Product and Measurement Solutions
for the Automotive Industry
Car body and vehicle related measurement solutions

- Acceleration noise measurement
  - Acceleration Noise Measurement System

- Measurement of sound absorption coefficient of road surface
  - Road Surface Sound Absorption Coefficient Measurement System

- Experimental mode analysis of automobile body
  - Mode Analysis System (ME'Scope VES)

- Automobile body sound source localization
  - Sound Source Localization System

Engine related measurement solutions

- Analysis of noise and vibrations related to engine rotation
  - Order Tracking Analysis System

- Inspection of transmission vibrations and noise
  - Gear Tester Evaluation System

- Cylinder head volume measurement
  - Acoustical Capacity Meter

- Combustion chamber volume measurement
  - Acoustical Capacity Meter
Car interior comfort related measurement solutions

Psychoacoustic evaluation
 Sound Quality Assessment
 Measurement System

Acoustic characteristics testing of interior materials
 Vertical Incident Absorption Coefficient
 Measurement System

Exhaust system related measurement solutions

Testing of muffler acoustic characteristics
 Muffler Sound Reduction Index
 Measurement System

Information about the RIONOTE Multifunction Measurement System and the Multi-Channel Signal Analyzer SA-02

Information about piezoelectric accelerometer and measurement microphone products

Other product information
Car body and vehicle related measurement solutions

Acceleration noise measurement
[Acceleration Noise Measurement System]

The Acceleration Noise Measurement System can perform measurement in compliance with the international standards ISO 362 and R51-03 which define accepted methods for assessing acceleration noise in four-wheeled vehicles.

Measurement of sound absorption coefficient of road surface
[Road Surface Sound Absorption Coefficient Measurement System]

Measurement of noise emitted by road vehicles requires a standard test track as specified in ISO 10844 (JIS D 8301). The test method for in situ measurement of the sound absorption coefficient is specified by ISO 13472-2:2010. This measurement system complies with these requirements. By simply placing the acoustic duct on the track surface, the sound absorption coefficient can be measured quickly, making the system optimal for measurements during construction of a standard track, as well as for aging measurements.
Experimental mode analysis of automobile body
[Mode Analysis System (ME'Scope VES)]

In order to control car body vibrations or to establish a fatigue life prognosis, knowing the natural frequency, vibration mode, and similar characteristics is a key requirement. This system makes it easy to perform continuous operation from measurement to analysis and animation by using the Multi-Channel Signal Analyzer SA-02, mode analysis software (ME'Scope VES), and mode analysis direct link software.

Automobile body sound source localization
[Sound Source Localization System]

This system allows displaying the incidence direction of a sound in real time. Using the triaxial acoustic intensity probe facilitates operation and enables the realization of sound source localization measurement at low cost. The frequency band (range) to analyze can be selected, and the optional video recording function also supports sound source identification.
Analysis of noise and vibrations related to engine rotation

[Order Tracking Analysis System]

Examining the rotational frequency or order can be useful in determining conditions related to rotation speed such as the natural frequency of structural parts and components. This system uses the Multi-Channel Signal Analyzer SA-02 or the RIONOTE Multifunction Measurement System to obtain revolution data and noise and vibration waveform data simultaneously and perform rotation order ratio analysis.

Tracking analysis system using Multi-Channel Signal Analyzer SA-02

Tracking analysis system using RIONOTE Multifunction Measurement System
Combustion chamber volume measurement

[Acoustical Capacity Meter]

On the assembled engine, the volumetric capacity of the combustion chamber can be measured in a short time (about 2 seconds) by joining the volumeter to the spark plug hole with a dedicated adapter.

