RION

# Product and Measurement Solutions for the Railway Industry

## Solutions for train carriages and bogies

P.4-5

Measurements of carriage body performance and multi-channel measurements of sound and vibrations caused by passing trains
**【Measurement System for Train Vibration and Sound】**

Acoustic characteristics testing of interior materials and sound insulation materials
**【Normal Incidence Sound Absorption Ratio / Sound Transmission Loss Measurement System】**

Evaluation of interior sound in carriages
**【Sound Quality Evaluation Measurement System】**

Sound and vibration analysis of main drive motor
**【Order Tracking Analysis System】**

## Environmental measurement solutions for track-side locations and railway stations etc.

P.6-7

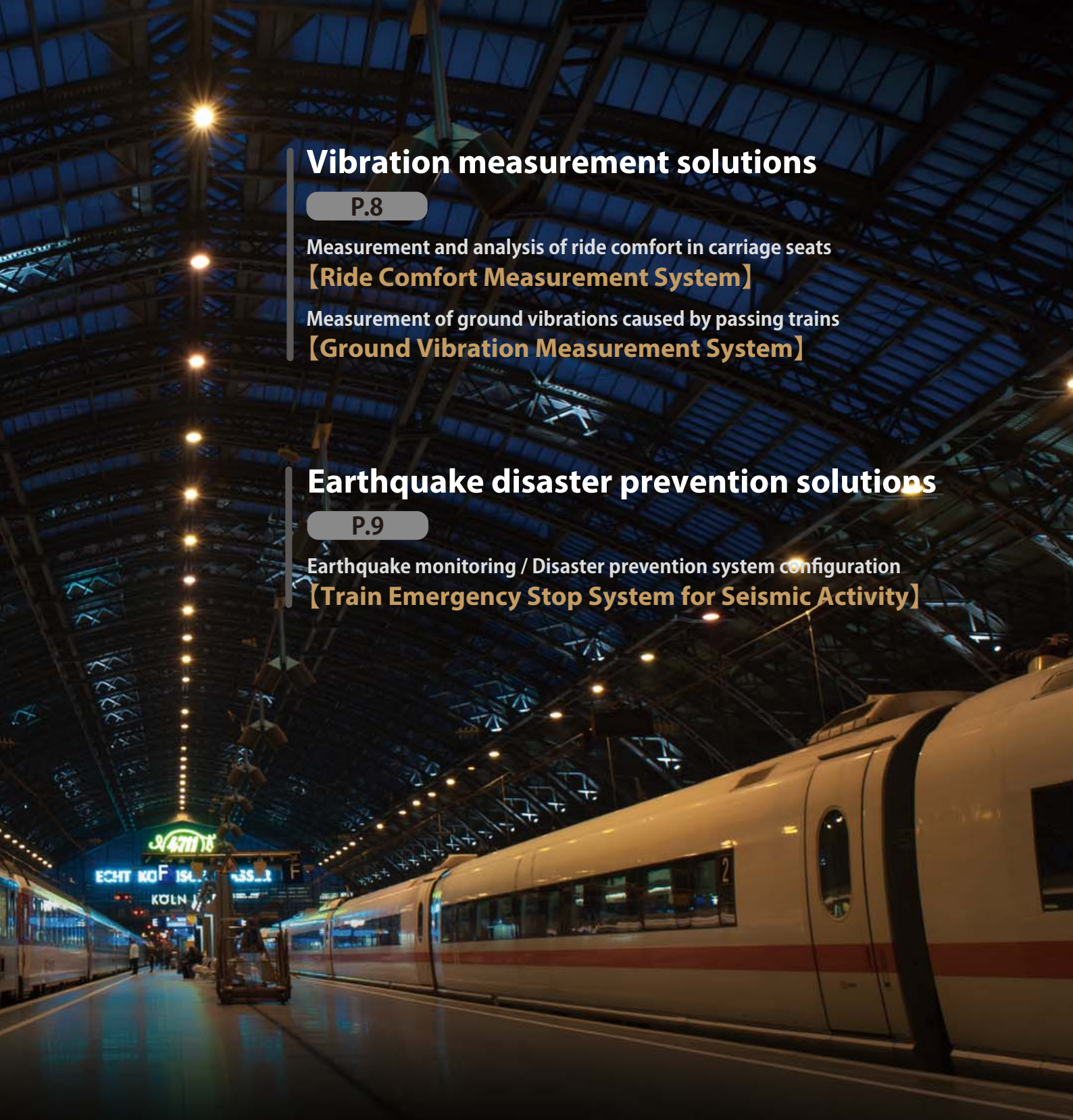
Detection of peeling of tunnel walls, abnormality of carriage body and loose bolts etc.
**【Tapping Sound Inspection System】**

