

22-23 JUNE 2016

**BITEC • BANGKOK
THAILAND**

***AUTOMOTIVE* *SUMMIT* 2016**

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Co-organized by:



Miniature Damped Accelerometer Series offers Wide Range of Applications

developed & manufactured by
Kyowa Electronic Instruments Co. Ltd.,

Presented by
KYOWA Electronic Instruments Co.
Kouhei Shimosumi

23 June, 2016

Move into the future with reliable measurements



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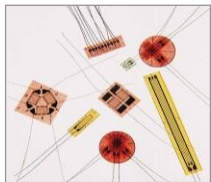
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Manufacturer in Stress Measurement



Kyowa is the leading manufacturer in stress measurement
based on **Strain Gage** technology.



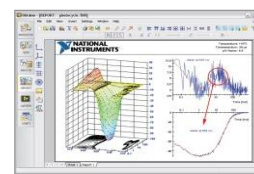
Strain Gage



Transducer



Amplifier/Data Recorder



Software



Consulting



Maintenance

Kyowa has provided total system and services of stress measurements including measurement process, data acquisition and data analysis

Main Business Field

I . Environment and Energy

II . Industrial Instrumentation

III . Automotive Engineering

IV . Transportation System

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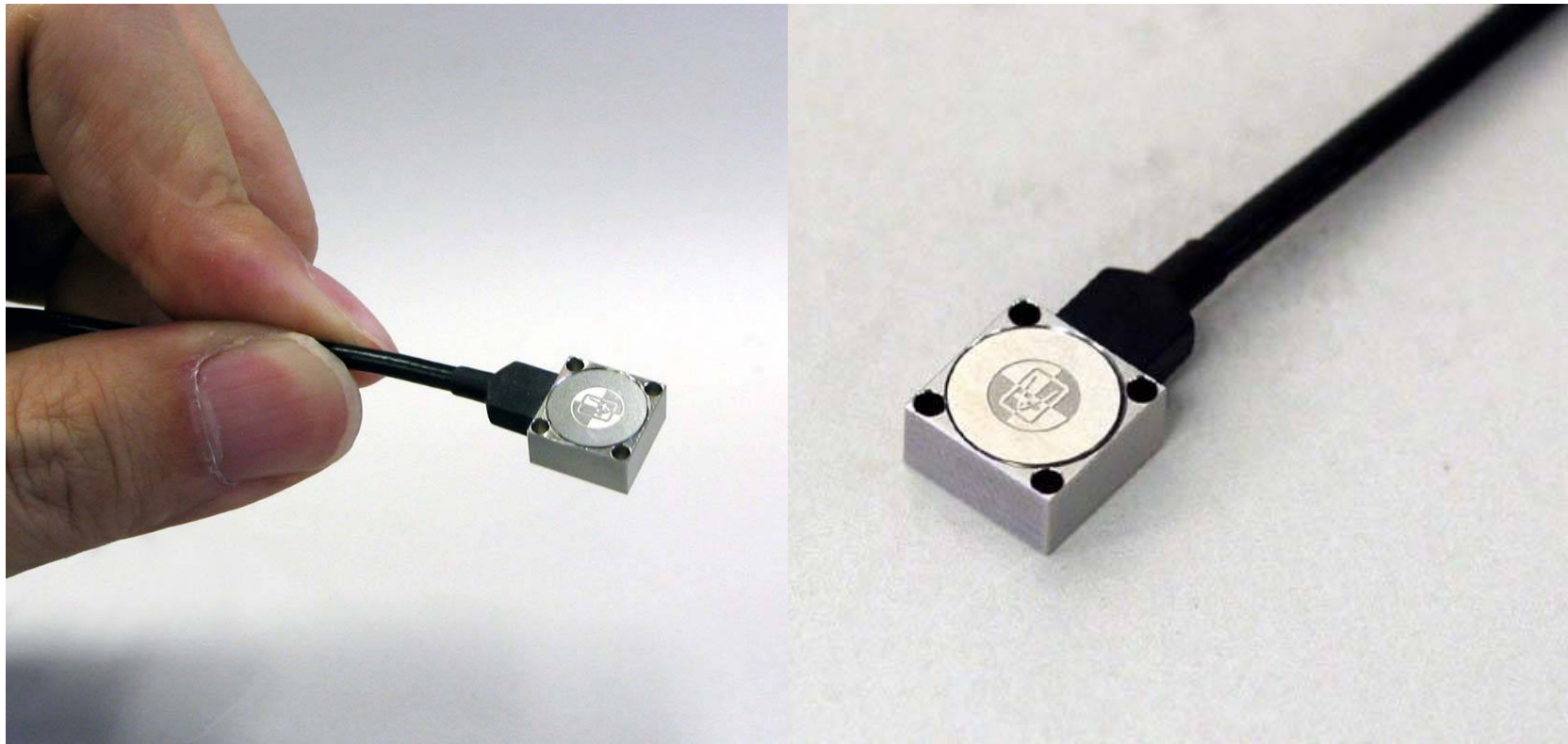
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Damped Accelerometer



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Introduction

Accelerometers

Accelerometers are used to detect & measure acceleration of a mass such as a vehicle and its components.

When connected to the appropriate Data Acquisition System, they accurately quantify:

- Amplitude of vibration
- Frequency spectrum
- Velocity
- Displacement



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Introduction

Accelerometers

Accelerometers are an essential sensor for automobile development and evaluation, experimental measurement, and analysis.

