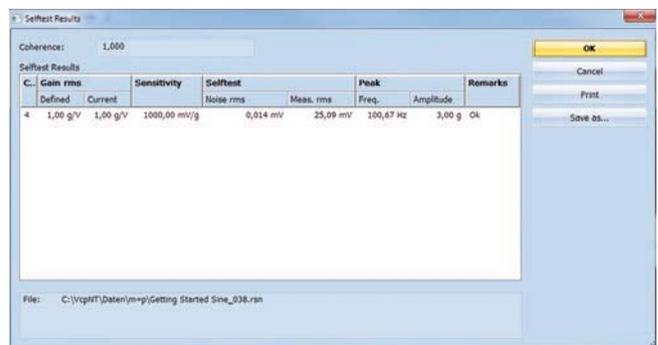
The m+p VibControl solutions for data reduction with time history recording to throughput disc and acoustic testing in a reverberant chamber are based on the same user interface and hardware platform as the shaker control systems. Therefore they can be configured for different applications simply by adding software modules, significantly reducing purchase costs and operator training.

Our user interface is multi-language.

**Test Item Protection and Safety**

Protecting your valuable unit under test is our top priority. Our software and hardware utilize many safety features to ensure reliable closed-loop vibration control – from pre-test checks to abort checking, notching and controlled shutdown.

The self-check function is an extremely powerful tool for detecting possible set-up problems before your test is started. During closed-loop control the m+p VibControl software performs RMS and line-by-line abort checks, sigma clipping and drive limitation and continuously checks for open channels and overloads. Notching limits the upper vibration level on any number of control or measurement channels, thus minimizing overtesting of the structure. m+p international’s hardware ensures rapid, safe shutdown under any circumstances.



The self-check results indicate that the test was properly configured

**True Multi-Tasking**

Since the real-time measurement and control processes are independent of the user interface, you can utilize all the capabilities of the host computer, e.g., generate and print out a test report or set up a new test while the front-end performs the measurement and vibration control tasks.

This multi-tasking concept not only guarantees powerful and time-efficient vibration testing even with time-critical tests but is also an important safety feature, as any unwanted computer command or failure cannot affect the vibration controller.

**“We selected m+p international following the good experience of other Continental Automotive Labs and also because the technical specification of the controller completely matched our needs. I’d also like to commend the very good support we received from them.”**

Christian Tibke, Group Leader Qualification Laboratory at Continental Automotive, Timisoara, Romania

### Automated Functional and Climatic Testing

With the m+p VibUtil module, our vibration controllers offer a versatile tool for automated vibration testing and combined climatic and functional testing. m+p VibUtil easily combines individual vibration tests of identical or different test modes in any complexity of nested loops.

When the system is left unattended, you still remain in control. Test status reports can be sent via email or SMS text message to your mobile phone. A protocol file documenting the most important test events is attached to each email.