Investigating sound sources in pantographs, carriage bodies, and bogies
**【Microphone Array Sound Source Visualization System】**

Microbaric wave measurement during tunnel entry
**【Ultra Low Frequency Infrasound Level Meter XN-1J】**

Measurement of environmental sound and vibrations and sound and vibration effects of blasting excavation work
**【Sound Level Meter (class 1) NL-62】【Vibration Level Meter VM-55】**

Vibration analysis in station buildings and track-side facilities
**【Vibration Analysis Program SX-A1VA】【Vibration Analyzer VA-12】**




## Vibration measurement solutions

P.8

Measurement and analysis of ride comfort in carriage seats
【Ride Comfort Measurement System】

Measurement of ground vibrations caused by passing trains
【Ground Vibration Measurement System】

## Earthquake disaster prevention solutions

P.9

Earthquake monitoring / Disaster prevention system configuration
【Train Emergency Stop System for Seismic Activity】

# Solutions for carriages and bogies

## Measurements of carriage performance and multi-channel measurements of sound and vibrations caused by passing trains

### 【Measurement System for Train Vibration and Sound】

This system supports measurement, analysis, and report creation for vibrations and sound caused by passing trains.



## Acoustic characteristics testing of interior materials and sound insulation materials

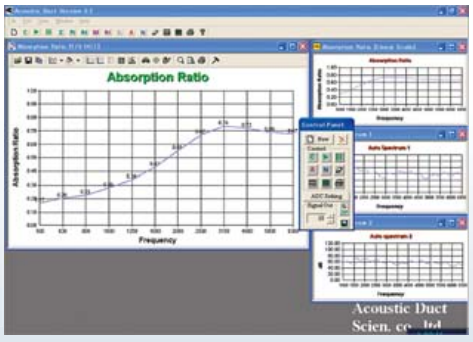
### 【Normal Incidence Sound Absorption Ratio / Sound Transmission Loss Measurement System】

Using the 4-microphone method in conjunction with an acoustic duct, the Normal incidence Sound absorption ratio / Sound transmission loss measuring device can be measured. The system facilitates evaluation and measurement of the physical properties of sound absorbing material and sound insulation material (in compliance with JIS A 1405-2 and ISO 10534-2).

A piece of material cut to fit the duct diameter is inserted into the duct

High frequency duct

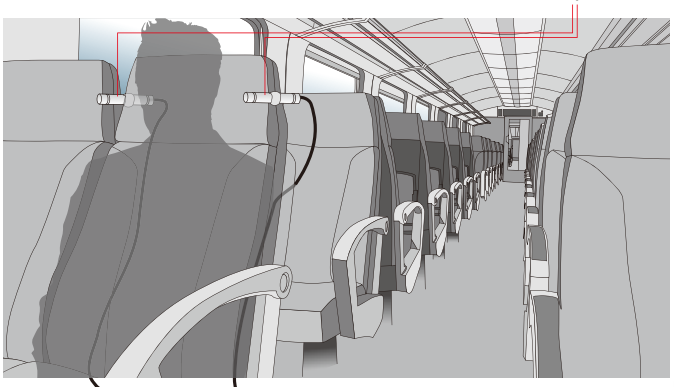
Low frequency duct

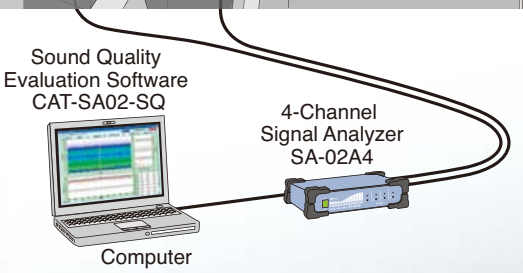


# Evaluation of interior sound in carriages

## 【Sound Quality Evaluation Measurement System】

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



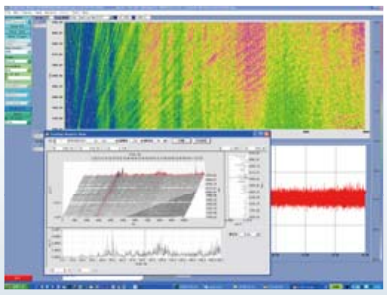

# Sound and vibration analysis of main drive motor

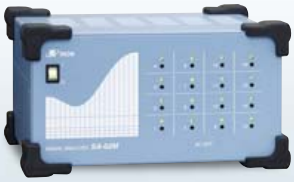
## 【Order Tracking Analysis System】

The system allows measuring the sound and vibration caused by the rotation of a rotating body such as a motor. It uses the Multi-Channel Signal Analyzer SA-02 or the RIONOTE Multifunction Measurement System to obtain revolution data and sound and vibration waveform data simultaneously and perform rotation order ratio analysis.

