

# *Sound and Vibration*



RION S&V Measuring Instruments General Catalog

2015 ► 2016

# RION

## About the JCSS Calibration Certificate

The Quality & Environmental Management system Center of RION Co., Ltd. has gained accreditation by the JCSS (Japan Calibration Service System) as an MRA (Mutual Recognition Arrangement) compliant operator in the category of acoustic measuring instruments and vibration acceleration measuring instruments (accreditation number JCSS 0197).

JCSS is operated by the accreditation body (IA Japan) which is a signatory to the Asia Pacific Laboratory Accreditation Cooperation (APLAC) as well as the International Laboratory Accreditation Cooperation (ILAC).

Being recognized as an international MRA compliant JCSS operator means that RION can issue calibration certificates bearing the ILAC MRA compliant JCSS symbol for acoustic measuring instruments (sound level meters, measurement microphones, sound calibrators) and vibration acceleration measuring instruments (vibration meters).

The calibration results stated in the certificates can be obtained internationally through the MRA.

### JCSS Compliant Acoustic Measuring Instruments

■ Sound Level Meters ■ Measurement Microphones ■ Sound Calibrators ■ Reference Piezoelectric Accelerometers (added Nov. 2012)



RION Co., Ltd. is recognized by the JCSS which uses ISO/IEC 17025 (JIS Q 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 Laboratory Accreditation Cooperation (APLAC) as well as the International Laboratory Accreditation Cooperation (ILAC). The Quality & Environmental Management system Center of RION Co., Ltd. is an international MRA compliant JCSS operator with the accreditation number JCSS 0197.

#### Designated models

Sound Level Meters	NL-42, NL-52, NL-62, NL-20, NL-21, NL-22, NL-31, NL-32, NL-26, NL-27, NA-28, NA-42S
Measurement Microphones	UC-30, UC-31, UC-52, UC-53A, UC-57, UC-59
Pistonphone	NC-72A
Sound Calibrators	NC-74
Reference Piezoelectric Accelerometers	PV-03

## Designated Manufacturer According to the Japan Measurement Act

RION Co., Ltd. is a designated manufacturer according to the Japan Measurement Act, category for special measurement instrument (sound level meters and vibration level meters). A designated manufacturer is officially recognized as having excellent manufacturing facilities as well as effective quality control systems. Such a manufacturer is allowed to carry out product verification corresponding to national certification verification, based on the Japan Measurement Act verification regulations. Products which pass such a verification receive a seal that certifies compliance with the required standards. The seal has the same legal status as an official verification mark, and means that the measurement device can be used for commercial transactions and authentication.

#### Designation dates and designation numbers

- Sound level meters Designation date: May 13, 1998, Designation number: 341301
- Vibration level meters Designation date: March 6, 2000, Designation number: 351301

## ISO Certification

### ISO 14001 certification

In 1999, RION Co., Ltd. obtained ISO 14001 certification for its environment management system, and is keeping the certification current (ISO 14001: 2004).

### ISO 9001 certification

In 1993, RION Co., Ltd. obtained ISO 9001 certification for its quality management system, and is keeping the certification current (ISO 9001: 2008).

## CE marking

Products being marketed in the European Economic Area must display the CE mark.

※The CE mark is a self-certification by the manufacturer, asserting that the item fully meets the requirements of all relevant European Directives.

# INDEX

■ Rion Green Products ..... P4 to 5

## Sound Level Meter

- Sound Level Meter ..... P6 to 11
- Sound Level Meter Unit ..... P11
- Environmental Sound Monitor ..... P12 to 14
- Measurement Microphone / Preamplifier ..... P15
- Optional accessories (For Sound Level Measurement) ..... P16
- Sound level Meter Selection Examples /  
Condenser microphone selection examples ..... P17
- Measurement Microphone Combination Examples ..... P18
- Sound Level Meter Connection Examples ..... P19

## Vibration Meter

- Piezoelectric Accelerometers ..... P20
- Servo Accelerometer etc. .... P21
- Vibration Level Meter ..... P22
- 3-Axis Vibration Meter ..... P23
- General-Purpose Vibration Meter ..... P24 to 25
- Vibration Analyzer / Data Collector ..... P26 to 27
- Vibration Meter Unit /  
2-Channel Charge Amplifier / etc. .... P28 to 29
- Vibration Monitor / Piezoelectric Accelerometers ..... P30
- Vibration Meter Selection Examples ..... P31
- Accelerometer Selection ..... P32
- Vibration Meter Connection Examples ..... P33

## Frequency Analyzer

- Multi-Channel Signal Analyzer / Software /  
System ..... P34 to 39
- Portable Multi-function Measuring System ..... P40

## Recorder

- Data Recorder / Software ..... P41 to 42
- Level Recorder / Printer / Viscotester ..... P43

## Related Products

- Tapping Machine / Heavy Floor Impact Source /  
Impact Ball / Random Noise Generator ..... P44
- Anechoic Box / Anechoic Room /  
Sound Proof Chamber ..... P45
- Acoustical Volumeter /  
Remote Noise Monitoring System etc. .... P46

External view drawings of measurement  
microphone and accelerometer cables ..... P47

## Measuring Instrument Combinations

..... P48 to 55

## Out line

- Noise and Sound Level Meters ..... P56
- Vibration and Vibration Meters ..... P57
- Frequency and Frequency Analyzers ..... P58
- Recording Sound and Vibration ..... P59

## Knowledge in a Nutshell

..... P60

## Quality Documentation

..... P61

## Company Outline

- RION Service Center Co., LTD. .... P62
- Kobayasi Institute of Physical Research ..... P63
- RION Co., LTD. .... P64

## INDEX

- INDEX (Model) ..... P65
- INDEX (Name) ..... P66

# RION Green Products

With the aim of creating truly environment friendly products, RION has established the "RION Green Procurement Guidelines". We use them as a standard for product development and parts procurement, to ensure that we can offer products that do not contain any harmful or hazardous chemical substances. Such products are entitled to bear our original "RION Green Product" logo.



## Class 1 / Class 2 Sound Level Meters NL-42/52/62

Allow measurement of sound level, equivalent sound level, maximum and minimum sound level, as well as time percentile level and sound exposure level. Measurement results can be stored in internal memory or on SD card. Single range design eliminates the need for range switching. Standard requirement specifications are met even with mounted windscreen. The 3-inch backlit color TFT display also functions as touch panel. Support for Japanese language display. Output connectors include AC output, DC output, RS-232C output, and USB port. IP54 water-resistance rating for unit body (excluding microphone section) facilitates outdoor use. Powered by IEC R6 (size AA) batteries, with support for nickel-hydride rechargeable types. NL-62 allows sound pressure level measurements in low frequency range / audible frequency range (1 Hz to 20 kHz).

## Class 2 Sound Level Meter NL-27

Compact and lightweight unit, designed for simple operation. Offers wide linearity range of 100 dB and covers 30 to 130 dB sound level measurement with a single range. Allows  $L_p$ ,  $L_{eq}$ ,  $L_E$ , and  $L_{max}$  measurement.

\* Use with detached microphone not supported.  
\* Use of program cards not supported.



## Measuring Amplifier NA-42

Acoustic measurement device offers wide frequency range, wide measurement level range, and support for connection of many different types of microphones.



## Environmental Sound Monitor NA-37



Provides a full range of functions for automated observation and monitoring, in a compact, sturdy unit designed for easy maintenance.

- Aircraft Noise Processing Program NX-37B/C Allows constant monitoring of aircraft noise.

Fully automated sound level measurement.

Supports new environmental standards.

- Environmental Noise Processing Program NX-37A Allows monitoring of road traffic noise, factory noise, and construction site noise.

## Sound Level Meter Unit UN-14

Designed for linked use in a measurement system for sound and vibrations, supporting flexible configuration.

Integrated A, C, and Z weighting characteristics. AC and DC outputs allow connection of level recorder or analyzer.



## Multi-Channel Signal Analyzers

**SA-02M** (4-channel expandable type)

**SA-02A4** (4-channel fixed type)



Frequency analyzers providing both FFT analysis capability and 1/1, 1/3, 1/12 octave band analysis capability. Allow direct sensor connection with TEDS support. Designed for easy operation. Wide range of optional software available.

## Pistonphone NC-72A



Suitable for JIS C 1515: 2004 Class LS/C.  
Calibration sound source outputs 250 Hz tone at 114 dB SPL.



## RION Green Product logo

### ★Design concept

The green leaves represent the natural environment.

The green circle protecting them symbolizes the ongoing cooperative efforts to reduce harmful substances, and it also is a zero that expresses the drive towards complete elimination of toxic content.



## Portable Multi-function Measuring System RIONOTE

Consists of the Main Control Unit and two types of sensor amp units. In combination with analysis programs and a wireless dock, the system adapts to a wide variety of measurements, including remote measuring applications. A choice of input and output connectors enables easy system expansion, and the large-format color touch panel display makes operation simple and intuitive. Various types of analysis programs will be released progressively.

## Vibration Meter Unit UV-15

Suitable for a wide range of vibration measurements. Three types of input connectors and AC and DC outputs are provided. Integrator converts vibration acceleration signal into vibration displacement signal. Display readings for three detection types.



## General-Purpose Vibration Meter VM-83

Measure and evaluate vibrations using a piezoelectric accelerometer or servo accelerometer. With the servo accelerometer, even very low frequency vibrations from 0.1 Hz upwards can be measured. Measurement items are acceleration, velocity, and displacement.



## 2-Channel Charge Amplifier UV-16

Input connectors and AC output connectors for two channels. Linked use of several units allows multi-channel configuration. Integrator converts vibration acceleration signal into vibration displacement signal. Other features include high-pass filter, low-pass filter, and integrated oscillator for calibration of a level recorder or frequency analyzer.



## Piezoelectric Accelerometers PV Series



Covering a broad range of applications, these accelerometers are available in many sizes and configurations, ranging from an ultra-compact unit weighing only 0.7 grams to high output and high sensitivity types, as well as accelerometers with high temperature resistance for nuclear power plant use, 3-axis types, integrated amplifier types, and more.

## Vibration Analyzer VA-12

Vibration meter with FFT analysis function. Designed for hand-held use in the field, for example to perform equipment diagnosis. Color TFT display provides excellent readability, and convenient Japanese-language or English-language menus can be used for measurement. Sampling frequency 51.2 kHz. 24 bit A/D conversion provides dynamic range of up to 110 dB. Equipped with USB port and SD card slot.