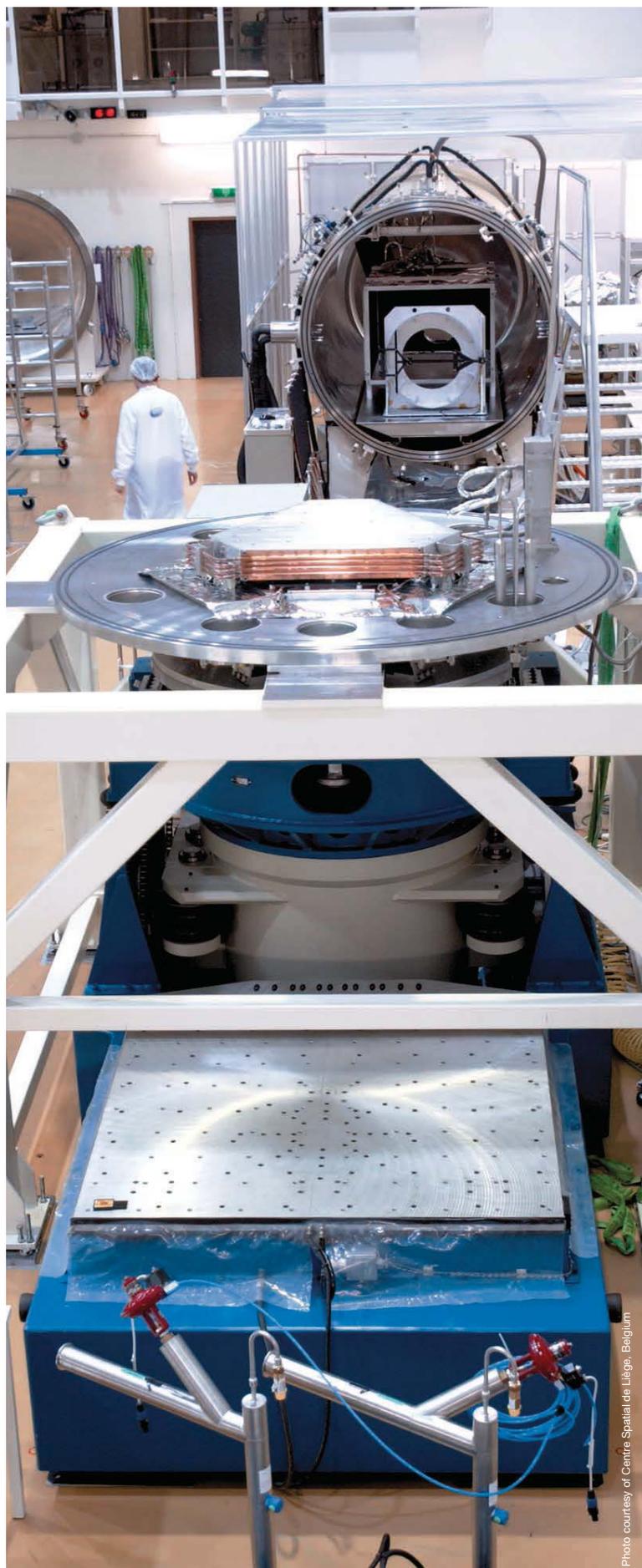
m+p VibUtil can be easily extended to control eight digital input channels and eight digital output channels which provide links to external equipment such as environmental chambers for combined testing. You can also automatically control the power amplifier, i.e., shut it down at the test end and switch it on when a new vibration test is to be started.



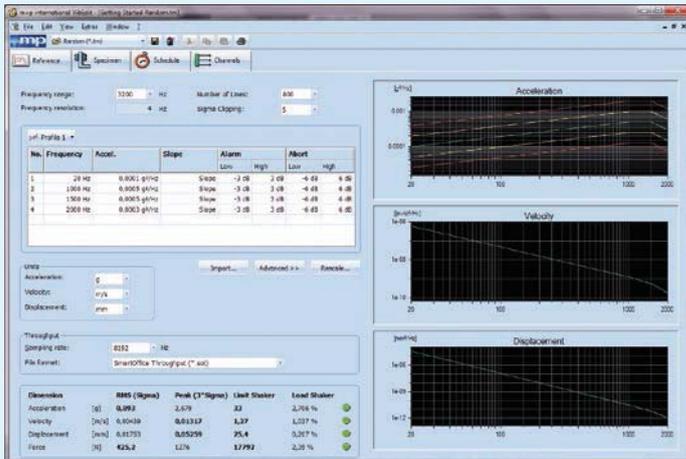
Always in control: test status report via SMS text message

### Remote Client

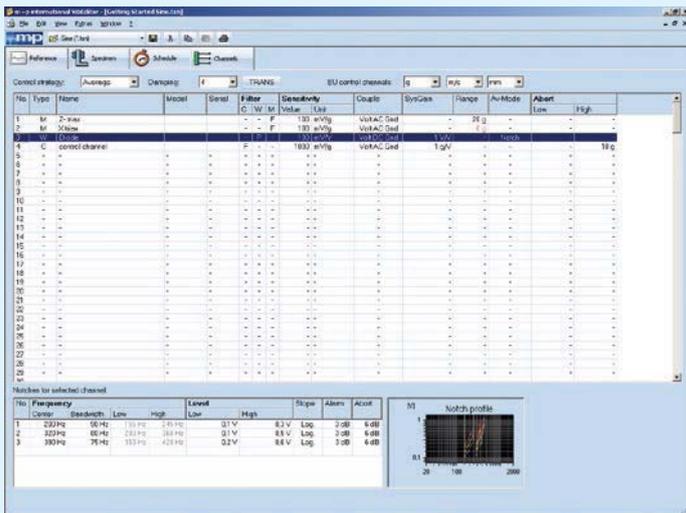
The m+p VibControl systems can also provide an optional remote client licence which is invaluable to many operators. Often a controller is crowded by engineers trying to view a vibration test during the test run. This is not only a disturbance for operators, it can also lead to mistakes as they might be distracted by questions, requests, etc. However with the remote client, live data can be viewed during an actual test via network or wireless network on a tablet or desktop PC in an entirely different area. The licence allows full m+p VibControl functionality except running the test.



