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Acceleration Measurement And Analysis System

SM-500

Shock Manager (Hardware:SMH-12, Software:SMS-500)

The advanced acceleration measurement and analysis system surely and quickly drives rationalization and cost reduction forward in the work of physical distribution, manufacture and development.

Acceleration Measurement And Analysis System

The acceleration measurement and analysis system Shock Manager SM-500 has been born, making it possible to conduct shock resistance evaluation in a simple way. The evaluation is indispensable to achieve "high reliability," one of the crucial elements to augment product value. This achievement is not only in the field of product testing. The device also plays an active role in a variety of other areas where reliability and rationalization are sought, such as in the analysis and evaluation of packaged freight and cushioning materials.
Based on the ample and varied functions of Windows[*1], the ease of handling in the work of testing has been materialized in this device in the form of user-friendly operability, availability of multiple channels, adoption of USB, and other related features.

1 Acceleration measurement through a maximum 10 channels

The measuring unit (SMH-12) incorporates a maximum of 10 channels[*2] in the piezoelectric type and built-in amplifier piezoelectric type, or one channel in the resistance wire type. An acceleration pickup with a wide range of sensitivity can be used, and simple connection of it allows conducting acceleration measurement through multiple channels. The resistance wire type is used when low-range characteristics are particularly important, such as in the measurement of trapezoidal waveforms of a shock tester, etc. The system is also capable of processing outputs from an external amplifier.

When max. 10 channels are incorporated

2 Free scale setting

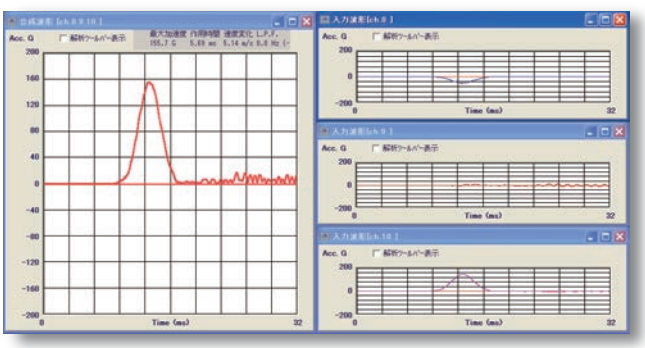
The system automatically calculates peak accelerations, action times and speed variations in accordance with a standard, and also performs calculations specified with the cursor. The indications of acceleration values are produced on the scale easiest to view, selected by the auto-scale function, or on the same specified scale, for all channels. And, any desired channels can be displayed in parallel or overlapped. Either m/s2 or G can be selected for the acceleration unit.

3 Equipped with digital filter function

In the case of a shock measurement, a low-pass filter specified at 5 to 20 times the fundamental waveform of the input acceleration waveform can be configured by automatic setting.
The digital filter function allows measuring waveforms on the filter conditions that are individually specified for each of the channels.
Even after data is recorded, waveforms can be obtained according to filter conditions that are later arbitrarily changed.

4 Three-way acceleration composite waveform

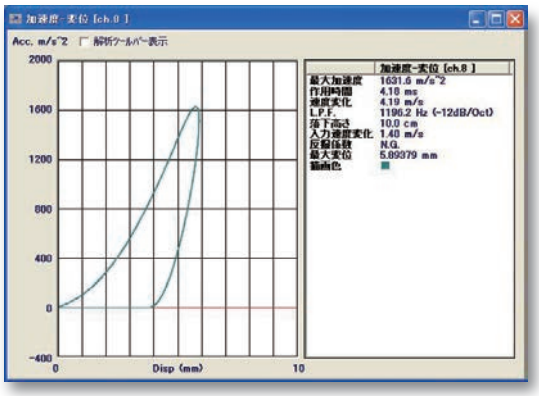
The system plots a composite waveform of the three-way accelerations when packaged freight, etc., is dropped onto its angle or edge, and then, analyzes the data.