### Tracking Analysis System

Using Multi-Channel Signal Analyzer SA-02



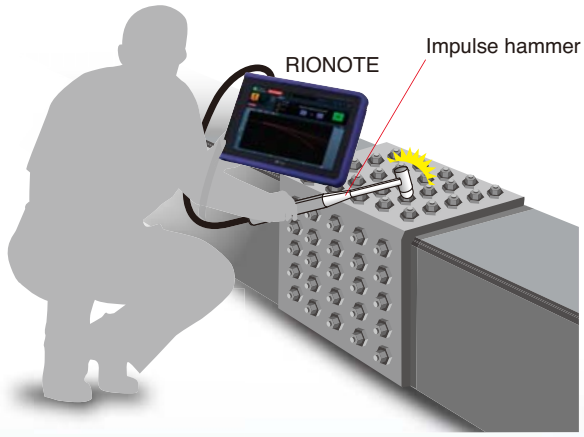


# Environmental measurement solutions for track-side locations and railway stations etc.

## Peeling detection of tunnel walls, abnormality of carriage body and loose bolts etc.

### 【Tapping Sound Inspection System】

The system uses the RIONOTE Multifunction Measurement System together with an impulse hammer to perform inspections. Properly tightened bolts and loose bolts will respond differently to an impact force. Tapping with the impulse hammer makes it possible to judge this difference.

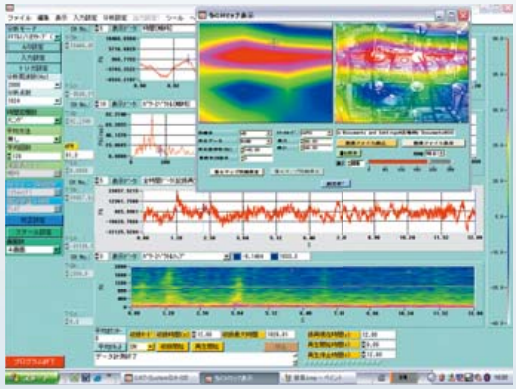


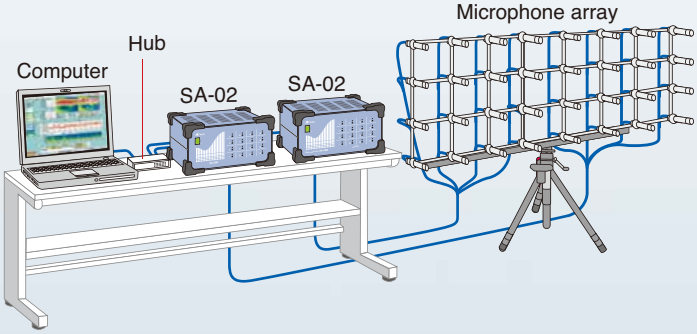


## Investigating sound sources in pantographs, carriage bodies, and bogies

### 【Microphone Array Sound Source Visualization System】

Using a microphone array allows the visualization of the sound pressure level changes of a moving sound source.
The power spectrum and spectrum map (3-D display) of the sound pressure at the measurement position can be observed, and linking with image data and video is also possible.