■ Widely utilized in various fields:

- ❑ Power train
- ❑ Controllability
- ❑ Drive train
- ❑ Strength, Reliability
- ❑ Car Crash Testing
- ❑ Product Line

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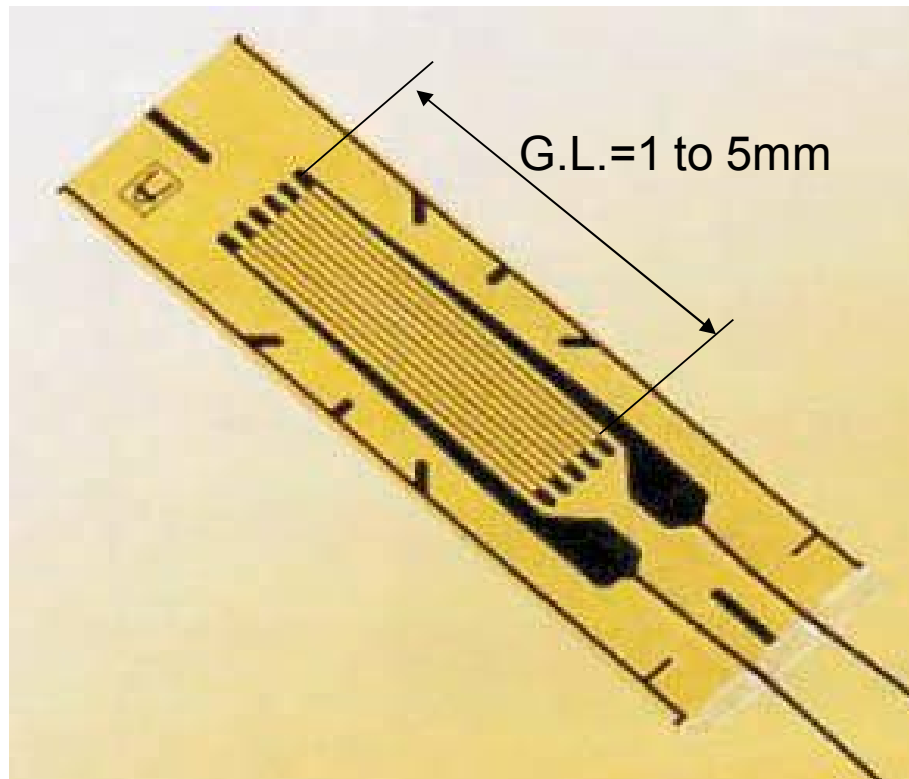
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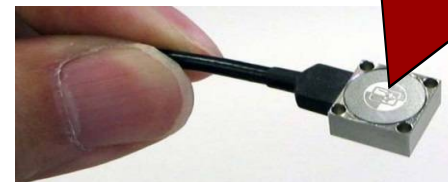
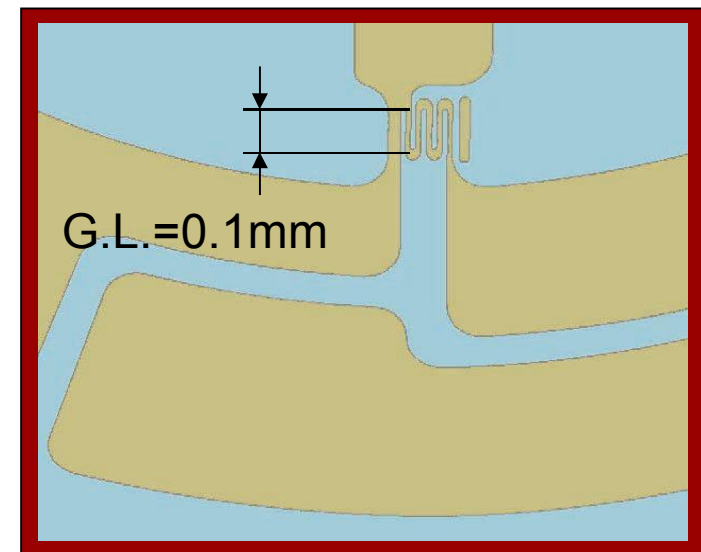
Damped Accelerometer ASE-A Series

ASE-A Accelerometer Technical Features

- Typical Strain gage for stress measurement



- New Accelerometer gage pattern using sputtering techniques



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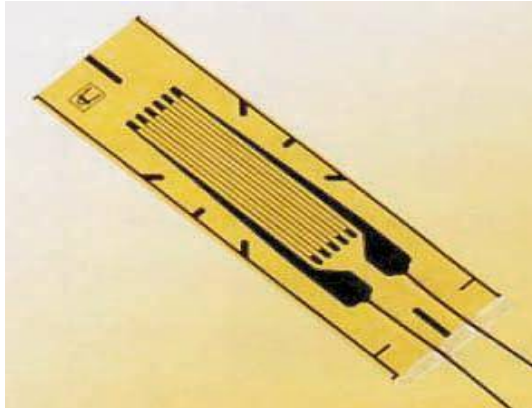
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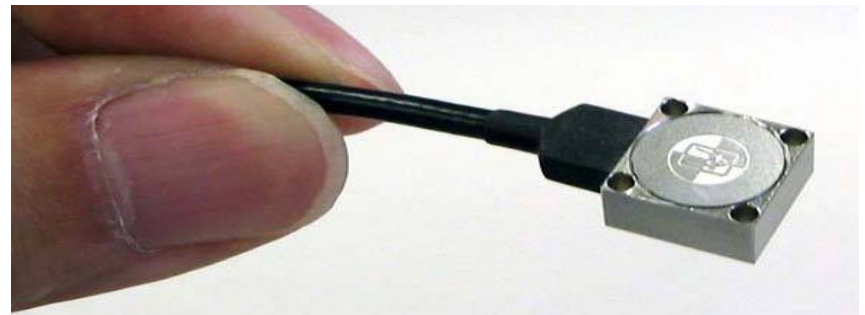
Damped Accelerometer ASE-A Series

Kyowa Strain Gage Technology

KYOWA commercialized the first Japanese-made strain gages in 1951.



Based on the abundant experience and technologies accumulated over 50 years, KYOWA now manufactures many kinds of high-performance Strain Gages and Strain gage based Transducers.



ASE-A using sputtering techniques to form micro-size strain gage and install without any adhesive.