## 4 channel Data Recorder DA-21

Capable of recording acoustic or vibration waveforms and various electrical signals in the field. Data are saved on memory card in WAVE format, and analog playback is supported. Directly importing data into a computer for waveform analysis processing is also possible.



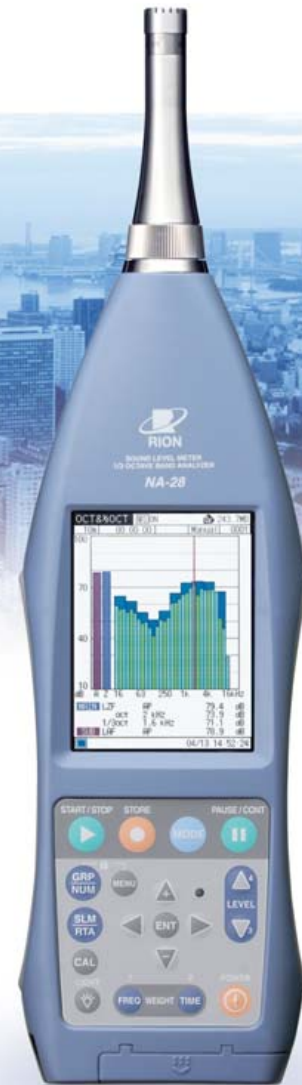
## Viscotester VT-06

(High viscosity) 0.3 to 4,000 dPa·s

Rotary type viscometer using resistance to rotor movement caused by viscosity (torque) to obtain readings. Designed for quality control applications in manufacturing of industrial products such as petrochemicals, paint, and adhesives, as well as foodstuffs.



# Sound Level Meter



**Simultaneous real-time octave band and 1/3 octave band analysis**  
**Simple operation combined with high performance**  
**Optimized features for on-site use**

## Sound Level Meter (Class 1) and 1/3 Octave Band Real-time Analyzer

NA-28

Designated manufacturer of special measurement instrument  
 Designation number: 341301 (The Japan Measurement Act)  
 Type certification number (The Japan Measurement Act): SLF061

**Memory card compatible model**  
 For details, see "Memory Card" on page 16.

- Sound level meter and filter functions for octave band and 1/3 octave band analysis, compliant with international standard requirements
- Simultaneous real-time octave band and 1/3 octave band analysis capability
- Direct storage of measurement result data on CompactFlash (CF) memory card  
 USB port also supports use of unit as removable disk. Optional infrared remote control allows convenient operation from a distance.

### Specifications

Applicable standards	Sound level meter: Sound Level Meter according to the Japan Measurement Act JIS C 1509-1: 2005 Class 1, JIS C 1513: 2002 Class 1, JIS C 1514: 2002 Class 1, IEC 61672-1: 2002 Class 1, IEC 61260: 1995 Class 1, ANSI S1.4-1983 Type 1, ANSI S1.43-1997 Type 1, ANSI S1.11-2004 Class 1
Measurement functions	Simultaneous main channel and sub channel measurement, both in sound level meter mode and analyzer mode. Frequency weighting and time weighting characteristics can be set separately for main channel and sub channel.
Measurement items	Simultaneous measurement of following items, with selected time weighting and frequency weighting characteristics: $L_p$ , $L_{eq}$ , $L_E$ , $L_{max}$ , $L_{min}$ , $L_N$ , $L_p$ of $L_{eq, 1s}$ For sub channel in sound level meter mode, one of following items can be selected: $L_{peak}$ , $L_{tms}$
Linearity range (according to JIS, IEC)	25 dB to 140 dB
Measurement level range	A weighting: 25 dB to 138 dB, C weighting: 33 dB to 138 dB, Z weighting: 38 dB to 138 dB
Measurement frequency range	10 Hz to 20 kHz
Analysis frequency range	Octave analysis: 16 Hz to 16 kHz (max. 8 kHz during simultaneous octave and 1/3 octave band analysis) 1/3 octave analysis: 12.5 Hz to 20 kHz (max. 12.5 kHz during simultaneous octave and 1/3 octave band analysis)
Correction functions	Windscreen correction: Compensation of frequency characteristics for standard compliance when windscreen is mounted. On/off selection from menu screen. Diffuse sound field correction: Compensation of frequency characteristics for standard compliance (ANSI S1.4) in diffuse sound fields. On/off selection from menu screen.
Storage	Sound level and processing results are stored by Manual store or Auto store in internal memory or on CF card. Internal memory has 1 block. One of Manual store, Auto store 1, or Auto store 2 can be selected.
Manual store	Manual recording of measurement results per address together with measurement start time
Auto store	Continuous recording of measurement results at selected time intervals. 4 types of markers can be set to identify events that occur while recording. Pause does not function during auto-store.
Auto 1	Maximum measurement time: 1 000 hours (when using CF card; for internal memory, see below) Sound level meter mode: Continuous store of $L_p$ , $L_{eq}$ , $L_{max}$ , $L_{min}$ as 1 set on CF card at 100 ms intervals (sub channel results cannot be stored) Sampling cycle: 100 ms ( $L_p$ , $L_{eq}$ , $L_{max}$ , $L_{min}$ ) only; internal memory storage capacity: max. 3 hours Analyzer mode: Continuous store of band level and all-pass time-weighted sound level $L_p$ on CF card Main channel: All-pass value and band level values, Sub channel: All-pass value only Sampling cycle: 1 ms to 1 sec, $L_{eq, 1s}$ ; internal memory storage capacity: max. 10 000 data sets (2.7 hours for 1 sec or $L_{eq, 1s}$ )
Auto 2	Sound level meter mode: Continuous recording on CF card of Main channel and sub-channel all-pass measurement values, together with measurement start time, for each measurement time interval Analyzer mode: Continuous recording on CF card of Main channel band levels and all-pass values and sub-channel all-pass values, together with measurement start time, for each measurement time interval Data capacity: Internal memory max. 1 000 data sets, CF card max. 300 000 data sets
Inputs/Outputs	AC output, DC output, comparator output, external trigger input, USB port, infrared remote control sensor
Power	Four IEC R14P (size C) batteries (16 hours operation with alkaline batteries) or external power supply (AC adapter NC-94B, supplied)
Temperature/humidity range for operation	-10 °C to +50 °C, 10 % to 90 %RH
Dimensions, Weight	331 (H) × 89 (W) × 51 (D) mm, approx. 730 g (including batteries)

### Options

Remote Control Unit	NA-27RC1
Memory Card (256 MB CF card*)	MC-25LC1
Memory Card (2 GB CF card*)	MC-20CF2
Microphone Extension Cable**	EC-04 (2 m and up)

\* 1 Use RION supplied cards for assured operation

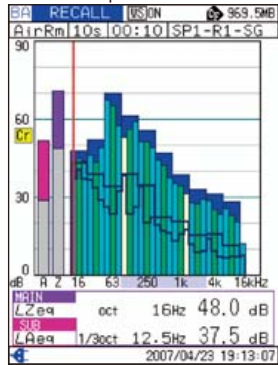
\*\* 2 Max. extension cable length for the Japan Measurement Act compliance is 35 meters.

# Building Acoustic Card NX-28BA

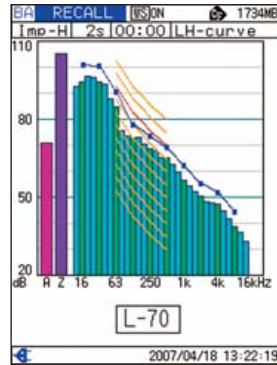


- Enables use of NA-28 for building acoustics measurements of airborne sound insulation and impact sound insulation (D value, L value etc.) as well as N/NC value measurement and reverberation time measurement
- Enables NA-28 to perform JIS and ISO compliant measurement and calculation of evaluation ratings
- Result data are stored as text files, and an Excel macro allows evaluation index calculation
- Combination with Waveform Recording Card NX-28WR allows simultaneous recording of sound pressure waveform at time of measurement

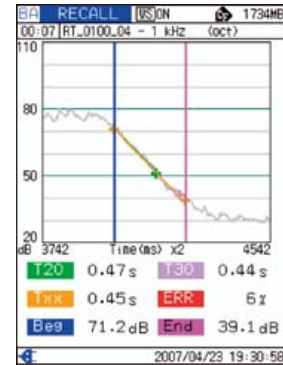
Screen examples



Overlay display of background noise measurement



Measurement result for floor impact sound insulation (heavy impact source)



Reverberation time decay curve

### Specifications

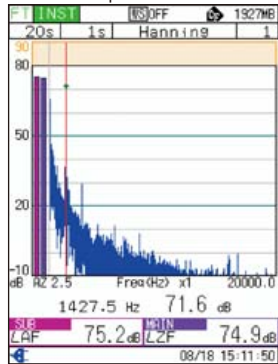
Analysis modes	Real-time octave analysis, real-time 1/3 octave analysis Simultaneous real-time octave and 1/3 octave analysis (sound level meter mode not available)
Measurement items (depending on measurement mode)	Instantaneous sound pressure level $L_p$ , Equivalent continuous sound pressure level $L_{eq}$ , maximum of time-weighted sound level $L_{max}$
Measurement types	Airborne sound insulation between rooms, measurement of floor impact sound insulation (standard light impact source), measurement of floor impact sound insulation (standard heavy impact source), room environmental sound level (N value or NC value), reverberation time, airborne sound insulation of facade elements and facades, sound level from service equipment

# FFT Analysis Card NX-28FT

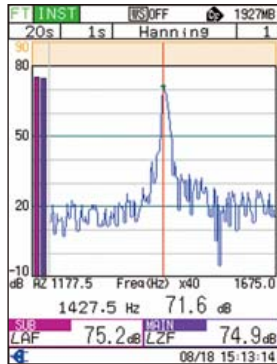


- Adds FFT analysis capability to NA-28
- Analysis frequency range: 20 kHz (fixed)
- Number of analysis lines: 8 000 (fixed) (frame time 400 ms, frequency resolution 2.5 Hz)
- Connection of vibration sensor enables vibration level measurement
- Pure tone evaluation capability compliant with ISO 1996-2: 2007 - Annex C

Screen examples



Measurement screen (zoom factor x1)



Measurement screen (zoom factor x40)

### Specifications

Measurement mode (FFT mode)	Main channel all-pass value and FFT analysis Sub-channel all-pass value
Measurement items	Simultaneous measurement of INST and LIN or MAX Measurement time 1 to 999 seconds
Dynamic range	100 dB
Analysis frequency range	20 kHz (fixed)
Time window functions	Hanning, Rectangular
Number of spectrum lines	8 000 (fixed) (frame time 400 ms, frequency resolution 2.5 Hz)
Sampling frequency	48 kHz (fixed)
Top list screen	List display of frequency and level values for top 20 lines, in descending order
Trigger	Controls start of measurement and memory store operation
Manual store	Stores measurement results.