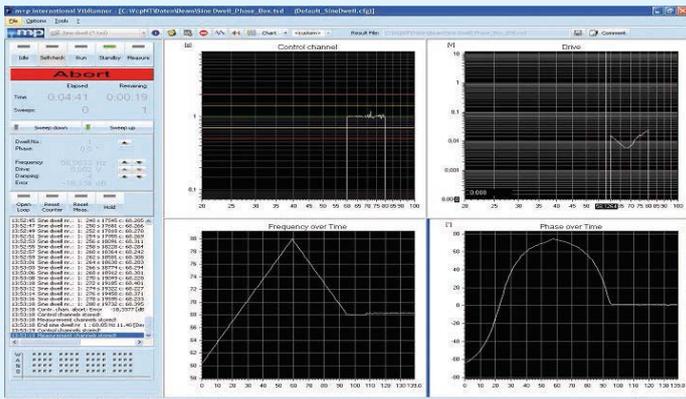
Reliable, high-speed multi-channel vibration controller for spacecraft testing



Setting up a random test



Notching on defined channels to protect against over-testing



Sine dwell test run with frequency/phase over time charts

### Multi-Screen Support

The highly flexible online display capabilities are expandable, thus making monitoring of high-channel count systems quicker and easier. Operators can open up to 16 online graphics windows on a single monitor to display 64 channels and see all the necessary information at a glance. The remote monitoring function enables customers to observe the channel information on remote PCs without any measurement hardware connected. If you need to observe more than 64 channels, simply use the multi-screen option. A system can be configured with the multi-screen module and a dual or quad graphics card for support of up to four monitors and 256 channels; if required, even more monitors are supported. Channel layouts for each monitor can be set up and stored for quick access.



Displaying 32 online graphics windows on two screens

### Vibration Monitoring and Overtest Protection

Vibration tests must be safe and reliable and this is especially true for high value specimens in critical testing applications. Here, our monitoring system offers maximum safety: It captures and records data such as acceleration, temperature and strain continuously during the vibration test. Each channel can be configured separately for total flexibility. m+p international's monitoring system protects the specimen and shaker reliably, e.g. against misconfiguration. If required, the shaker will be switched off immediately. Alarm events are entered into a log file and can be reviewed at any time. Continuous monitoring before, during and after a test with m+p VibControl online or offline is also provided.

### Excitation Modes

m+p VibControl supports all control modes used in today's vibration testing – everything from simple ESS random to mixed mode gunfire, drop table capture and unlimited time data replication. All tests are fully compliant with ISO, DIN, MIL-STD 810 and many other standards. In sine and random modes, you can designate all input channels as control, watchdog and/or measurement channels. DC signals can be measured and monitored for functional testing in all test modes.

#### Random incl. Notching/Force Limiting

Resolution up to 25,600 lines, selectable in 8 steps. Frequency range up to 12.8 kHz or 40 kHz, hardware dependent. Control strategies: average, maximum or minimum. Frequencies or frequency bands can be defined where limiters take control if the response vibrations exceed a predetermined limit. Kurtosis control increases the peak level content to enable a wider range of real world situations to be simulated.

#### Sine incl. Notching/Force Limiting

Frequency range up to 20 kHz or 40 kHz, hardware dependent. Measurement filters: RMS, peak, averaged or digital tracking filter. Control on acceleration, velocity, displacement and force.

#### Sine Resonance Search & Dwell

Control criteria: fixed frequency, fixed phase, defined phase, auto phase, peak amplitude.