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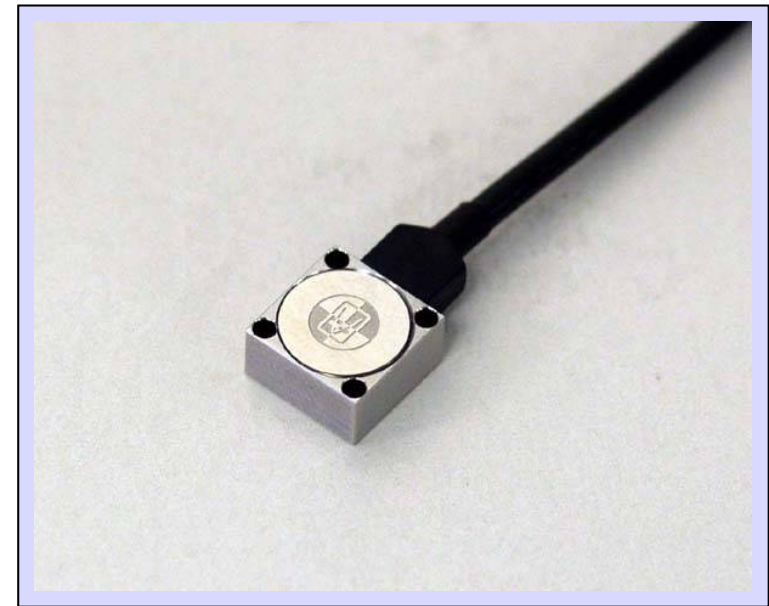
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Damped Accelerometer ASE-A Series

Optimized Damping

Achieving the Optimized Damping Ratio Prevents Transducer Resonance



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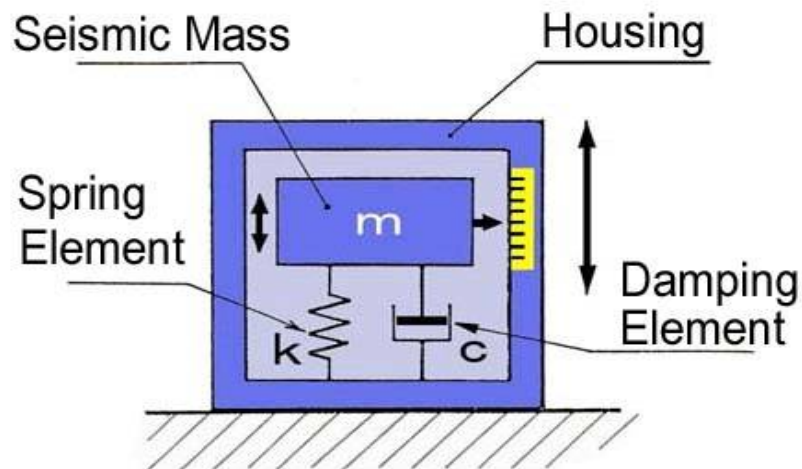
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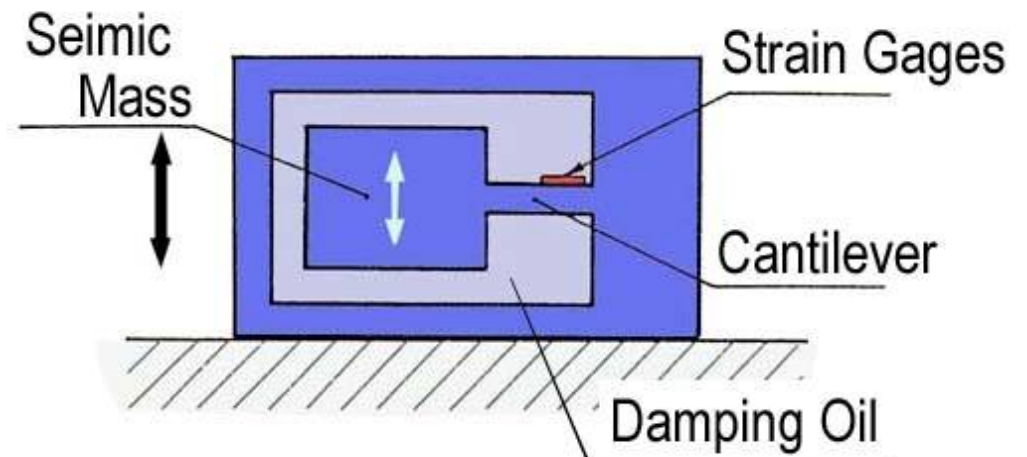
Fundamental Structure of Accelerometers

Common accelerometer structure consists of seismic mass, spring, and damping element.

Conceptualization

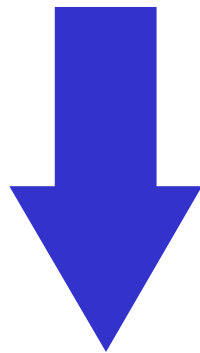


Example of Structure

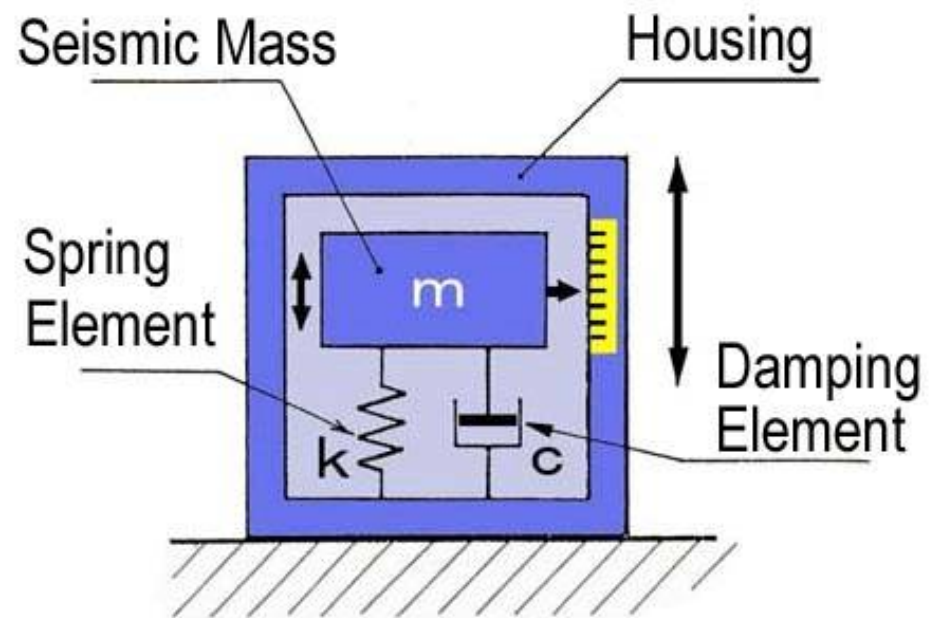


Fundamental Structure of Accelerometers

Relative displacement between housing and seismic mass are in proportion to the input acceleration within a frequency response range.



Acceleration is measured by detecting the relative seismic mass displacement .