・Three-way accelerations and composite waveform

・Simultaneous measurement and analysis of multiple channels

5 Cushioning material characteristics analysis

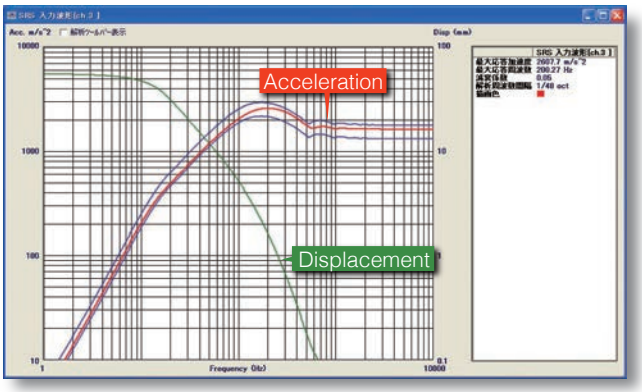
The system calculates the displacement and coefficient of rebound corresponding to the case where a shock load is applied to the contents of a falling freight packaged with cushioning material or to the cushioning material itself. Then, the system also plots a displacement waveform and acceleration - displacement diagram, along with the acceleration waveform. These graphs allow analyzing the actual effect of shock on the packaged freight or the shock absorbing characteristics of the cushioning material.



When max. 10 channels are incorporated

6 SRS analysis to predict damage

When shock response spectrum (SRC) analysis is performed, the system can be used as a means to predict the response acceleration and displacement that are produced at different parts of a packaged freight or product when the freight or product is directly subjected to a shock. Furthermore, the system can be applied to acquire vibration data of a transport vehicle or the response of packaged freight on the loading platform.

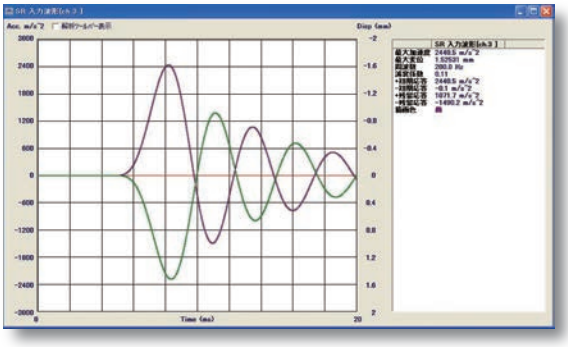


Shock response spectrum analysis (SRS)

7 Shock response analysis particularly effective for damage prevention

When shock response spectrum (SRC) analysis is performed, the system is able to predict the acceleration and displacement waveform that will be produced by shock at the parts prone to damage. It also allows analyzing the effect of vehicle vibration on the loaded freight.

When a natural frequency and damping coefficient are set for part of the product prone to damage or a part where the effect of an external force requires scrutiny, the system calculates and displays the response waveforms of the parts.



Shock response (SR)

*1: A registered trademark of Microsoft Corp., U.S.A.

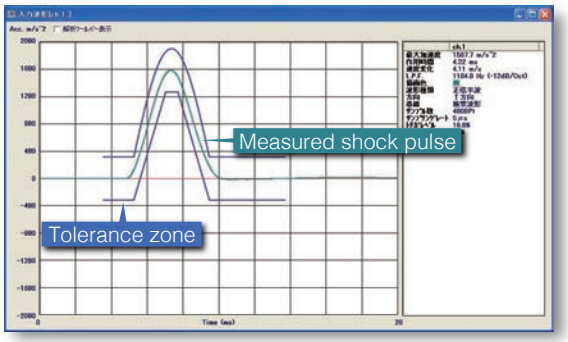
*2: The piezoelectric type and built-in amplifier piezoelectric type can be combined with each other by five channels each.

Examples:

- 5 channels on only the piezoelectric type, or 5 channels on only the built-in amplifier piezoelectric type.
- 10 channels on only the piezoelectric type, or 10 channels on only the built-in amplifier piezoelectric type.
- 5 channels on the piezoelectric type and 5 channels on the built-in amplifier piezoelectric type (Total 10 channels).