#### 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 a displacement transducer to an accelerometer.

#### Classical Shock

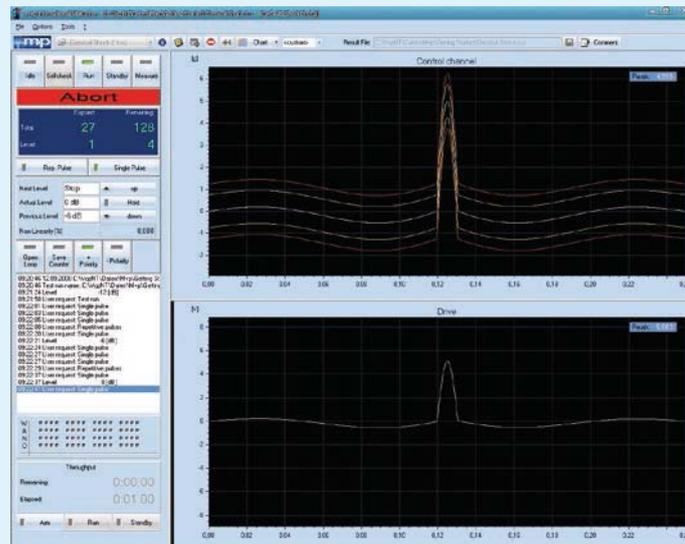
Reference waveforms: half-sine, haversine, sawtooth, triangle, rectangle, trapezoid. Alarm limits as per MIL-STD 810, DIN, GAM-EG 13 and user-defined. Peak-to-peak displacement to guarantee the best shaker performance.

#### Shock Response Spectrum (SRS)

Frequency range up to 20 kHz. Calculation of maximum, positive and negative SRS. Automatic SRS optimization. Wavelets and damped sine components. 1/1-1/24 octave analysis.

#### External Pulse

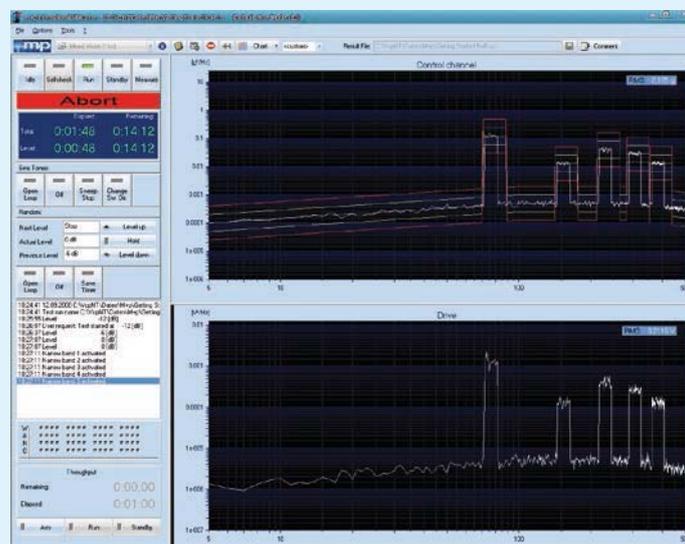
Import of ASCII data for replication with pulse editor. Synthesis of any pulse form. Kinematic compensation for minimum shaker displacement.



Classical Shock test run



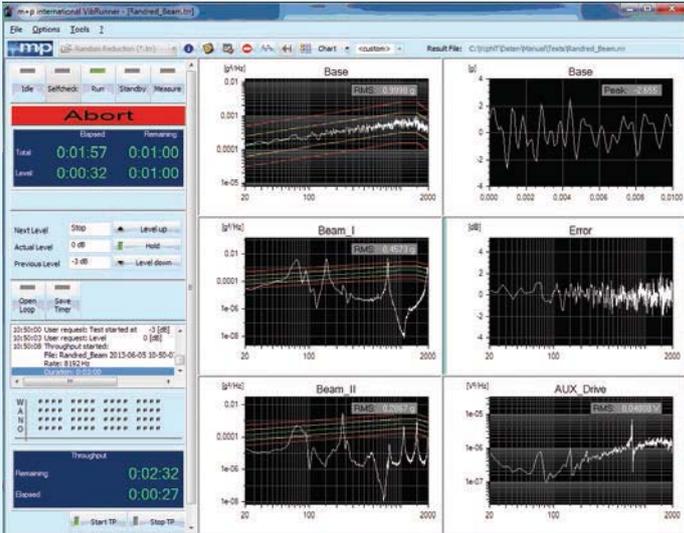
Setting up a shock response spectrum (SRS) test