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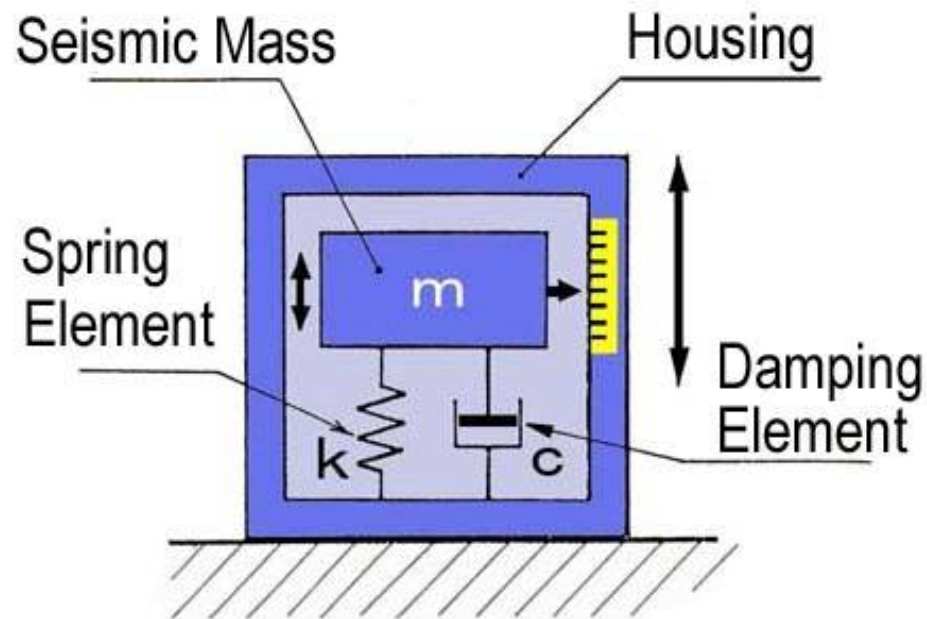
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Fundamental Structure of Accelerometers

What is damping?

Fundamental Conceptualization of Accelerometer



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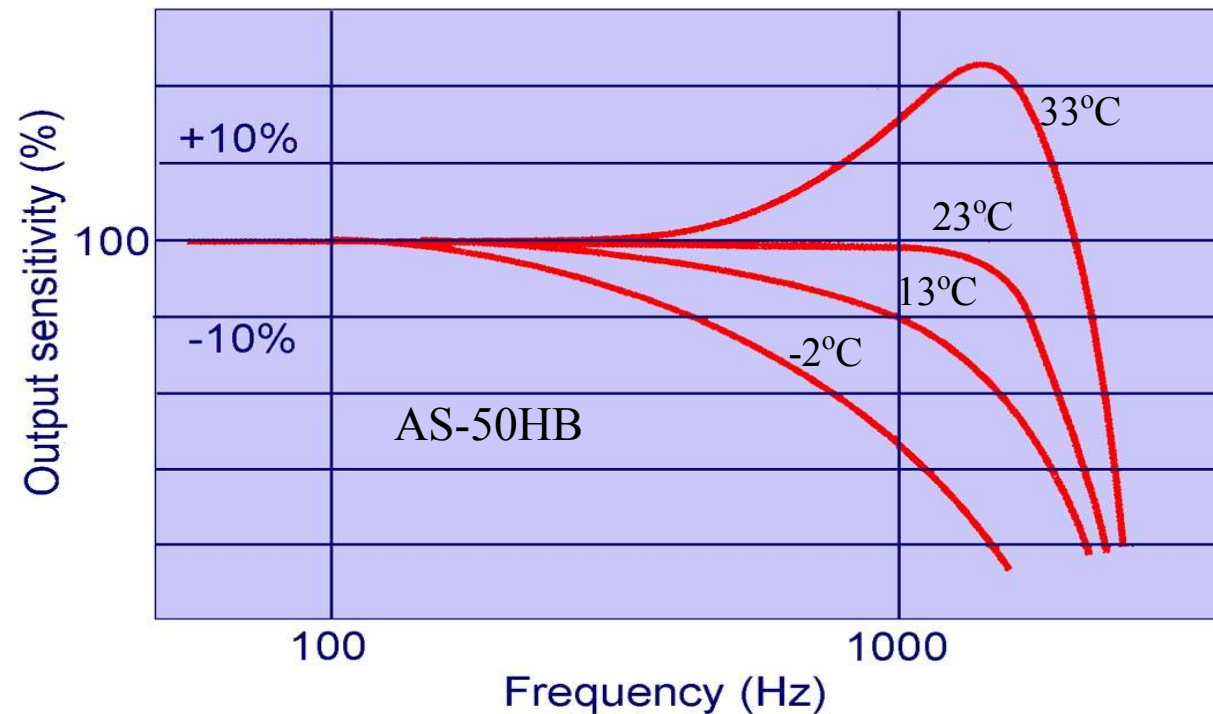
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Temperature Effect for Frequency Response

The viscosity of the damping oil is adjusted to the frequency response optimized at 23°C.

Changes in viscosity due to temperature changes affect the frequency response and Phase characteristics. The frequency response characteristics of our typical damped accelerometer are affected by Temperatures as shown in the figure below.



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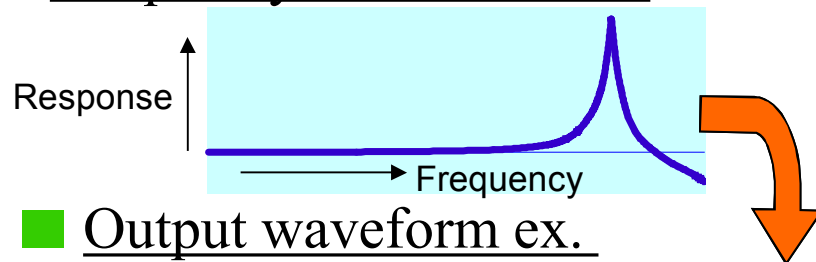
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Comparison between Damped and Undamped Accelerometers

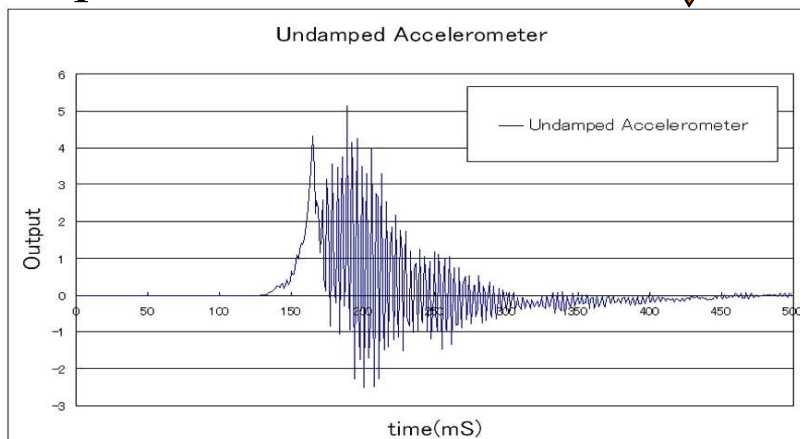
Undamped Type

Small in size. Has a resonance peak in the frequency characteristic.