# Waveform Recording Card NX-28WR



- Adds recording capability to NA-28
- Allows simultaneous recording of sound pressure waveform along with sound pressure level while performing frequency analysis with NA-28
- Recorded data are in uncompressed WAVE format that can be handled by generic software\*
- Use of various waveform analysis applications possible

### Sampling frequency settings and recording times on CF card

	256 MB	2 GB
48 kHz	30 m	4 h 40 m
24 kHz	1 h	9 h 20 m
12 kHz	2 h 10 m	18 h 50 m
64 kHz	20 m	3 h 30 m
32 kHz	50 m	7 h
16 kHz	1 h 40 m	14 h 10 m

\* Actual times may differ slightly depending on the number of files.

### Specifications

Sampling frequencies	
Simultaneous analysis	48 kHz, 24 kHz, 12 kHz
Sound level meter, octave band analysis, 1/3 octave band analysis	64 kHz, 32 kHz, 16 kHz
Frequency weighting characteristics	Z weighting (flat response, fixed)
Recording functions	
Event mode	Level recording, interval recording, manual recording
Total mode	Total recording
Combined use with Building Acoustic Card (NX-28BA)	
Insulation and impact sound measurement	Total recording
Reverberation time measurement	Total recording with pretrigger (1 sec)

Playback and reanalysis is done on your PC, not the NA-28.

Display and analyze data recorded with NX-28WR in various software applications

**Waveform Analysis software AS-70**

For specifications, see page 42.

**Waveform Analysis software CAT-WAVE**

For specifications, see page 42.

# Sound Level Meter

Measure Sounds Reliably  
Extremely User Friendly  
Provide full support for the measurement process.

Designated manufacturer of special measurement instrument  
Designation number: 341301 (The Japan Measurement Act)



SD-CARD Memory card compatible model  
For details, see "Memory Card" on page 16.

## Sound Level Meter (Class 1) NL-52

Type certification number (The Japan Measurement Act): SLF112

## Sound Level Meter (Class 2) NL-42

Type certification number (The Japan Measurement Act): SLS111

- 3-inch color screen easy to read anywhere: indoors, outdoors, or in dark locations
- A brief manual and a help function can be easily accessed on the device.
- Guaranteed water-resistant to at least level IP54 (resistant to spraying water).  
Helps reduce failures caused by sudden rain showers.
- In these new models it is possible to use rechargeable batteries which make these meters environmentally-friendly. 24 hour continuous measurement is possible (when using dry alkaline batteries).
- Supports long-term measurements (up to about 1 month) for environment monitoring etc. (using AC adapter)



		Sound Level Meter (Class 1) <b>NL-52</b>	Sound Level Meter (Class 2) <b>NL-42</b>
Specifications			
Applicable standards		IEC 61672-1: 2002 Class 1 ANSI S1.4-1983 Type 1, ANSI S1.4A-1985 Type 1 ANSI S1.43-1997 Type 1, JIS C 1509-1: 2005 Class 1 CE Marking (EMC Directive 2004/108/EC, Low Voltage Directive 2006/95/EC), WEEE Directives, Chinese RoHS (export model for China only)	IEC 61672-1: 2002 Class 2 ANSI S1.4-1983 Type 2, ANSI S1.4A-1985 Type 2 ANSI S1.43-1997 Type 2, JIS C 1509-1: 2005 Class 2
Measurement functions		Simultaneous measurement of the following items, with selected time weighting and frequency weighting	
	Processing (main ch)	Instantaneous sound pressure level: $L_p$ , Equivalent continuous sound pressure level: $L_{eq}$ , Sound exposure level: $L_e$ , Maximum sound pressure level: $L_{max}$ , Minimum sound pressure level: $L_{min}$ , Percentile sound levels: $L_N$ (0.1 to 99.9 %, 0.1-increment steps, max. 5 values)	
	Processing (sub ch)	Instantaneous sound pressure level: $L_p$	
	Additional processing	In addition to main processing items, one of the following can be selected for simultaneous processing: C-weighted equivalent continuous sound level: $L_{Ceq}$ , C-weighted peak sound level: $L_{Cpeak}$ , Z-weighted peak sound level: $L_{Zpeak}$ , I-time-weighted equivalent continuous sound level: $L_{A1eq}^{*2}$ , Maximum I-time-weighted equivalent continuous sound level: $L_{A1max}^{*2}$ . The power average of the maximum level of each 5 second interval: $L_{A1ms}$ . The frequency weighting for the additional processing synchronizes with the frequency weighting of the sub-channel, so when the sub-channel has A-weighting, $L_{A1ms}$ can be selected. When C-weighting (Z-weighting) is selected, the additional processing $L_{Ceq}$ and $L_{Cpeak}$ ( $L_{Zpeak}$ ) are selectable.	
Measurement range		A-weighting: 25 dB to 138 dB, C-weighting: 33 dB to 138 dB, Z-weighting: 38 dB to 138 dB, C-weighting peak sound level: 55 dB to 141 dB, Z-weighting peak sound level: 60 dB to 141 dB	
Frequency range		20 Hz to 20 kHz	20 Hz to 8 kHz
Frequency weighting		A, C, and Z	
Time weighting		F (Fast) and S (Slow)	
Correction functions		Windscreen correction: Compliant with IEC 61672-1 and JIS C 1509-1 standards when the windscreen is installed. Diffuse sound field correction: Correction of frequency characteristics in order to comply with standards (ANSI S1.4) in diffuse sound field.	
Store	Manual	Data for measurement results are stored manually in single address increments. Internal memory: max. 1 000 sets, SD Card: depends on the capacity of the SD Card <sup>*1</sup>	
	Auto <sup>*2</sup>	Instantaneous values ( $L_p$ mode) and processed values ( $L_{eq}$ mode) are stored continuously and automatically at preset intervals.	
	$L_p$ sampling cycle	100 ms, 200 ms, 1 s, $L_{eq}$ 1s	
	$L_{eq}$ sampling cycle	10 s, 1, 5, 10, 15, 30 ms, 1, 8, 24 h	
	Measurement Time	Max.1 000 h (depends on the capacity of the SD Card) <sup>*1</sup>	
Waveform recording <sup>*3</sup>		File format: Uncompressed waveform WAVE file, Sampling frequency: Select 48 kHz, 24 kHz or 12 kHz, Data length: Select 24 bit or 16 bit	
Outputs		DC output, AC output, Comparator output <sup>*2</sup>	
USB		Allows USB to be connected to a computer and recognized as a removable disk, Allows USB to be controlled via communication commands	
RS-232C communication		Allows for RS-232C communication via use of a dedicated cable	
Data continuous output <sup>*2</sup>	Type of data	Instantaneous value: $L_p$ , Processed value: $L_{eq}$ , $L_{max}$ , $L_{min}$ , $L_{peak}$	
	Output interval	100 ms	
Power requirements		Four IEC R6 (size AA) batteries (alkaline or rechargeable batteries) or external power supply (option: NC-98C)	
	Battery life (23 °C)	Alkaline battery LR6 (AA): 26 h Ni-MH secondary battery: 25 h At the maximum *Depends on the setting	
Dustproof / water-resistant performance <sup>*4</sup>		IP code: IP54 (except for microphone). See precautions regarding waterproofing	
Dimensions, weight		Approx. 250 (H) x 76 (W) x 33 mm(D), approx. 400 g (with batteries)	
Options			
Memory Card (512 MB SD card)	MC-51SD1	Microphone extension cables <sup>*5</sup>	EC-04 (2 m and up)
Memory Card (2 GB SD card)	MC-20SD2	All-Weather windscreen	WS-15
AC adapter (100 V to 240 V)	NC-98C	Rain-protection windscreen	WS-16

\*1 Use Rion fully guaranteed products. \*2 NX-42EX required (sold separately). \*3 NX-42WR required (sold separately).  
\*4 Protection against harmful dust and water splashing from any direction.  
\*5 Max. extension cable length for the Japan Measurement Act compliance is 105 meters.

### Precautions regarding waterproofing

Before use, verify that the rubber bottom cover and the battery compartment lid are firmly closed.  
To maintain the water and dust proof rating, internal packing replacement is required every five years (at cost).



Adds a number of programs.

## Extended Function Program NX-42EX

Installation of NX-42EX \*1 enables addition of NX-42WR / NX-42RT / NX-42FT / NX-42RV\*2

\*1 The NX-42EX program cannot be uninstalled.  
\*2 NX-42RV requires that NX-42RT or NX-62RT is installed.

The NX-42EX is supplied on the 512 MB SD card. The 512 MB SD card can be used as a memory card after installing the program.



NX-42EX	
Auto store function (instantaneous value, processed value)	
Comparator function	
Continuous data output function	

Program type	NX-42WR	NX-42RT	NX-42FT	NX-42RV
Additional function				
Real sound monitor (waveform recording)	●			
Octave, 1/3 octave band analysis		●		
Octave, 1/3 octave band filter output		●		
FFT analysis			●	
Reverberation time measurement				●

## Waveform Recording Program NX-42WR

This function enables users to record sounds and to process sound levels simultaneously. Recorded data can be played on computer and used for frequency analysis. (Uncompressed waveform WAVE file)

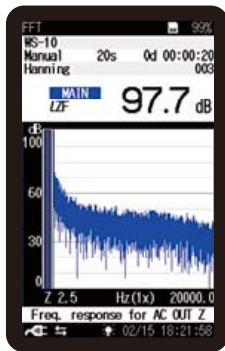
Sampling at 48 kHz, 24 kHz, 12 kHz, Selection of 24 bit or 16 bit

Sampling frequency	Maximum recording time (16 bit)	
	Memory card 512 MB	2 GB
48 kHz	1 h	4 h
24 kHz	2 h	8 h
12 kHz	4 h	16 h

The NX-42WR is supplied on the 2 GB SD card. The 2 GB SD card can be used as a memory card after installing the program.