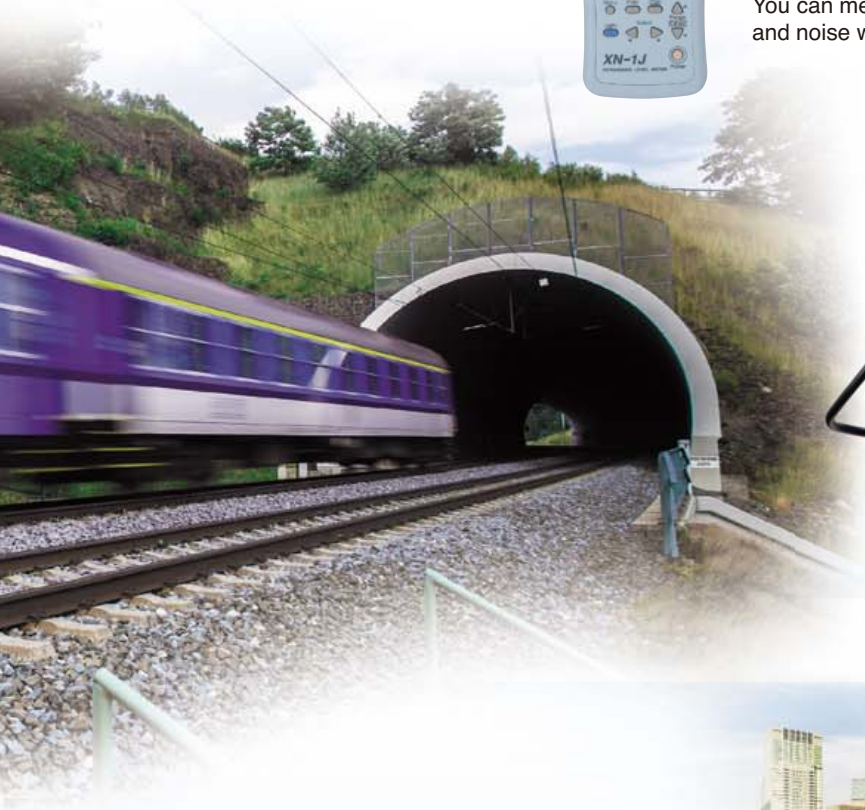




## Microbaric wave measurement during tunnel entry

### 【Ultra Low Frequency Infrasound Level Meter XN-1J】

Measures sound pressure levels down to very low frequencies, with a lower frequency limit of about 0.2 Hz. In addition to flat response, three types of low-pass filters can be selected for the frequency response.

## Measurement of environmental sound and vibrations, and sound and vibration effects of blasting excavation work

### 【Sound Level Meter (class 1) NL-62】

**(With low-frequency sound measurement function)**

Supports measurement over a wide frequency range from 1 to 20 000 Hz. You can measure low-frequency sounds and noise with a single unit.


### 【Vibration Level Meter VM-55】

Supports simultaneous measurement of vibration level ($L_V$) and vibration acceleration level ($L_{Va}$).

## Vibration analysis in station buildings and track-side facilities

### 【Vibration Analysis Program SX-A1VA】

The program allows simple diagnosis of normal or abnormal conditions by using the absolute value determination function, and precision diagnosis utilizing the FFT analysis and envelope processing functions. Because up to four accelerometers can be connected, 3-axis measurement or simultaneous multi-plane measurement are possible. Trend management using spreadsheet software such as Excel can be realized by periodically measuring and exporting accumulated data.

### 【Vibration Analyzer VA-12】

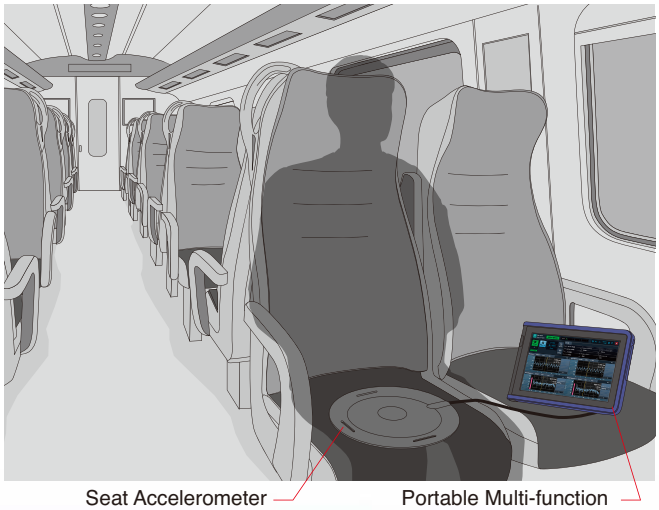
Designed for hand-held use in the field, the unit comprises analysis functions suitable for equipment diagnosis and on-site measurements.
Both simple diagnosis and detailed diagnosis are possible.

# Vibration measurement solutions

## Measurement and analysis of ride comfort in carriage seats

### 【Ride Comfort Measurement System】

The system allows measuring vibrations transmitted to the human body while sitting in a carriage seat. It uses the RIONOTE Multifunction Measurement System together with the Seat Accelerometer PV-62.