Frequency characteristics



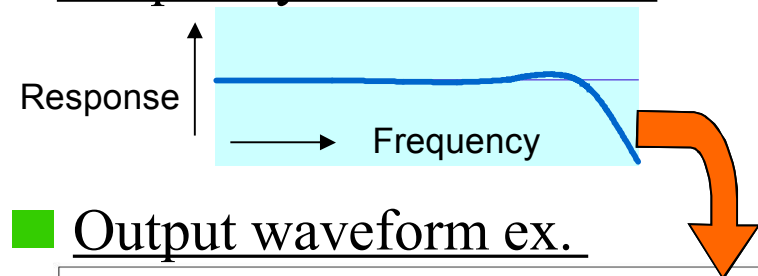
Output waveform ex.



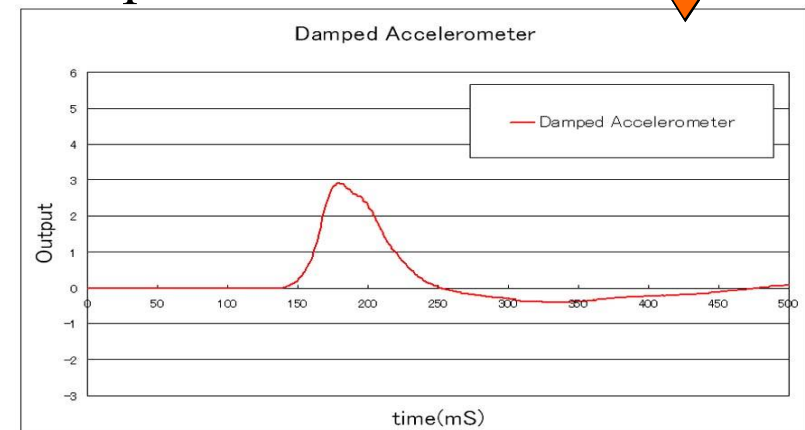
Damped Type

Larger size. No resonance peak in the frequency characteristic.

Frequency characteristics



Output waveform ex.



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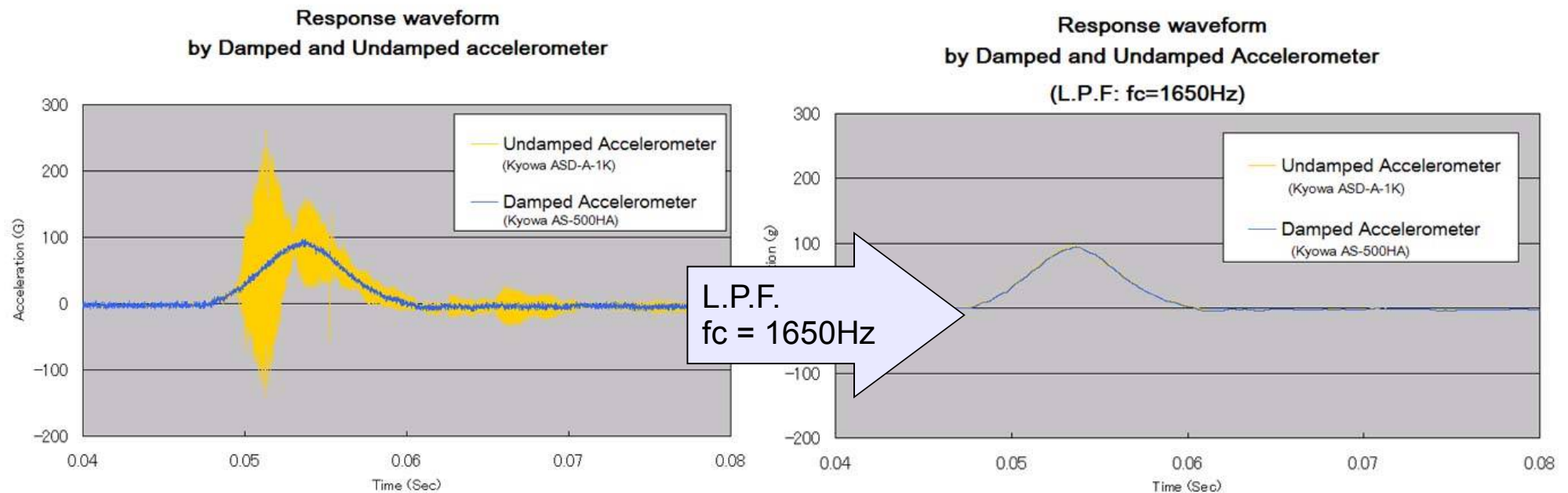
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Undamped Accelerometer Measurement Problems

Undamped Accelerometer Measurement Problems

If a waveform contains a spectrum of frequencies that are near the resonance frequency of the accelerometer, a resonance vibration occurs.

This introduces the possibility of resonant waveform signals that exceed the range of the input amplifier (saturates the amplifier).