## FFT Analysis Program NX-42FT

FFT analysis can be performed.

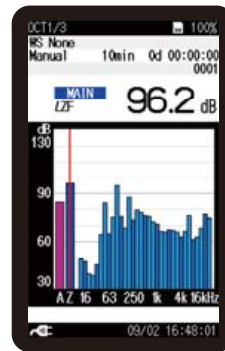


Analysis screen (x1)

The NX-42FT is supplied on the 512 MB SD card. The 512 MB SD card can be used as a memory card after installing the program.

## Octave, 1/3 Octave Real-time Analysis Program NX-42RT

Octave band and 1/3 octave band analysis can be performed.



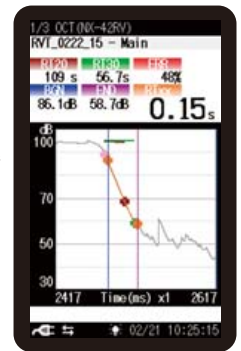
1/3 octave band analysis screen

The NX-42RT is supplied on the 512 MB SD card. The 512 MB SD card can be used as a memory card after installing the program.

## Reverberation Time Measurement Program NX-42RV

Enables reverberation time measurement.

\* NX-42RV requires that NX-42RT or NX-62RT is installed.



Reverberation time decay curve

The NX-42RV is supplied on the 512 MB SD card. The 512 MB SD card can be used as a memory card after installing the program.

## Complete software for environmental measurements

### Data Management Software For Environmental Measurement AS-60

- Easy to use
- Reports easy to prepare
- Simultaneous display of multiple data items (up to 8 data items)
- Data on the data recorder can be loaded (CSV file for DA-40 Viewer)
- Data combination

Enables measurement data graph display, arithmetic processing, sound exclusion, report creation, file output, and real-sound file playback.

#### Supported models

- NL-62\* NL-52/42\*
- NL-32/31/22/21\* DA-40Viewer

\* Only auto store data are supported.



Data management screen

#### Recommended computer specifications (Common for AS-60/AS-60RT/AS-60VM)

CPU	Intel CoreTM2 Duo 2.0 GHz or higher
RAM	2 GB or more
DISPLAY	XGA (1024 x 768) or more, at least 65 536 colors
OS	Microsoft Windows XP Professional 32 bit / 7 Professional 32 bit and 64 bit / 8 Pro 64bit

● If AS-60/60RT/60VM is used on the NL-52/42, the NX-42EX is also needed.

### Adds support for handling octave band analysis data to AS-60

### Data Management Software For Environmental Measurement (Includes octave and 1/3 octave data management software) AS-60RT

#### Supported models

- SX-A1RT\* NX-62RT\*
- NX-42RT\* NA-28\*

\* Only auto store data are supported.



Data management screen

This software analyzes and stores data files (recorded by the NX-42WR) in the WAVE format.

### Waveform Analysis Software AS-70

### Waveform Analysis Software CAT-WAVE

# Sound Level Meter (Sound Level Meter/Sound Level Meter Unit)

Measure frequencies from 1 to 20 000 Hz.  
Measure low-frequency sound and noise with a single unit.

Designated manufacturer of special measurement instrument  
Designation number: 341301 (The Japan Measurement Act)



SD-CARD Memory card compatible model  
For details, see "Memory Card" on page 16.

## Sound Level Meter (Class 1) (With low-frequency sound measurement function) NL-62

Type certification number  
(The Japan Measurement Act): SLF123

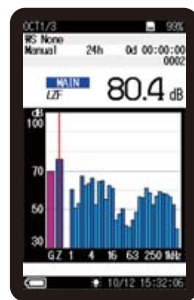
- 3-inch color screen easy to read anywhere: indoors, outdoors, or in dark locations
- A brief manual and a help function can be easily accessed on the device.
- Guaranteed water-resistant to at least level IP54 (resistant to spraying water). Helps reduce failures caused by sudden rain showers.
- In these new models it is possible to use rechargeable batteries which make these meters environmentally-friendly. 16 hour continuous measurement is possible (when using dry alkaline batteries).
- Supports long-term measurements (up to about 1 month) for environment monitoring etc. (using AC adapter)

## Octave, 1/3 Octave Real-time Analysis Program NX-62RT

- Octave band and 1/3 octave band analysis can be performed.



The NX-62RT is supplied on the 512 MB SD card. The 512 MB SD card can be used as a memory card after installing the program.



1/3 octave band analysis screen (low range)



For information on option programs listed below, see page 7.

### Waveform Recording Program NX-42WR

### FFT Analysis Program NX-42FT

### Reverberation Time Measurement Program NX-42RV

### Data Management Software For Environmental Measurement AS-60

### Data Management Software For Environmental Measurement (Includes the octave and 1/3 octave data management software) AS-60RT

### Waveform Analysis Software AS-70

#### Specifications

Applicable standards	IEC 61672-1: 2002 Class 1, ISO 7196: 1995 ANSI S1.4-1983 Type 1, ANSI S1.4A-1985 Type 1, ANSI S1.43-1997 Type 1, JIS C 1509-1: 2005 Class 1 CE Marking (EMC Directive 2004/108/EC, Low Voltage Directive 2006/95/EC), WEEE Directives, Chinese RoHS (export model for China only)
Measurement functions	Simultaneous measurement of the following items, with selected time weighting and frequency weighting Processing (main ch) Instantaneous sound pressure level: $L_p$ , Equivalent continuous sound pressure level: $L_{eq}$ , Sound exposure level: $L_E$ , Maximum sound pressure level: $L_{max}$ , Minimum sound pressure level: $L_{min}$ , Percentile sound levels: $L_N$ (0.1 to 99.9 %, 0.1-increment steps, max. 5 values) Processing (sub ch) Instantaneous sound pressure level: $L_p$ Additional processing One of the following can be selected: C-weighted equivalent continuous sound level: $L_{Ceq}$ , G-weighted average sound level: $L_{Geq}$ , C-weighted peak sound level: $L_{Cpeak}$ , Z-weighted peak sound level: $L_{Zpeak}$ , Power average of max. I-time-weighted average sound level: $L_{AImax}$ , Max. value of I-time-weighted average sound level: $L_{AImax}$ * Because additional processing frequency characteristics are linked to sub channel frequency characteristics, $L_{Atm5}$ , $L_{AImax}$ , $L_{AImax}$ can be selected when A characteristics are selected for sub channel. When C, G, or Z characteristics are selected, $L_{Ceq}$ and $L_{Cpeak}$ , $L_{Geq}$ , and $L_{Zpeak}$ can be selected for additional processing.
Measurement range	A-weighting: 25 dB to 138 dB, C-weighting: 33 dB to 138 dB, G-weighting: 43 dB to 138 dB, Z-weighting: 50 dB to 138 dB, C-weighting peak sound level: 60 dB to 141 dB, Z-weighting peak sound level: 65 dB to 141 dB
Frequency range	1 Hz to 20 kHz
Frequency weighting	A, C, G and Z
Time weighting	F (Fast) and S (Slow), I (Impulse) and 10 s
Correction functions	Windscreen correction: Compliant with IEC 61672-1 and JIS C 1509-1 standards when the windscreen is installed. Diffuse sound field correction: Correction of frequency characteristics in order to comply with standards (ANSI S1.4) in diffuse sound field.
Store	Manual Data for measurement results are stored manually in single address increments. Internal memory: max. 1 000 sets, SD Card: depends on the capacity of the SD Card** Auto Instantaneous values ( $L_p$ mode) and processed values ( $L_{eq}$ mode) are stored continuously and automatically at preset intervals. $L_p$ sampling cycle 100 ms, 200 ms, 1 s, $L_{eq}$ 1s $L_{eq}$ sampling cycle 10 s, 1, 5, 10, 15, 30 ms, 1, 8, 24 h Measurement Time Max. 1 000 h (depends on the capacity of the SD Card)**
Waveform recording**2	File format: Uncompressed waveform WAVE file, Sampling frequency: Select 48 kHz, 24 kHz or 12 kHz, Data length: Select 24 bit or 16 bit
Outputs	DC output, AC output, Comparator output
USB	Allows USB to be connected to a computer and recognized as a removable disk, Allows USB to be controlled via communication commands
RS-232C communication	Allows for RS-232C communication via use of a dedicated cable
Data continuous output	Type of data Instantaneous value: $L_p$ , Processed value: $L_{eq}$ , $L_{max}$ , $L_{min}$ , $L_{peak}$ Output interval 100 ms
Power requirements	Four IEC R6 (size AA) batteries (alkaline or rechargeable batteries) or external power supply (option: NC-98C) Battery life (23 °C) Alkaline battery LR6 (AA): 16 h Ni-MH secondary battery: 16 h At the maximum * Depends on the setting
Dustproof / water-resistant performance**3	IP code: IP54 (except for microphone), See precautions regarding waterproofing
Dimensions, weight	Approx. 255 (H) x 76 (W) x 33 mm(D), approx. 400 g (with batteries)

\* 1 Use Rion fully guaranteed products. \* 2 NX-42WR required (sold separately). \* 3 Protection against harmful dust and water splashing from any direction. \* Max. extension cable length for the Japan Measurement Act compliance is 105 meters.