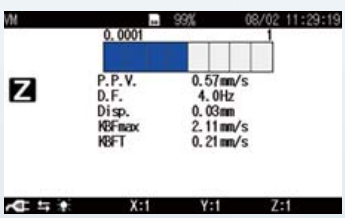
Seat Accelerometer
PV-62

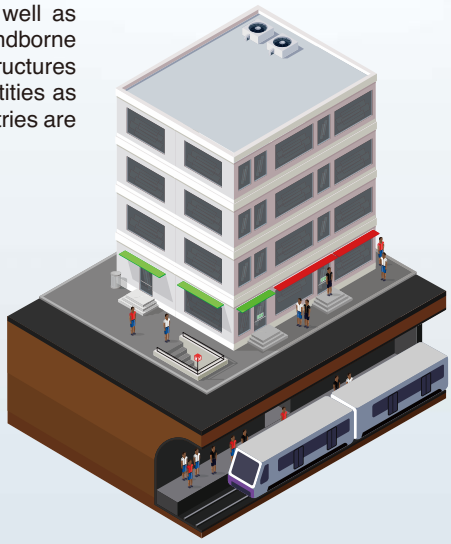
Portable Multi-function
Measuring System
RIONOTE

## Measurement of ground vibrations caused by passing trains

### 【Ground Vibration Measurement System】

In some cases, it may be necessary to evaluate the effects of vibrations generated for example by underground moving trains on the human body when propagated into a living space in a building above or inside the passenger compartment, as well as checking for possible damage to structures. The system uses the Tri-axial Groundborne Vibration Meter VM-56 to measure and evaluate the influence on building structures and the degree of discomfort caused to the human body. (Measurement quantities as specified by DIN 45669-1, ISO 8041, and other standards of various other countries are calculated simultaneously.)

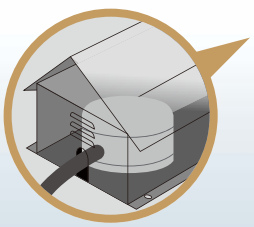



# Earthquake disaster prevention solutions

## Earthquake monitoring / Disaster prevention system configuration

### 【Train Emergency Stop System for Seismic Activity】

In the event of a major earthquake, it is essential to quickly stop running trains. Using the Strong Motion Measuring Device SM-28 and the Digital Output Seismic Sensor PV-24, this system can send earthquake occurrence information to a central monitoring system that issues stop signals to trains.

Digital Output Seismic Sensor
PV-24

Strong Motion Measuring Device
SM-28

# 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

Portable Multi-function Measuring System
RIONOTE


Wireless Dock
**SA-A1WD**

Platform (main unit) and amplifier

＊Selling of Wireless dock (SA-A1WD) differs from each country. Please contact us for further questions.

---

## Multi-Channel Signal Analyzer SA-02

**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

Multi-Channel Signal Analyzer
**SA-02M** (4ch to 16ch)

4-Channel Signal Analyzer
**SA-02A4**

**By linking two SA-02M units, up to 32 channels are supported**

# Information about piezoelectric accelerometer and measurement microphone products

**Broad and versatile lineup makes it possible to choose the optimum product for any given application.**

## Piezoelectric Accelerometers

| | With built-in amplifier | | Triaxial | | General type | High sensitivity type |
|---|---|---|---|---|---|---|
| Photo |  |  |  |  |  |  |
| Model | PV-91C | PV-91CH | PV-97 | PV-93 | PV-85 | PV-87 |
| Outline /purpose | **Compact, lightweight, High temperature** | **Compact, lightweight, High sensitivity** | **Triaxial, 200 °C** | **Electric charge, general purpose** | **Electric charge, general purpose** | **Electric charge, High sensitivity** |
| Mass g | 1.8 | 3 | 10 | 30 | 23 | 115 |
| Charge sensitivity pC/ (m/s²)*1 | — | — | 0.29 | 0.831 | 6.42 | 40 |
| Voltage sensitivity mV/ (m/s²)*1 | 1 | 11 | — | — | — | — |
| Vibration frequency range (±1 dB) Hz*2 | 1 to 20 000 (10 %) (1 to 2 Hz (±15 %) at 150 to 170 degrees.) | 1 to 15 000*3 (±10 %) | 1 to 10 000 (Z) 1 to 5 000 (X・Y) (±10 %) | 1 to 8 000 (2-axis) 1 to 4 000 (1・3) | 1 to 7 000 | 1 to 3 000 |
| Temperature range for use / °C | −50 to +170 | −50 to +170 | −50 to +200 | −50 to +160 | −50 to +160 | −50 to +160 |
| Dimensions mm | 7 (Hex) × 12.5 (H) | 8 (Hex) × 13.3 (H) | 13 (H) × 13 (W) × 13 (D) | 16(H) × 21(W) × 21(D) | 17 (Hex) × 18.5 (H) | 24 (Hex) × 30.5 (H) |