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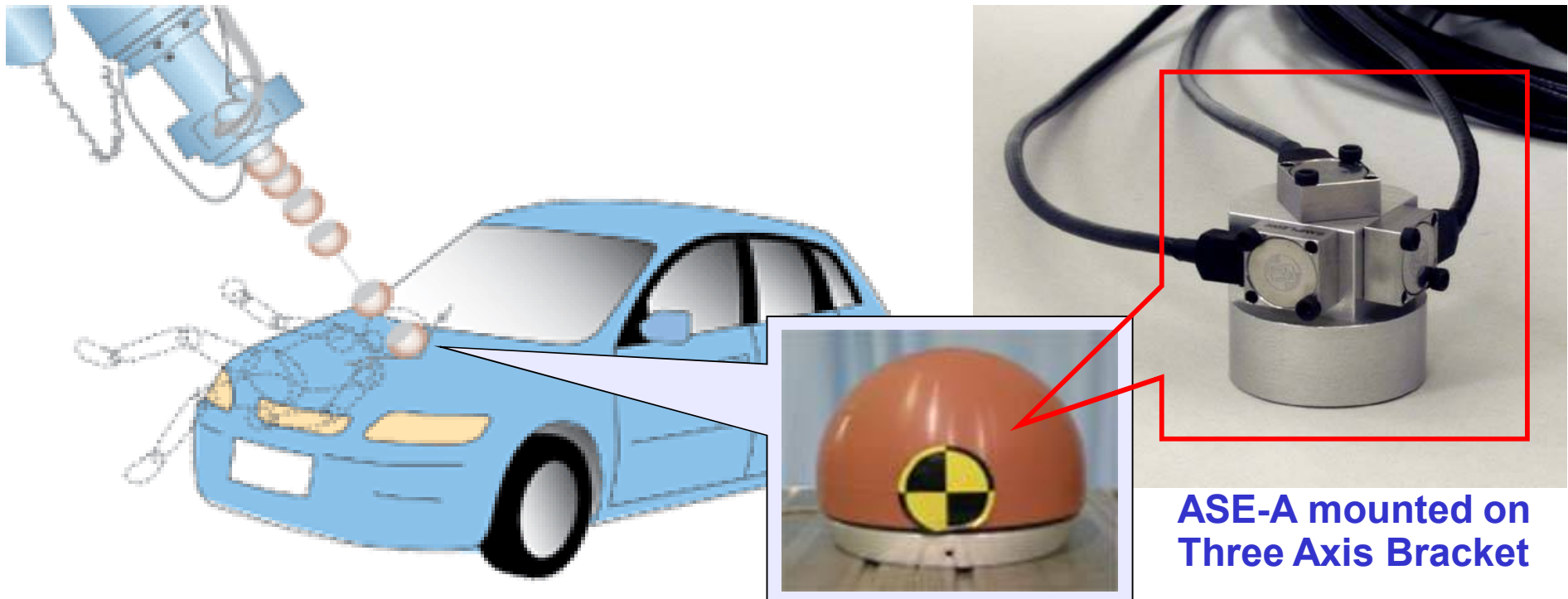
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Damped Accelerometer ASE-A Series

Application Example of Damped Accelerometer ASE-A

■ Application Example for Pedestrian Head Protection Performance Tests



**ASE-A mounted on
Three Axis Bracket**

*Photo by courtesy of
National Organization for Automotive Safety & Victims' Aid*

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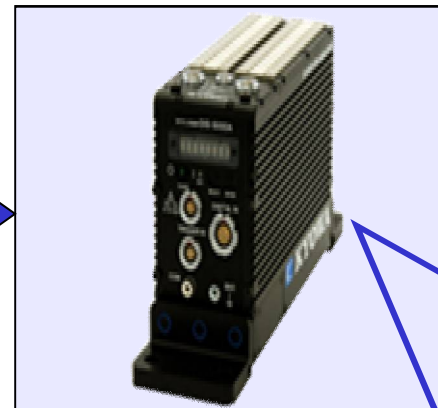
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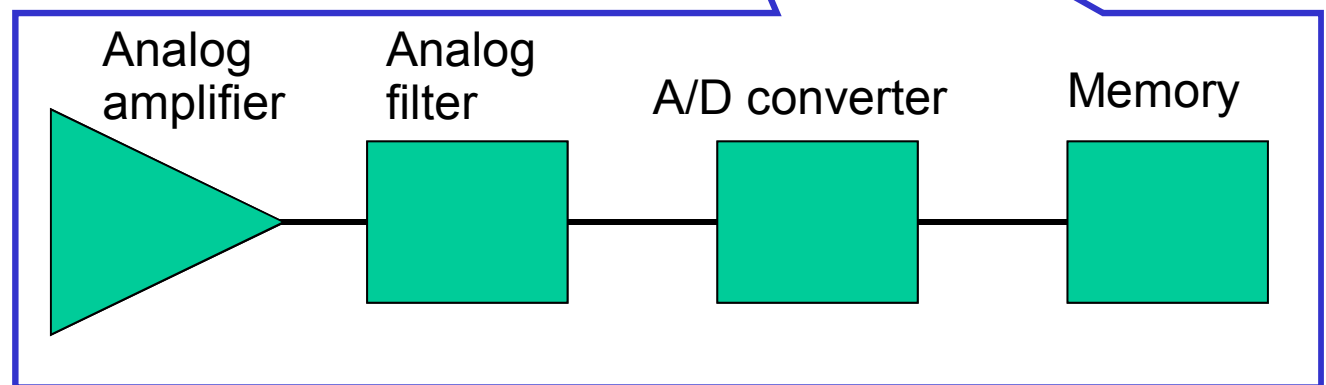
Damped Accelerometer ASE-A Series