## Ultra compact, Lightweight, High-performance

Designated manufacturer of special measurement instrument  
Designation number: 341301 (The Japan Measurement Act)

### Sound Level Meter (Class 2) NL-27

Type certification number  
(The Japan Measurement Act):  
SLF091



- Compliant with Japan Measurement Act, JIS, and IEC requirements
- Wide 107 dB linearity range allows sound level measurements from 30 to 130 dB without range switching
- Easy measurement of sound level ( $L_p$ ), equivalent continuous sound level ( $L_{eq}$ ), maximum sound level ( $L_{max}$ ), sound exposure level ( $L_E$ ), and peak sound level ( $L_{Cpeak}$ )

#### Specifications

Standard compliance	General-Purpose Sound Level Meter according to Japan Measurement Act JIS C 1509-1: 2005 Class 2, IEC 61672-1: 2002 Class 2 CE mark (EMC Directive 2004/108/EC), WEEE Directive
Measurement functions	Sound level $L_p$ , equivalent continuous sound level $L_{eq}$ , sound exposure level $L_E$ , maximum sound level $L_{max}$ , peak sound level $L_{Cpeak}$ (only when peak range was selected)
Processing functions (normal mode)	
Measurement level range (normal mode)	A-weighting: 30 dB to 130 dB C-weighting: 36 dB to 130 dB
Measurement frequency range	20 Hz to 8 kHz
Power	Two IEC R03 (size AAA) batteries
Dimensions, Weight	Approx. 120 mm (H) × 63 (W) × 23.5 mm (D), approx. 105 g (including batteries)

## For a wide range of high-precision acoustic measurements

### Measuring Amplifier NA-42 (without microphone)



- Supports connection of low-noise microphones UC-34P and UC-57 as well as microphones UC-29/54 and others allowing measurement up to 100 kHz

#### Specifications

Measurement functions	Sound pressure level $L_p$ , maximum sound level $L_{max}$ , peak sound pressure level $L_{peak}$
Measurement frequency range	1 Hz to 100 kHz (main unit characteristics)
Frequency weighting characteristics	A, C, FLAT
Time weighting characteristics	F (Fast), S (Slow), I (Impulse)
External filter	BNC connector
input/output connector	
Power	Four IEC R14 (size C) batteries, AC adapter (NC-98C, supplied)
Dimensions, Weight	171 (H) × 120 (W) × 236 (D) mm, approx. 1.8 kg (not including batteries)

#### Options

Microphone Extension Cable*	EC-04 (2 m and up)	
External Input Adapter	UA-01	
Interface Cable	5WKR4030	*Max. extension cable length for the Japan Measurement Act compliance is 15 meters.

- Allows connection of various microphones and preamplifiers to fit different measurement requirements
- Sound pressure level, sound level maximum, peak sound pressure level measurement modes (selectable)
- Measurement value display to two decimal values or one decimal value (selectable). Parameter information also shown.
- AC and DC output, serial communication function, comparator output function allow flexible configuration of various measurement or monitoring systems

## Build flexible measurement systems for simultaneous measurement of sound and vibrations

### Sound Level Meter Unit UN-14



Front View



Rear View

- Sound Level Meter Unit UN-14 and Vibration Meter Unit UV-15 can be linked in a measurement system with up to 16 channels
- Supports connection of measurement microphones and various preamplifiers (with TEDS compliant input etc.)
- Display shows parameters, measurement value, and bar graph indication
- Linking with Interface Unit UV-22 allows setup and control from a computer, and transfer of measurement values
- Backlit LCD and LED warning indicators

#### Specifications

Inputs	7-pin input connector	For measurement microphone or preamplifier (max. input voltage ±10 V) (excl. UC-34P connection)
	BNC connector	Microphone bias voltage +30 V, +60 V, +200 V For CCLD compliant microphone or preamplifier (24 V 4 mA) For TEDS compliant microphone (24 V 4 mA)
Frequency weighting characteristics	Measurement level range	A, C, Z (JIS C 1509-1 Class 1, IEC 61672 Class 1 electrical characteristics) A: 30 dB to 128 dB (using UC-59, NH-17), C: 36 dB to 128 dB (using UC-59, NH-17) Z: 41 dB to 128 dB (using UC-59, NH-17) (HPF 20 Hz, LPF 20 kHz)
	Frequency range	1 Hz to 80 kHz (20 Hz to 40 kHz ±0.5 dB) (1 Hz to 80 kHz ±3 dB)
Time weighting characteristics	F, S, 10 ms (JIS C 1509-1 Class 1 electrical characteristics)	
Power	9 V to 15 V DC, suitable AC adapter NC-97A (for up to 10 units), NC-99 (for up to 16 units) Battery Pack Unit BP-17, Cigarette plug adapter CC-82 (option, up to 16 units*) *Depending on car battery capacity	
Dimensions, Weight	150 (H) × 36 (W) × 179 (D) mm (not including protruding parts), approx. 500 g	

#### Options

Microphone Extension Cable*	EC-04 (2 m and up)	AC Adapter	NC-97A (For up to 10)
BNC-BNC Coaxial Cable	EC-90A (2 m and up)	AC Adapter	NC-99 (For up to 16)

### Interface Unit UV-22

### Battery Unit BP-17

For specifications, see page 26. 27.

# Sound Level Meter (Environmental Sound Monitor)

Designed for Long-term Noise Monitoring Application. Provides the Functionality and Durability Required for Automated System, and Ease of Maintenance.

## Environmental Sound Monitor NA-37



- Multiple interfaces for flexible data collection via LAN, public telecom line, leased analog line, USB memory etc.
- High-capacity internal memory provides ample long-term data storage capability (1 month or more)
- Optional internal GPS module provides automatic time correction and position information
- Internal battery with auto-shutdown and auto restart functions assures operation also during power failure

Great for environmental noise measurements along highways

## Environmental Noise Processing Program NX-37A

### NX-37A

- Allows automated measurement of basic data for environmental noise assessment, such as  $L_{eq}$  and  $L_N$
- Choice of interval mode and continuous mode enables automated round-the-clock evaluation.
- Sound Discrimination Unit AN-37 (option) can be used to obtain sound arrival direction data, to differentiate between noise originating on site and off site.



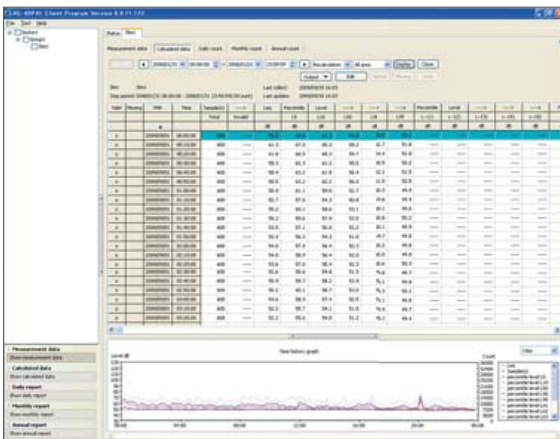
Environmental sound measurement screen example

## Environmental Noise Data Processing Software AS-40PA1

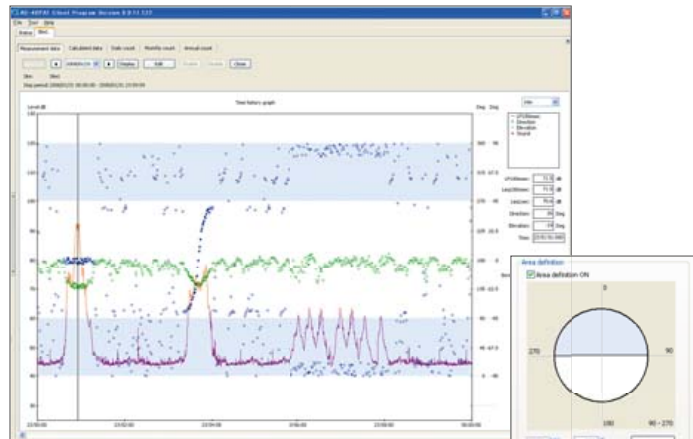
### AS-40PA1

- Collects data measured by NX-37A and allows saving, editing, and report creation.
- Multiple measurement locations can be registered, and collected data can be managed in a database for tabulation and report creation.
- Real sound data can be played, and tabulated data can be exported as tab separated text files, useful for creating reports.
- It is possible to discriminate the direction of the sound arrival.

\* Supported operating systems: Microsoft Windows XP Professional/Vista Business



Daily count calculated data screen (example)



Display for the level, direction, elevation & direction angles

Aircraft Noise Processing Program NX-37C and Aircraft Noise Data Processing Software AS-50PA2 including support for ground-level sound events\* are also available.

\* Ground noise event refers to noise produced by aircraft while on the ground, within the airport area. This includes noise from take-off and landing, taxiing, engine trial runs, APU etc.

# NA-37 Related Products

## Sound Level Meter (Class 1) NA-83



- Wide overall linear operation range enables 28 dB to 138 dB sound level measurement without range switching

## Outdoor microphone MS-11

Supplied with NA-83



- MS-11 has a built-in heater and a built-in sound source for automatic calibration, and is suitable for long-term outdoor use.

## All-Weather Windscreen WS-13



- Unit complies with requirements of IEC 61672-1 Class 1, JIS C 1509-1: 2005 Class 1 also when using this windscreen
- WS-13 has bird spikes to keep birds away.



AN-37/37R

## Noise Discrimination Unit AN-37/37R

- 3-axis microphone system allows determination of incident sound direction
- Detection microphone spacing of 25 cm results in compact dimensions and easy installation
- Aircraft radar signal reception capability provides additional identification data and enables counting of aircraft numbers (AN-37R)

## Real sound recording Program NX-37WR

(Factory-installed option)

- Selectable Compressed format (for long-term recording) or PCM format (for re-analysis)
- Internal memory can hold more than 1 month's worth of files (Compressed format, event duration 5 seconds, 1 000 events per day)

## Monitor aircraft noise for compliance with the Japan environmental regulations\*

(\* Environmental Directive 114, amended December 2007)

## Aircraft Noise Processing Program NX-37B

- Detects noise events and automatically identifies aircraft noise.
- Real sound recording, triggered by noise event (using optional Real Sound Monitor Program NX-37WR)



Evaluation result display (noise other than aircraft)

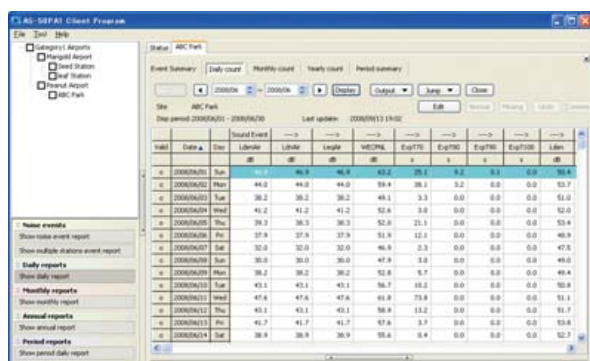


Evaluation result display (aircraft)