System Configuration

- 1/2 inch electret condenser microphone UC-59
- Accelerometer PV-91C
- Accelerometer (Triaxial type) PV-97C
- Preamplifier NH-22
- Accelerometer cable VP-51 Series
- BNC-BSI coaxial cable EC-90 Series
- BNC Adapter VP-52C
- Multi-Channel Signal Analyzer SA-02
- Charge Converter VP-40
- Tachometer
- For noise measurement
- For benchmarking
- Computer
- RS-232C
- PLC
- LAN
- Computer

When using a 3-axis accelerometer, three VP-40 units are required, one for each axis.
Car interior comfort related measurement solutions

**Psychoacoustic evaluation**  
[Sound Quality Assessment Measurement System]

There are considerable individual differences in whether sounds generated inside a car are perceived as pleasant or unpleasant. Psychoacoustic evaluation is therefore necessary to quantify how a person perceives a sound. The Sound Quality Assessment Measurement System makes this possible by displaying psychoacoustic evaluation results in numeric form.

**Acoustic characteristics testing of interior materials**  
[Vertical Incident Absorption Coefficient Measurement System]

This measurement setup determines the vertical incident sound absorption coefficient by using the dual microphone method in conjunction with an acoustic duct. The system facilitates evaluation of the physical properties of sound absorbing material in compliance with JIS A 1405-2 and ISO 10534-2.
Exhaust system related measurement solutions

Testing of muffler acoustic characteristics
[Muffler Sound Reduction Index Measurement System]

Assessing the sound absorption performance of a muffler as part of a car’s exhaust system is an essential requirement. The vertical incident sound absorption coefficient/sound reduction measurement system makes it possible to directly determine the sound reduction index.
Information about the RIONOTE Multifunction Measurement System and the Multi-Channel Signal Analyzer SA-02

Portable Multi-function Measuring System
RIONOTE

The RIONOTE Multifunction Measurement System makes it possible to realize optimal analysis functions for a wide range of application fields. The capability for wireless measurement allows quick and simple setup even in locations where cabling would be difficult. A wide range of analysis programs are available, and customization is also supported.

- Color LCD touch screen allows intuitive operation.
- B5 size ideal for measurements in the field.
- Light weight: only 1.2 kg including amplifier and battery.
- Support for wireless measurements
- Use of Wireless Dock SA-A1WD provides support for up to 16 measurement channels

Multi-Channel Signal Analyzer SA-02 Combines FFT Analysis and 1/1, 1/3, 1/12 Octave Band Analysis Capability

- Up to 32 channels supported (using two SA-02M units)
- Allows high frequency analysis in multiple channels
- Various analysis software available
- Customizing of analysis software also possible

By linking two SA-02M units, up to 32 channels are supported
Information about piezoelectric accelerometer and measurement microphone products

Piezoelectric Accelerometers

<table>
<thead>
<tr>
<th>Model</th>
<th>PV-91C</th>
<th>PV-90T</th>
<th>PV-97</th>
<th>PV-90H</th>
<th>PV-08A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline / purpose</td>
<td>Compact, lightweight, High temperature</td>
<td>Compact, TEDS compliant</td>
<td>Triaxial, 200 °C</td>
<td>Compact, lightweight, High temperature</td>
<td>Compact, Lightweight</td>
</tr>
<tr>
<td>Mass g</td>
<td>1.8</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Charge sensitivity pC/(m/s²)</td>
<td>—</td>
<td>—</td>
<td>0.29</td>
<td>0.29</td>
<td>0.102</td>
</tr>
<tr>
<td>Voltage sensitivity mV/(m/s²)</td>
<td>1</td>
<td>0.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Vibration frequency range (±1 dB) Hz²</td>
<td>1 to 20 000 (10 %)</td>
<td>1 to 12 000 (10 %)</td>
<td>1 to 10 000</td>
<td>1 to 20 000 (10 %)</td>
<td>1 to 25 000</td>
</tr>
<tr>
<td>Temperature range for use / °C</td>
<td>−50 to +170</td>
<td>−20 to +100 (TEDS: −20 to +86)</td>
<td>−50 to +200</td>
<td>−50 to +250</td>
<td>−50 to +160</td>
</tr>
<tr>
<td>Dimensions mm</td>
<td>7 (Hex) × 12.5 (H)</td>
<td>7 (Hex) × 11.4 (H)</td>
<td>13 (H) × 13 (W) × 13 (D)</td>
<td>7 (Hex) × 11 (H)</td>
<td>5.5 (φ) × 7.8 (H)</td>
</tr>
</tbody>
</table>

² 1 Representative value; actual value is noted on calibration sheet supplied with accelerometer.
² 2 Representative value when mounted on flat surface according to standard mounting method.