8 Specified waveforms display function

The system can display the tolerance zones by severity of each specified waveforms shock (sinusoidal half-wave, trapezoidal wave and triangular wave) of the shock test standard.



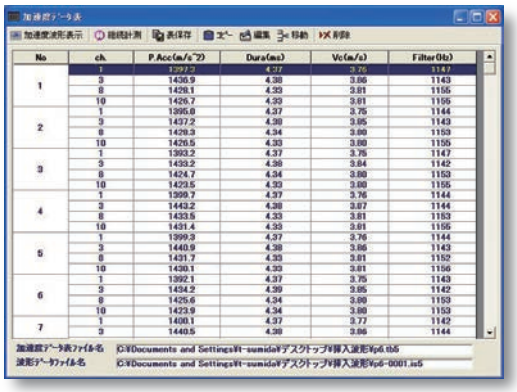
Display of tolerance zones of test standard

9 Comparison with theoretical values

The system creates the reference shock pulses of each standard and the pulses based on arbitrary peak accelerations and action times from rectangular waves, trapezoidal waves, sinusoidal half-waves, versine waves, sawtooth waves (3 types) and triangular waves, which are ideal shock waveforms of each standard, plots reference diagrams of SRS and SR. Then, they are compared with the diagrams based on theoretical simulations and input pulses.

10 Improved continuous data processing function

The system displays measurement data tables of peak accelerations, action times and continuous changes, acquired in drop tests of packaged freights in the continuous test mode, continuous tests on a shock tester, etc., and records the acceleration waveforms of each channel. The continuous measurement data tables can be later printed out, and the acceleration waveforms can be subjected to various analyzing processings.



Example of continuous calculation data table

11 Specified calculation range of waveforms

Each channel's recorded waveform indicates the positions of peak acceleration andaction time, which were automatically calculated with the vertical and lateral cursor lines. Calculation can also be made with the positions moved arbitrarily.

Moreover, the zooming function of the time axis allows enlarging waveforms. The acceleration axis can be switched to the specified scale, apart from the auto-scale.

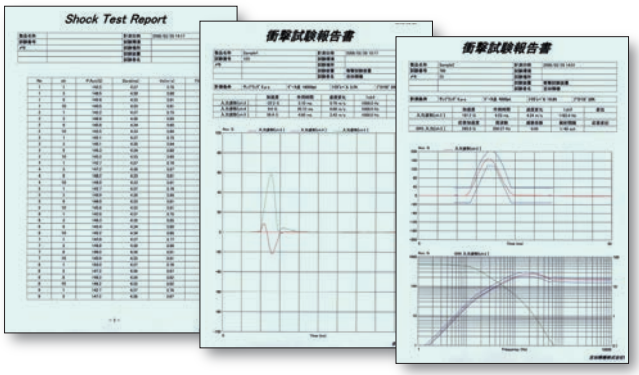
12 Creation of customized screens

The display screens can be processed in many customized ways, such as entry, change and deletion of any characters, no coloring and coloring, overlapping of multiple types of screens, and others.

13 Simple, fast report preparation

Test reports can be drawn out in such formats as acceleration - time, acceleration - displacement record, or overlapped and combined accelerations, and by arbitrarily altering the data, title, memo, etc., of SRS and SR diagrams and others. Use of the Wordout function enables the measurement result data to be directly output to a Microsoft Word file.*3

*3: Microsoft Office to be separately prepared by the user.



Examples of report format printouts

14 Equipped with calculation control function*

Use of the calculation, measurement and analysis software (SMS-500M, CS) selects a shock-absorbing body and automatically calculates its effective height and falling height, when any arbitrary shock acceleration, action time and test sample mass are entered. The software also displays the calculated results on the PC screen when the Shock Tester ASQ Series and SMS-500CS are employed.