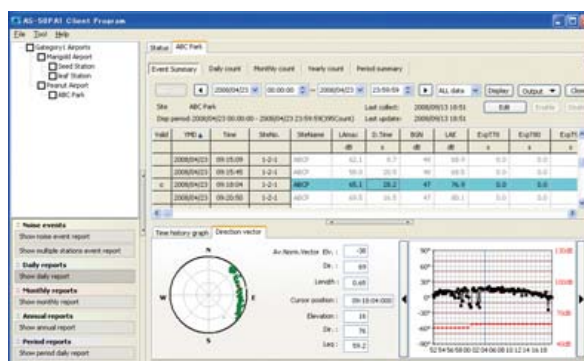
## Aircraft Noise Data Processing Application Software AS-50PA1

- Compile, tabulate, edit, and view data measured with NX-37B
- Locate noise event details for specific events and play real sound data with a few simple steps
- Create daily, monthly, and yearly reports
- Output tabulated data in CSV format for later report creation (NA-35/36/37)

\* Supported operating systems: Microsoft Windows XP Professional/Vista Business



Daily report screen



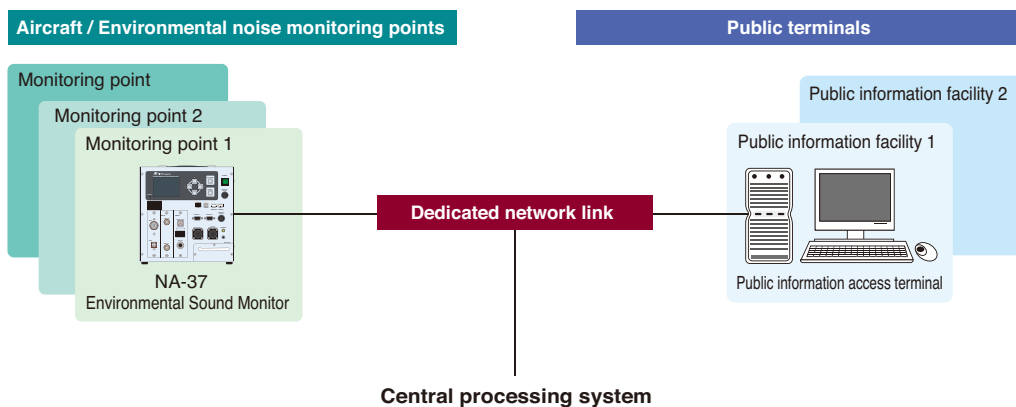
Event compilation screen

# Sound Level Meter (Environmental Sound Monitor)

## System Application Examples

### Aircraft / Environmental noise online monitoring system

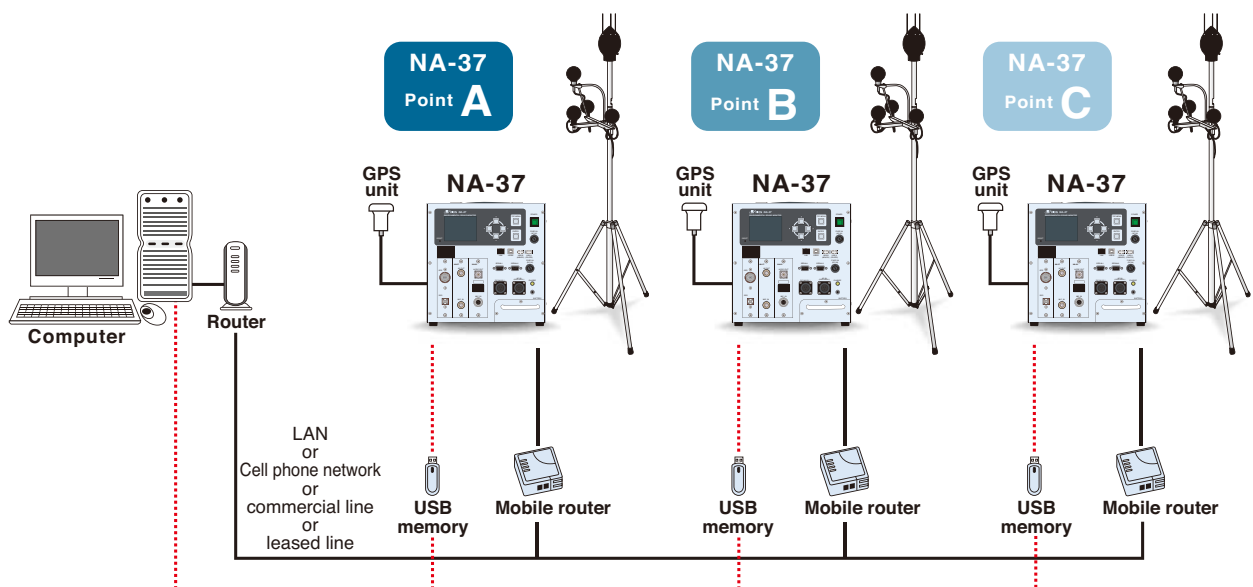
- Multiple NA-37 units installed at different points are linked via a VPN (Virtual Private Network) or other means. Measurement data are handled by a central processing system which implements real-time noise level display, statistical processing, log processing and other tasks.
- Information-providing servers can display real-time information on public system terminals.



### Mobile measurement point monitoring system

- Data can be collected from mobile measurement points also if no network connection is available, by using one of the following methods:
  - Data transfer using cell phone network with mobile router
  - Data collection using USB memory
- GPS unit (option) can provide measurement point position information

#### Monitoring system configuration example using temporary connection



# Condenser Microphones UC Series

- 1 inch type microphones are suitable for measurement also of very low sound pressure levels, but upper measurement frequency is limited to a few over 10 kHz.
- 1/2 inch and 1/4 inch type microphones are suitable for measurement of high frequencies and high sound pressure levels.



Model	UC-27	UC-32P	UC-34P	UC-30	UC-31	UC-33P	UC-52	UC-59	UC-57	UC-29	UC-54
Suitable preamplifier	NH-06A	NH-06A	NH-34 supplied	NH-04A/05A/12A	NH-04A/05A/12A	NH-04A/05A/12A	NH-17/17A/22	NH-17/17A/22	NH-17/17A/22	NH-05A (using UA-12)	NH-17/17A/22 (using UA-12)
Nominal diameter	1 inch			1/2 inch					1/4 inch		
Frequency response	Sound field	Sound pressure	Sound field	Sound field	Sound field	Sound pressure	Sound field	Sound field	Sound field	Sound field	Sound field
Measurement frequency range (Hz)	5 to 12 500	5 to 9 000	10 to 12 500	10 to 20 000	10 to 35 000	10 to 20 000	20 to 8 000	10 to 20 000	10 to 16 000	20 to 100 000 <sup>*2</sup>	20 to 100 000 <sup>*2</sup>
Bias voltage (V)	200	200	200	200	200	200	0	0	0	200	0
Sensitivity level (dB re 1 V/Pa) <sup>*1</sup>	-26.5	-27	-21	-25.5	-37	-38	-33	-27	-22	-47	-48
Capacitance (pF)	54	56	—	17	20	20	19	13	14	6	4
Maximum input sound pressure level (dB) (Linearity tolerance ± 0.3 dB)	152	154	—	144	160 <sup>*4</sup>	160	150	148	132 <sup>*4</sup>	164 <sup>*4</sup>	164
Inherent noise level (dB)	12	13	2	20	26	28	24	18	13	42	45
Temperature coefficient (dB/°C)	-0.005	-0.008	—	-0.007	-0.007	-0.009	-0.008	within ±0.35 dB (at 1 kHz) <sup>*3</sup>	within ±0.45 dB (at 250 Hz) <sup>*3</sup>	-0.01	within ±0.7 dB (at 250 Hz) <sup>*3</sup>
Diaphragm	Titanium alloy									Titanium	
Dimensions (mm)	dia.23.8 x 21.0	dia.23.8 x 21.0	dia.23.8 x 13.1	dia.13.2 x 15.0	dia.13.2 x 13.2	dia.13.2 x 13.2	dia.13.2 x 12.0	dia.13.2 x 14.3	dia.13.2 x 13.5	dia.7.0 x 10.0	dia.7.0 x 10.0

\*1 Representative value for 1 kHz \*2 UC-29/54 frequency range refers to microphone without grid. \*3 -10 °C to +50 °C referenced to 23 °C \*4 Distortion 3 %  
 This product is environment-friendly. It does not include toxic chemicals on our policy.

# Microphone With Preamplifier

- TEDS compliant



# Preamplifiers NH Series

- Faithful transmission of voltage signal generated by microphone to subsequent amplifier stages
- Versatile preamplifier lineup allows choosing the best combination of diameter and microphone type



Model	UC-52T	UC-57T	UC-59T
Microphones	UC-52	UC-57	UC-59
Preamplifier	NH-22T	NH-22T	NH-22T
Nominal diameter	1/2 inch		
Frequency response	Sound field	Sound field	Sound field
Measurement frequency range (Hz)	20~8 000	10~16 000	10~20 000
Drive current	2 mA~4 mA	2 mA~4 mA	2 mA~4 mA
A-weighted inherent noise level (dB)	24	13	18
Dimensions (mm)	φ13.2×97.1	φ13.2×98.6	φ13.2×99.4
Cable type	EC-90 series (BNC)	EC-90 series (BNC)	EC-90 series (BNC)

Model	NH-06A	NH-04A	NH-12A	NH-17	NH-17A	NH-22	NH-05A
Suitable microphones	UC-27/32P	UC-30/31/33P	UC-30/31/33P	UC-52/54 <sup>*1</sup> /57/59	UC-52/54 <sup>*1</sup> /57/59	UC-52/54 <sup>*1</sup> /57/59 (constant current drive) 2 mA to 4 mA	UC-29 <sup>*1</sup> UC-30/31/33P
Nominal diameter	1 inch	1/2 inch, 1/4 inch <sup>*1</sup>					1/2 inch, 1/4 inch
Input impedance (GΩ)	3	3	3	3	3	5	10
Input capacitance (pF)	0.3	0.25	0.25	0.8	0.8	0.8	0.2
Measurement frequency range (Hz)	5 to 100 000	10 to 100 000	10 to 100 000	10 to 100 000	10 to 100 000	10 to 100 000	10 to 100 000
Bias voltage (V)	200	200	200	0	0	0	200
Gain (dB), representative value	-0.1(54 pF)(UC-27)	-0.2(17 pF)(UC-30)	-0.2(17 pF)(UC-30)	-0.5(13 pF)(UC-59)	-0.5(13 pF)(UC-59)	-0.5(13 pF)(UC-59)	-0.5(6 pF)(UC-29) <sup>**</sup>
A-weighted inherent noise level (dB)	12 (UC-27)	19 (UC-30)	19 (UC-30)	18 (UC-59)	18 (UC-59)	18 (UC-59)	42 (UC-29)
Output impedance (Ω)	100 or less	100 or less	100 or less	300 or less	300 or less	approx. 120	100 or less
Cable type	EC-04 series (7P)		1.5 m integrated (7P)	5 m integrated (7P)	EC-04 series (7P)	EC-90 series (BNC)	EC-04 series (7P)

\*1 Using UA-12

**TEDS** TEDS (Transducer Electronic Data Sheet) is a format for sensor-specific information defined by the IEEE 1451 series of standards. It includes the data listed below and allows automatic calibration when the sensor is connected to TEDS compliant equipment.  
**TEDS data** Manufacturer ID, Model, Serial number, Sensitivity, Calibration date, etc.