Charge converters with CCLD support

| Charge Converter | VP-42 (Compact relay type) | VP-40 |
| University of Hawaii | Charge Converter VP-40 (For direct connection to BNC input) | Specifications |
| Model | VP-40 | VP-42 |
| Gain | 1 mV/pC ±2.5 % (80 Hz) | 1 mV/pC ±2.5 % (80 Hz) |
| Frequency range | 1 Hz to 30 kHz (±5 %) | 1 Hz to 30 kHz (±5 %) |
| Drive current | 2 mA to 4 mA | 2 mA to 4 mA |
| Dimensions (mm) | φ14.5 × 45 | φ7 × 27.7 |

Measurement Microphone

Condenser Microphones

UC Series

<table>
<thead>
<tr>
<th>Model</th>
<th>UC-35P</th>
<th>UC-59</th>
<th>UC-54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline / purpose</td>
<td>Quiet measurement</td>
<td>General purpose</td>
<td>Ultrasound</td>
</tr>
<tr>
<td>Nominal diameter</td>
<td>1 inch</td>
<td>1/2 inch</td>
<td>1/4 inch</td>
</tr>
<tr>
<td>Measurement frequency range (Hz)</td>
<td>10 to 12 500</td>
<td>10 to 20 000</td>
<td>20 to 100 000²²</td>
</tr>
<tr>
<td>Sensitivity level (dB re 1 V/Pa)</td>
<td>0</td>
<td>−27</td>
<td>−48</td>
</tr>
<tr>
<td>Capacitance (pF)</td>
<td>—</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Maximum input sound pressure level (dB) (Linearity tolerance ± 0.3 dB)</td>
<td>96</td>
<td>148</td>
<td>164</td>
</tr>
<tr>
<td>A-weighted inherent noise level (dB)</td>
<td>4</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>φ23.8 × 132.7</td>
<td>φ13.2 × 14.3</td>
<td>φ7.0 × 10.0</td>
</tr>
</tbody>
</table>

² 1 Representative value for 1 kHz
² 2 Frequency range refers to microphone without grid.

Microphone With Preamplifier (TEDS compliant)

<table>
<thead>
<tr>
<th>Model</th>
<th>UC-59T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Multi-point</td>
</tr>
<tr>
<td>Microphones</td>
<td>UC-59</td>
</tr>
<tr>
<td>Preamplifier</td>
<td>NH-22AT</td>
</tr>
<tr>
<td>Measurement frequency range (Hz)</td>
<td>10 to 20 000</td>
</tr>
<tr>
<td>Drive current</td>
<td>2 mA to 4 mA</td>
</tr>
<tr>
<td>A-weighted inherent noise level (dB)</td>
<td>16.6</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>φ13.2 × 99.4</td>
</tr>
</tbody>
</table>
## Other product information

### Other Products

<table>
<thead>
<tr>
<th>For applications ranging from environmental measurements to R &amp; D</th>
<th>For wide-band measurements from 1 Hz to 20 kHz</th>
<th>For facility diagnosis and on-site measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sound Level Meter (class 2)</strong> NL-42</td>
<td><strong>Sound Level Meter (class 1)</strong> NL-62</td>
<td><strong>Vibration Analyzer</strong> VA-12</td>
</tr>
<tr>
<td><strong>Sound Level Meter (class 1)</strong> NL-82</td>
<td>(With low-frequency sound measurement function)</td>
<td>(With FFT analysis function)</td>
</tr>
</tbody>
</table>

### Anechoic Box / Anechoic Room

The ideal "silent space" for performing stable and optimized acoustic measurements

- [Anechoic Box (Compact Type)](#)
- [Anechoic Room](#)
- [Sound Proof Chamber](#)