Specification

SMH-12 Acceleration Measurement Hardware

- Acceleration amplifier section	(1) Resistance wire type: Single channel (Frequency range: DC to 10kHz)
	(2) Voltage input: Single channel (DC ± 10V)
	(3) Piezoelectric type: 5 or 10 channels*1 (Frequency range: 0.1Hz to 10kHz)
	(4) Built-in amplifier piezoelectric type: 5 or 10 channels*1 (Frequency range: 0.1Hz to 10kHz)
- A/D conversion section	Channels: Max. 12 channels
	Sampling rate: Max. 1 MHz
	Resolution: 16 bits
	Data length: 500 to 16,000 words
	Trigger function: In any direction (0.4 to 30% range)
	Pretrigger function: 5 to 90% range
- Dimensions:	W:150mm x D:200mm x H200mm
- Supply voltage:	100 VAC to 240 VAC
- Operating environment:	Temperature: 0 to 40℃. Relative humidity: 85% or lower (Without condensation)
- Option:	Dedicated case
*1: The piezoelectric type and built-in amplifier piezoelectric type can be combined through five channels with each other.	
Examples	- 5 channels on only the piezoelectric type, or 5 channels on only the built-in amplifier piezoelectric type.
	- 10 channels on only the piezoelectric type, or 10 channels on only the built-in amplifier piezoelectric type.
	- 5 channels on the piezoelectric type and 5 channels on the built-in amplifier piezoelectric type (Total: 10 channels).

SMS-500 Acceleration Analysis Software

- Measuring function:	(1) Processable waveforms: Sinusoidal half-waves, trapezoidal waves, sawtooth waves, rectangular waves, versine waves, and triangular waves.
	(2) Number of measuring channels: 12
	(3) Acceleration measuring range: 1.0 - 980,000m/s^2 (0.1 - 100,000G)
	(4) Action time measuring range: 0.01 - 99.99ms
	(5) Speed variation measuring range: 0.01 - 99.99m/s
	(6) Measurement error: ±1% or less
- Digital filter function:	Can be individually set for each channel.
	Automatic processing (Variable to 5 to 20 times the fundamental waveform)
	Arbitrary setting (0.01 - 10,000Hz): Arbitrarily changeable even after data is recorded.
- Continuous measuring function:	Multi-channels are measured and data is automatically recorded at an interval of approximately 5 sec or longer.
	Continuous measurement data tables and acceleration waveforms are recorded.
- Evaluation function:	(1) SRS/SR analysis: Acceleration and displacement
	a. SRS and SR analysis frequency range: 1 Hz to 100 kHz (Range switchable)
	b. Analysis frequency spacing: 1/3 to 1/48 octave
	c. Damping coefficient: 0 - 0.99
	d. Scales: Waveform: Y-axis: Auto-scale, specified scale X-axis: Zooming function
	SRS: Y-axis: Auto-scale, specified scale, switchable between linear and logarithmic scales
	X-axis: Logarithmic scale (Dependent on analysis frequency range)
	SR: Y-axis: Auto-scale, specified scale X-axis: Zooming function
	(2) Creation of fundamental waveforms:Rectangular waves, trapezoidal waves, sinusoidal half-waves, versine waves, sawtooth waves (3 types of JIS, ISO, MIL), and triangular waves
	(3) Waveform analysis: Automatic analysis and arbitrary correction by cursor of peak acceleration, action time and speed variation
	(4) Evaluation by standard tests a. Sinusoidal half-wave: JIS C 60068-2-27 Tolerance limit*
	b. Trapezoidal wave: Ditto Ditto
	c. Sawtooth wave: Ditto Ditto
	* There is a zooming function for each tolerance limit, along with recorded waveform.
	(5) Triaxial acceleration waveform composition function:
	Calculation of waveform ,peak acceleration, action time, and speed variation.
	(6) Displacement analysis: Displacement waveform and coefficient of rebound calculated from input waveform and triaxial composite acceleration waveform.
	(7) Conversion function: Numeric values and waveform data can be converted into text file and used with other application software.
	(8) Basic software: Windows2000 / XP / 7
	(9) Output section: Output of measurement and analysis results. Test report format.
- Recommended personal computer:	Main memory: 256MB or more (512MB or more recommended), HDD with idle space of 100MB or more, CD-ROM drive, equipped with USB ports.

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