# Sound Level Meter

## Optional accessories (For Sound Level Measurement)

### 114 dB/250 Hz calibration sound source

#### Pistonphone NC-72A



- Suitable for RION microphones including 1 inch, 1/2 inch, and 1/4 inch diameter types and similar-diameter types such as the MR-103
- Unit is powered by alkaline or manganese batteries and rated for 13 hours of continuous use, giving a battery life of about two years if used for 1 to 2 minutes a day

#### Specifications

Applicable standards	JIS C 1515: 2004 (IEC 60942: 2003) Class LS/C
Nominal sound pressure level	114 dB, sound pressure level tolerance $\pm 0.15$ dB (101.325 kPa)
Frequency	250 Hz $\pm 1$ %
Distortion	2.5 % or less
Temperature range	-10 °C to +55 °C
Humidity range	10 % to 90 %RH (no condensation)
Dimensions, Weight	Approx. 60 (H) $\times$ 170 (W) $\times$ 40 (D) mm, approx. 740 g (including batteries)

### Compensation for atmospheric pressure not required

#### Sound Calibrator NC-74



- Compact, lightweight, convenient sound calibrator fully suitable for calibration of Sound level meters
- Powered from two size AA alkaline batteries giving more than 30 hours continuous operation at room temperature
- Automatic compensation function for atmospheric pressure changes

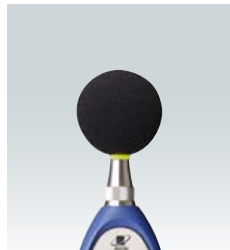
#### Specifications

Applicable standards	JIS C 1515: 2004 Class 1, IEC 60942: 2003 Class 1
Compatible microphones	1 inch, 1/2 inch types
Nominal sound pressure level	94 dB $\pm 0.3$ dB
Nominal frequency	1 000 Hz
Dimensions, Weight	Approx. 49 (H) $\times$ 80 (W) $\times$ 74 (D) mm, approx. 200 g (including batteries)

### Reduce adverse effects of wind noise Windscreens



WS-15



WS-16

Type	Model
Windscreen for 1/2 inch microphones	WS-10
Windscreen for 1 inch microphones	WS-01
Windscreen for 1/4 inch microphones	WS-05
All-weather windscreen	WS-15
Windscreen mounting adapter	WS15006
Rain-protection windscreen (For NL-42/52/62)	WS-16

### For stationary sound level measurement Tripods



ST-80



ST-81

Type	Model	Lowest position (mm)	Highest position (mm)	Weight (g)
Sound level meter tripod (compatible with extension rod)	ST-80	570	1 460	1 500
Extension rod (for ST-80)	ST-80-100	1 170	2 060	610
All-weather windscreen tripod	ST-81	1 350	2 150	3 200
Compact tripod	5SLIK	400	1 150	580

### Memory Card (CompactFlash / SD Card)

Commercially available memory cards (CompactFlash cards) may differ in specifications even among identical models from the same manufacturer.

When using RION equipment designed to handle memory cards, operation is guaranteed only when using memory cards from RION.



#### CF cards

Type	Model
256 MB memory card	MC-25LC1
2 GB memory card	MC-20CF2

#### Usage limitations

VM-53A	.....Max. 256 MB
NA-28	.....Max. 2 GB
DA-40	.....Max. 4 GB (dedicated card, see page 40.)

#### SD cards

Type	Model	Supported models
512 MB SD card	MC-51SD1	For NL-42/52/62
	MC-51SS1	For VA-12
2 GB SD card	MC-20SD2	For NL-42/52/62, DA-21, RIONOTE
	MC-20SS2	For VA-12
32 GB SD card	MC-32SD3	For DA-21, RIONOTE

### Reduction of wind noise for tunnel experiment

#### 1/2 inch Nose Cone (For UC-30, UC-31) UA-31



UA-31

### External power supply for sound level meters and vibration meters

#### Battery Pack BP-21A

- Holds four IEC R20 (size D) batteries
- Provides double battery life of IEC R14 (size C) or three times the battery life of IEC R6 (size AA) batteries



#### Specifications

Dimensions, Weight	80 (H) $\times$ 170 (W) $\times$ 50 (D) mm, approx. 1.1 kg
--------------------	--



## Sound Level Meter Selection Examples

### 1 Environmental noise

\* For product details, refer to the indicated pages.

\* For details on product combinations, refer to the section "Measuring Instrument Combinations" starting on page 47.

Application	Models	See page
General-purpose measurement	NL/NA series	6, 8 to 10
Sound level recording	NL/NA series + DA-40/21, LR series	6, 8 to 10, 41, 42
	NL/NA series (internal memory/memory card)	6, 8 to 10
Frequency analysis 1/1 Octave Band, 1/3 Octave Band Analysis	NA-28, NL-42/52/62 + Program	6, 8 to 10
	SA-02 + Software	34 to 39
	DA-40 + AS-70, DA-21 + AS-70	41, 42
Real sound recording, Data processing	NL-42/52/62 (+ NX-42WR) + AS-60 (RT), RIONOTE	8 to 10, 40
Monitoring	NA-37 + WS-13	12, 13
Low-frequency measurement	NL-62 + NX-62RT	10

### 2 Architectural acoustics

Application	Models	See page
A-weighted sound pressure level measurement	NL/NA series	6, 8 to 10
Frequency analysis	NA-28, NL-42/52/62 + Program, RIONOTE + Program	6, 8, 9, 40
Performance testing	SA-02 + Various software	34 to 39

### 3 Acoustic power level measurement

Application	Models	See page
Sound pressure level method	SA02 + AS-30PA5, AS-31PA5	34, 36
Acoustic intensity method	SA02 + AS-15PA5	34, 37

### 4 Others

Application	Models	See page
Ultrasound, high sound pressure measurement	NA-42 + UC-29/54/31 + NH series	11, 15
Low sound pressure level measurement	NA-42 + UC-34 + NH-34	11, 15
Coupler, diffuse sound field measurement	NA-42 + UC-32P/33P + NH series	11, 15
Comparator	NL-42/52/62, NA-42	8, 10, 11
	SA-02 + CAT-SA02-CMP03	34, 39
Acoustic analysis	NL-42/52 + NX-42FT	8, 9
	SA-02	34
	RIONOTE	40
Quality management	NL/NA series	6, 8 to 10
	SA-02	34
Calibration	NC-72A/74	16
Anechoic Chamber, Anechoic Box, Anechoic room, Sound-Proof Chamber	RKB series, RKA series, RKC series	45

## Condenser Microphone Selection Examples

### 1 Normal measurement

#### UC-52/UC-59

UC-52 is a microphone designed for use with Class 2 sound level meters, and UC-59 for use with Class 1 sound level meters. These are electret microphones which do not require a bias voltage.

### 4 Measurement of high-level sounds

#### UC-31/UC-29/UC-54\*

UC-31 is a low-sensitivity 1/2 inch microphone that can handle sound pressure levels in excess of 150 dB. UC-29/UC-54 is similar, but it has a nominal 1/4 inch diameter. UC-31 and UC-29 require a 200 V bias voltage.

\* UC-54: no bias voltage required.

### 2 Measurement of low-level sounds

#### UC-27/UC-57

UC-27 is a 1 inch microphone that can measure sound pressure levels down to about 20 dB, and UC-57 is a 1/2 inch type rated for 22 dB. This is suitable for use in quiet environments. UC-27 requires a 200 V bias voltage, but UC-57 is an electret microphone which operates without external bias voltage.

### 5 Measurement extending to ultrasonic range

#### UC-31/UC-29/UC-54

To make measurements of sounds including high-frequency components above 20 kHz, the same UC-31 (1/2 inch) and UC-29 (1/4 inch) microphones as for high-level measurements can be used.

Response of UC-31 extends to about 35 kHz, while UC-29/UC-54 goes up as high as 100 kHz.

### 3 Measurement of extremely low-level sounds

#### UC-34P (with Preamp NH-34)

UC-34 is a 1 inch microphone specially designed to make measurements in very quiet environments, with sound pressure levels as low as a few decibels. The dedicated preamplifier NH-34 is required to achieve flat frequency response and to provide the 200 V bias voltage required by the microphone.