Application Example of New Damped Accelerometer ASE-A

■ Application Example for Pedestrian Head Protection Performance Tests



**Data Acquisition Unit
DIS-5000B**



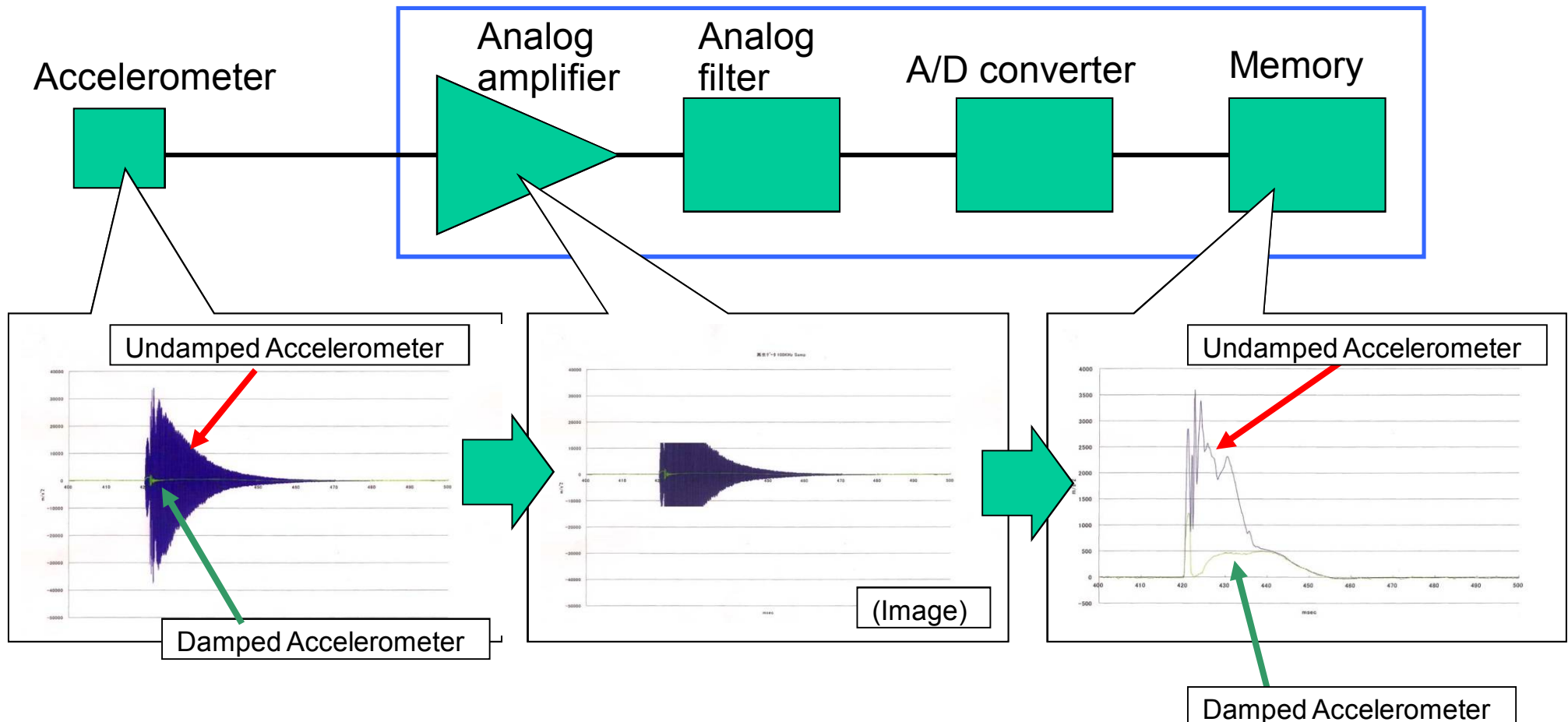
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Undamped Accelerometer Measurement Problems

If resonance output signal appears...



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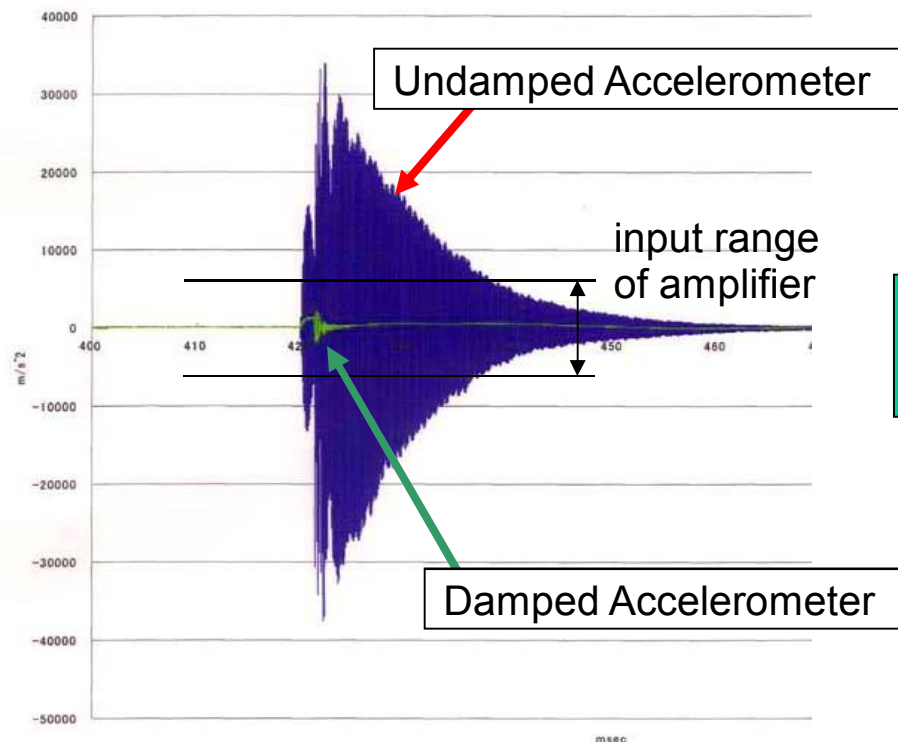
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Undamped Accelerometer Measurement Problems

If the resonant waveform signals exceed input range of amplifier...

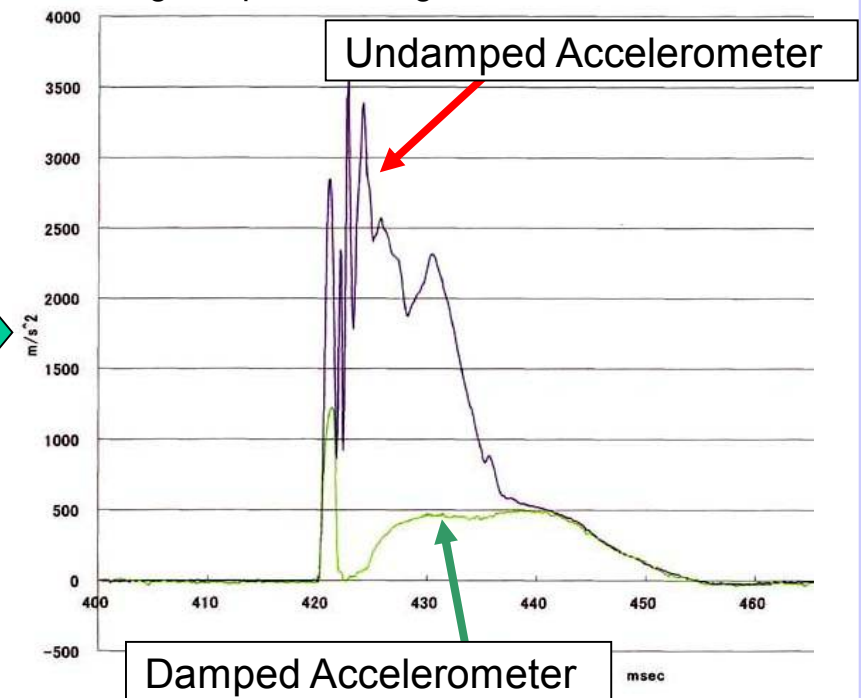
Accelerometer Output Signal

160kHz AD sampling by DAT



Recording Data

10kHz AD sampling by On-board DAS
using low-pass analog filter $f_c=1650\text{Hz}$