*1 Representative value; actual value is noted on calibration sheet supplied with accelerometer.
*2 Representative value when mounted on flat surface according to standard mounting method.
*3 0.6 Hz to 20 kHz (±20 %), 0.5 Hz to 20 kHz (±30 %)

### Charge converters with CCLD support

**Charge Converter VP-40**
(For direct connection to BNC input)

**Charge Converter VP-42**
(Compact relay type)

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 |

## Condenser Microphones
UC Series

| Model | UC-35P | UC-59 | UC-54 |
|---|---|---|---|
| Outline /purpose | **Quiet measurement** | **General purpose** | **Ultrasound** |
| Nominal diameter | 1 inch | 1/2 inch | 1/4 inch |
| Measurement frequency range (Hz) | 10 to12 500 | 10 to 20 000 | 20 to 100 000*2 |
| Sensitivity level (dB re 1 V/Pa)*1 | 0 | −27 | −48 |
| Capacitance (pF) | — | 13 | 4 |
| Maximum input sound pressure level (dB) (Linearity tolerance ± 0.3 dB) | 96 | 148 | 164 |
| A-weighted inherent noise level (dB) | 4 | 18 | 45 |
| Dimensions (mm) | ϕ23.8 × 132.7 | ϕ13.2 × 14.3 | ϕ7.0 × 10.0 |

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

## Ultra-Miniature Electret Microphone
XE-1F/1G

Specifications

| | |
|---|---|
| Sensitivity level (dB re 1 V/Pa)*1 | −33.5 dB (re 1 V/Pa) |
| Measurement frequency range | 50 Hz to 10 kHz (typical value) |
| A characteristics residual noise level (dB) | 25 dB (SPL) |
| Cable length | Can be specified from 2 m to 5 m |

*1: Typical value at 1 kHz

Size comparison

# Other product information

## Other Products

### For applications ranging from environmental measurements to R & D

**Sound Level Meter (class 2)**
NL-42

**Sound Level Meter (class 1)**
NL-52

### Simultaneous octave band and 1/3 octave band analysis

**Sound level meter and 1/3 octave band real-time analyzer**
NA-28

### On-site measurement calibrator

**Sound Calibrator**
NC-75

### For multi-channel vibration measurements

**2-Channel Charge Amplifier**
UV-16

### For multi-channel sound and vibration measurements

**Sound Level Meter Unit / Vibration Meter Unit**
UN-14 / UV-15

### For data recording in the train environments or on-site

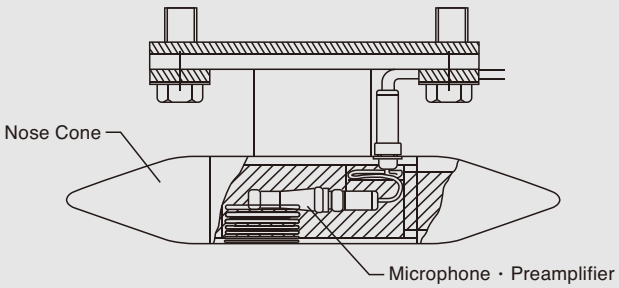
**4 channel Data Recorder**
DA-21

## Special product

### For suppression of running train wind noise

**Nose Cone**
XH-165

Designed for installation on a railway bogie or similar, this cone is designed for making sound measurements on a running train.
It reduces wind noise for improved measurement accuracy.




JCSS JCSS 0197

RION CO., LTD. is recognized by the JCSS which uses ISO/IEC 17025 as an accreditation standard and bases its accreditation scheme on ISO/IEC 17011. JCSS is operated by the accreditation body (IA Japan) which is a signatory to the Asia Pacific Accreditation Cooperation (APAC) as well as the International Laboratory Accreditation Cooperation (ILAC). The Quality Assurance Section of RION CO., LTD. is an international MRA compliant JCSS operator with the accreditation number JCSS 0197.

ISO 14001 RION CO., LTD.
ISO 9001 RION CO., LTD.

∗ Windows is a trademark of Microsoft Corporation. ∗ Specifications subject to change without notice.

Distributed by:

RION CO., LTD.
http://rion-sv.com/

3-20-41, Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan
Tel: +81-42-359-7888 Fax: +81-42-359-7442

This leaflet is printed with environmentally friendly UV ink.

2007-0 2007.P.D