Mixed mode testing: the ultimate in vibration control



Road load simulation provides an easy way to transfer data from the true environment to the test lab for reproduction on the shaker table



Online random data reduction with throughput to disc recording



Combined climatic and vibration testing of car sunroofs

**Sine-on-Random (SoR)**

Up to 10 independently sweeping sine tones are overlaid onto a random background. Sine tones and broadband random signal are generated separately. Gunfire burst simulation.

**Random-on-Random (RoR)**

Up to 25 independently sweeping narrowband random signals are overlaid onto a random background. Each narrowband has its own profile and limits.

**Sine-on-Random-on-Random (SoRoR)**

Sine-on-random is combined with random-on-random.

**Multi-Sine Excitation**

Simultaneously sweeping up to 10 sine tones at different levels across the desired frequency range using different levels and profiles. Also known as “no random option for mixed mode”.

**Time Domain Replication (e.g. Road Load Simulation)**

Complete solution for the transfer of data from the true environment to the vibration test lab. Unlimited time data replication. Continuous closed-loop control.

**Time History Recording to Throughput Disc**

For the most critical tests time sample data can be recorded in parallel to control with no reduction in control performance. Complete time domain history is available, recorded with high sample rate. This facility is also available in recorder modes without closed-loop control. Post-analysis of the time history data is possible using the Sine and Random Data Reduction modules with the benefit of using the same familiar user interface. Data can be exported for analysis to m+p Analyzer package or other advanced analysis systems.

**Data Reduction Modes**

**Random Data Reduction**

Online analysis of measured data or taped random data (PSD averaging). Measured data can be recorded on throughput disc.

**Sine Data Reduction**

Track and online analysis of measured data or taped swept sine data using a COLA signal. Time data can be recorded on throughput disc.

**Transient Capture**

Capture of transient signals such as drop table or pyroshock pulses with calculation and overlay of SRS or classical shock limits. For applications with high “g” hammer/tap impact. Scope function. Various triggers. Measured data can be recorded on throughput disc.

## Analysis

m+p VibControl's post-testing includes extensive data handling, advanced cursor functions, single and multiple data graphing, peak search, mathematical functions, and transfer function analysis, as well as displaying and printing traces from different sources in a single window.

### Transfer function and transmissibility

Linking the behaviour of control and measurement channels in the test run.

### Mathematical functions

Converting the measured acceleration signal into velocity and displacement, or vice versa (sine and random test mode).

### Automatic peak search

Peak values will be marked automatically in the graphics and listed with their numerical data in a table, single or multiple plots. Q-factor calculation in sine.

### Graphical and numerical measurement and reference data analysis

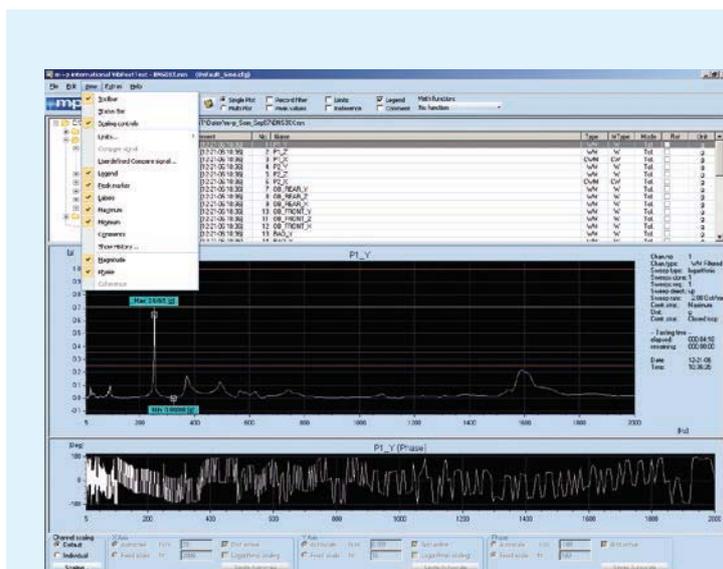
- Control and response spectra with reference, alarm, abort and notch limits
- Error
- Drive
- FFT amplitude and phase in sine and random
- Coherence in random