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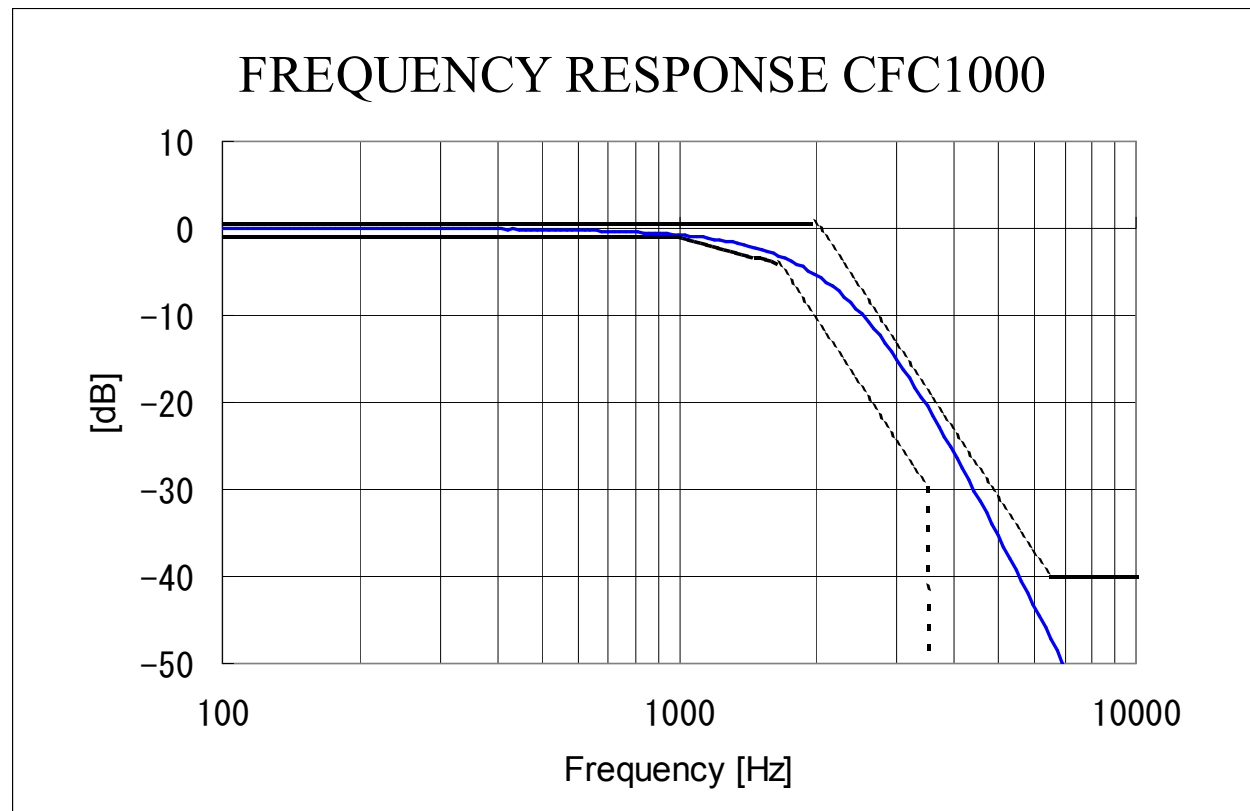
Reprinted by courtesy of *Japan Automobile Research Institute*

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Damped Accelerometer ASE-A Series

Frequency Response of ASE-A

with Kyowa's on-board DAS, DIS-5000B



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Damped Accelerometer

Damped Accelerometer Applications

■ Side Impact Tests

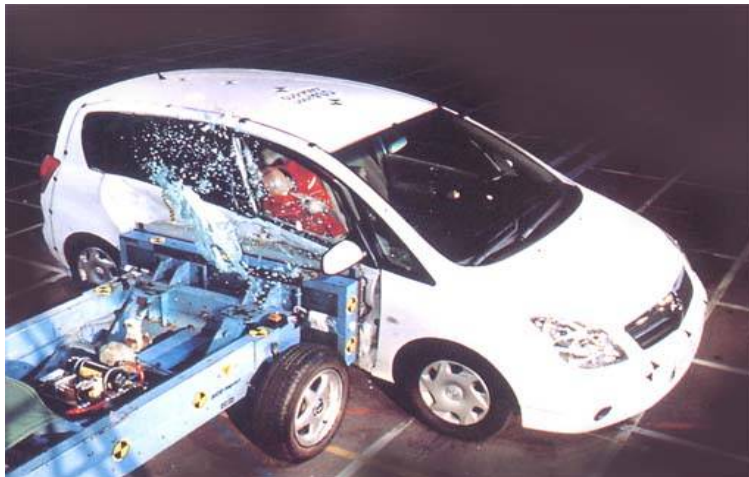


Photo by courtesy of
National Organization for Automotive Safety & Victims' Aid



**Damped
Accelerometer
(ASDE-A)**

**Kyowa On-board
Data Acquisition Unit
(DIS-5000B)**

■ Frontal Impact Tests



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Reed Tradex

Damped Accelerometer

Summary

Kyowa's New Damped Accelerometer Series

■ Size benefits

- Easy handling
- Miniaturization expands uses

■ Prevents resonance by optimized damping

- Improved measuring reliability & results

■ Immediate application benefits

- Pedestrian head protection performance tests
- Car body deformation measurements in car crash testing



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If you are interested in other products, visit  KYOWA at 1A16 of MANUFACTURING EXPO 2016.

Thank you for your attention!



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