### Printouts

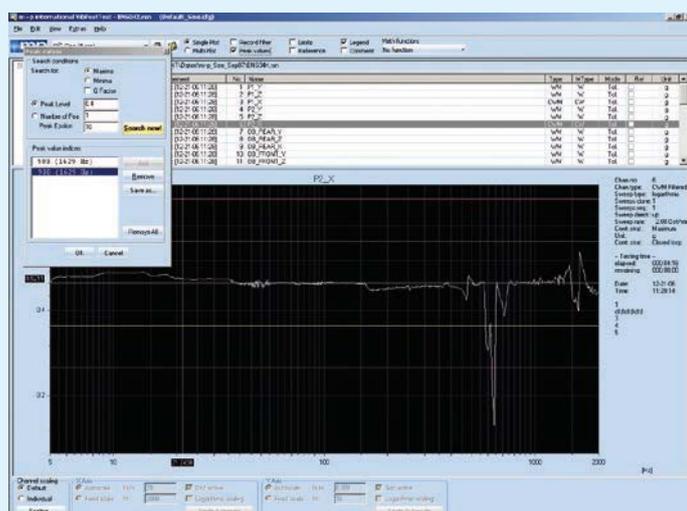
- Multiplot: displaying and printing traces from different test types, several test runs or multiple test specimens in one graphic window.
- Peak search
- Autoplot: automatically printing a preselected series of graphics.
- Printing a list of preselected test parameters.
- Printing directly to MS Word using a customer-defined template.

## Reporting

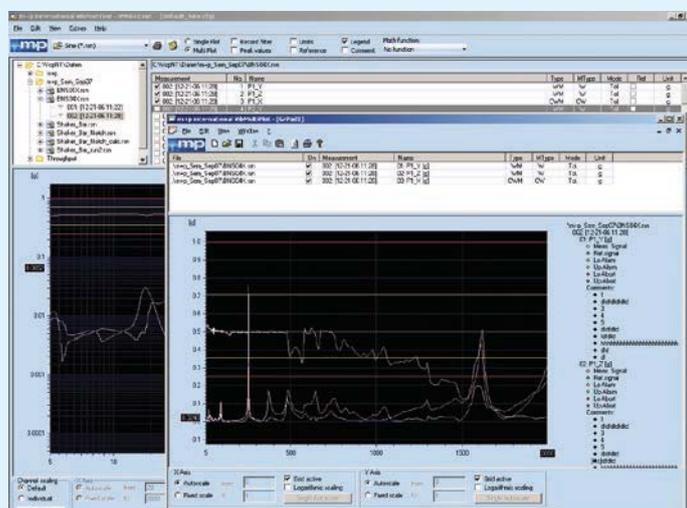
The presentation of the test results is as important as a successful test completion. The m+p vibration controllers are perfectly positioned to meet the most demanding requirements. The reports are generated online while running a test or upon test completion. User comments, company logos and graph markers can all be added to create a complete report-ready display. Data and graphics are copied and pasted to standard Microsoft Windows applications such as Word and Excel and can be exported into Universal File Format. The ultimate step in electronic report generation is using the m+p eReporter software package to which the m+p VibControl data can be directly exported.



Comprehensive analysis functions



Automatic display of peak values



Multiplot with data from different result files

## **m+p international**

Founded in Hannover, Germany in 1980, m+p international develops and manufactures test and measurement systems for vibration control, dynamic signal analysis, data acquisition, process monitoring and test stand engineering. Our product reputation and broad experience coupled with valuable user feedback have led to significant market share in numerous key industries worldwide.

The company has its headquarters in Hannover, Germany with sales/marketing subsidiaries in New Jersey (USA), England, France and China, along with representatives and agents in many countries.

Learn more on the full range of m+p international products and services and their applications. Select the m+p literature library on our website:  
[www.mpihome.com/en/literature-library.html](http://www.mpihome.com/en/literature-library.html)

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Specifications subject to change without notice.

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