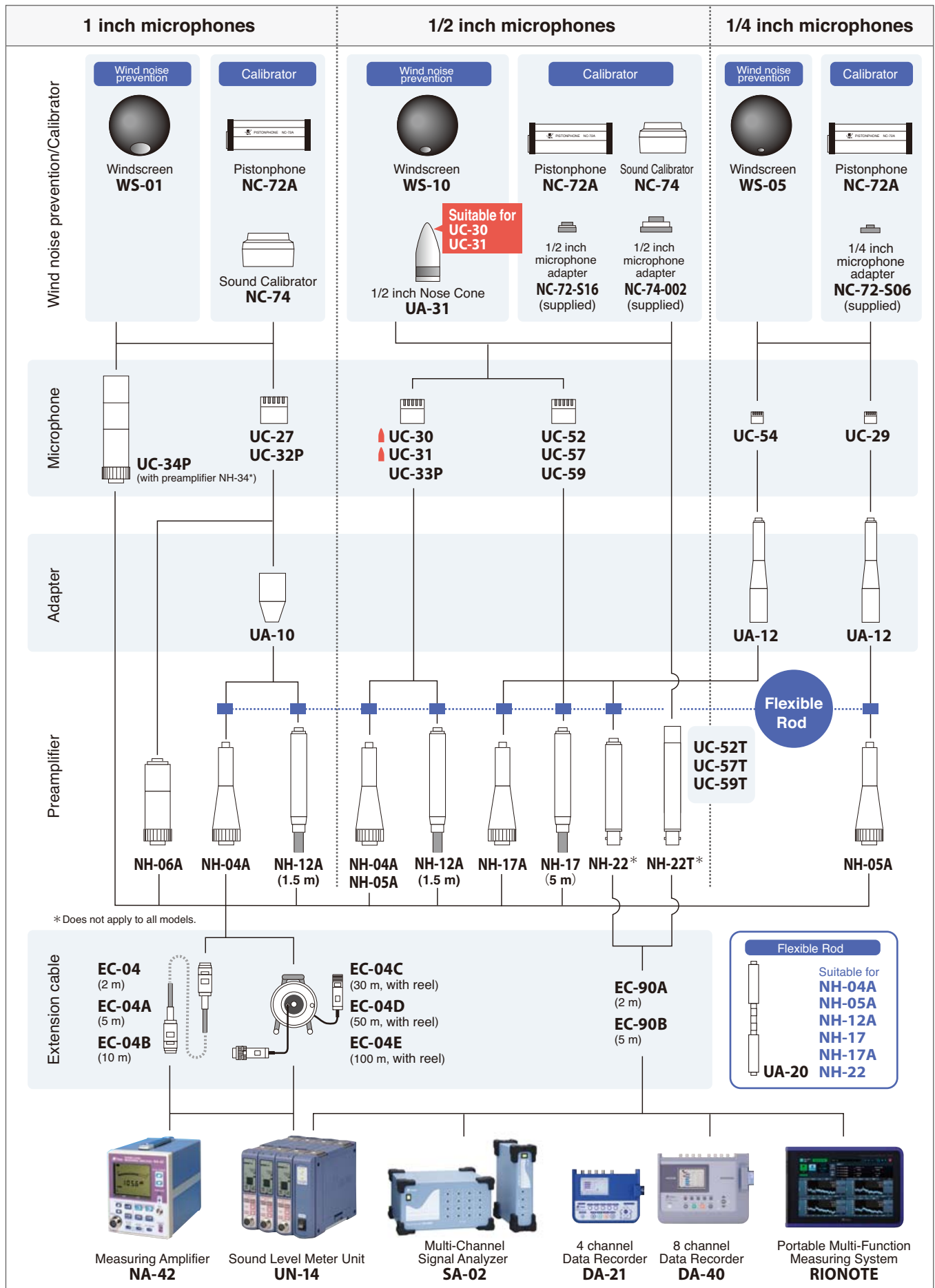
### 6 Coupler and random sound field measurements

#### UC-32P/UC-33P

UC-32P (1 inch) and UC-33P (1/2 inch) microphones are designed for acoustic measurements with the microphone mounted to a coupler, measurements in diffuse sound fields such as in a reverberation room, and similar applications. The microphones require a 200 V bias voltage.









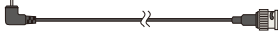



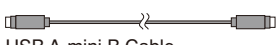


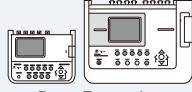


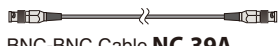

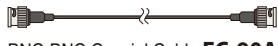
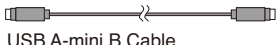

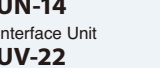
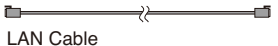
# Sound Level Meter

## Measurement Microphone Combination Examples











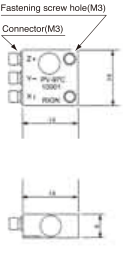
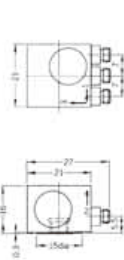
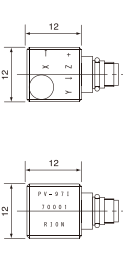
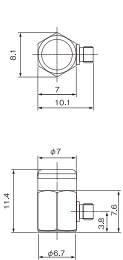
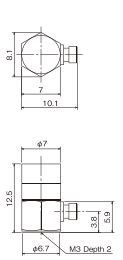
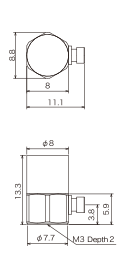
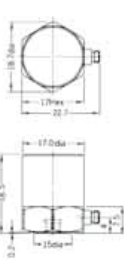
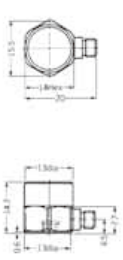
SD-CARD CF-CARD Memory card compatible model  
 For details, see "Memory Card" on page 16.









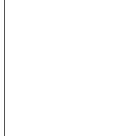
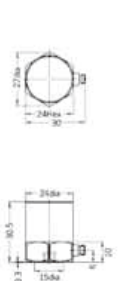
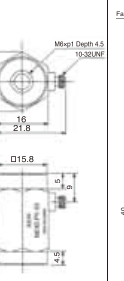
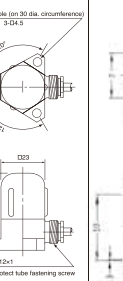

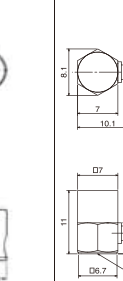
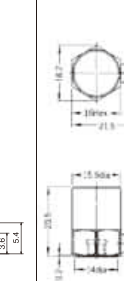

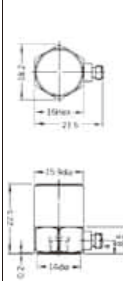
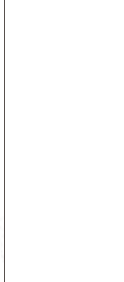
# Sound Level Meter Connection Examples

AC adapter	Sound level meter	Connection cable	Peripheral equipment
AC Adapter <b>NC-98C</b>  Battery Pack <b>BP-21A</b>	<b>Meter with integrated microphone</b>  Sound Level Meter <b>NL-42</b> 	USB A-mini B Cable  Computer	<b>Computer</b>  <b>Computer</b> <small>* For information on software for various measurements, see the respective sound level meter page.</small>
	Sound Level Meter <b>NL-52</b> 	RS-232C Serial I/O Cable <b>CC-42R</b>  Computer  Printer Cable <b>CC-42P</b>  Printer	<b>Printer</b>  Printer <b>DPU-414</b>
	Sound Level Meter <b>NL-62</b> <small>(With low-frequency sound measurement function)</small> 	BNC-mini plug Cable <b>CC-24</b>  Peripheral device with BNC connector  Comparator output Cable <b>CC-42C</b>  External device	<b>External device</b>  <b>Rotating light, alarm etc.</b>
AC Adapter <b>NC-94B</b>	Sound Level Meter <b>NA-28</b> 	USB A-mini B Cable  Computer  BNC-mini plug Cable <b>CC-24</b>  Peripheral device with BNC connector	<b>Peripheral device with BNC connector</b>  Level Recorder <b>LR-07</b>   Data Recorder <b>DA-21/40</b>
	<b>Meter with separate microphone option</b> <small>* For details, see "Condenser Microphone Combination Examples" on page 16.</small>	Measuring Amplifier <b>NA-42</b> 	Interface Cable <b>5WKR4030</b>  Computer  BNC-BNC Cable <b>NC-39A</b>  Peripheral device with BNC connector
AC Adapter <b>NC-97A/99</b>  Battery Unit <b>BP-17</b>	Sound Level Meter Unit <b>UN-14</b> 	BNC-BNC Coaxial Cable <b>EC-90A/90B</b> <small>* For information on comparator output connection, contact RION distributors.</small>  Peripheral device with BNC connector  USB A-mini B Cable  Computer	<b>Peripheral device with BNC connector</b>  Portable Multi-Function Measuring System <b>RIONOTE</b>
	Interface Unit <b>UV-22</b> 	LAN Cable  Computer	<b>Computer</b>

# Vibration Meter (Piezoelectric Accelerometers/Servo Accelerometers/Other)


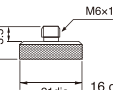
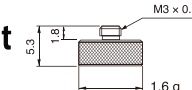
## Piezoelectric Accelerometers

Type	Triaxial type			With built-in amplifier			General-purpose	
External view	 <b>PV-97C</b>	 <b>PV-93</b>	 <b>PV-97I</b>	 <b>PV-90T</b>	 <b>PV-91C</b>	 <b>PV-91CH</b>	 <b>PV-85/86</b>	 <b>PV-94/95</b>
Principle	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Weight g	4.7	30	8	2	1.8	3	23	9
Charge sensitivity pC/(m/s²)*1	0.12	0.831	—	—	—	—	6.42	0.714
Voltage sensitivity mV/(m/s²)*1	—	—	1.1	0.5	1	11	—	—
Vibration frequency range (±1 dB) Hz*2	1 to 15 000 (Z) 1 to 10 000 (X·Y)	1 to 8 000 (2-axis) 1 to 4 000 (1-3)	1 to 7 000 (Z)*4 1 to 5 000 (X·Y) (±10%)	1 to 12 000 (±10%)	1 to 20 000 (±10%)*5	1 to 15 000 (±10%)*6	1 to 7 000	1 to 10 000
Mounting resonance frequency kHz*2	—	—	—	50	55	50	24/21	36
Temperature range for use °C	-50 to +160	-50 to +160	-20 to +125	-20 to +100 (TEDS: -20 to +85)	-50 to +170	-50 to +170	-50 to +160	-50 to +160
Supplied cable	VP-51L×3	VP-51C	VP-51W	VP-51LC	VP-51LC	VP-51LC	VP-51A	VP-51A
Dimensions mm								

Type	High-output	Standard	Waterproof insulation	Compact / Lightweight			High-temperature		
External view	 <b>PV-87</b>	 <b>PV-03</b>	 <b>PV-10B</b>	 <b>PV-90B</b>	 <b>PV-08A</b>	 <b>PV-90H</b>	 <b>PV-44A</b>	 <b>PV-63</b>	 <b>PV-65</b>
Principle	Shear	Compression	Compression	Shear	Shear	Shear	Compression	Shear	Shear
Weight g	115	38	120	1.2	0.7	2	29	28	26
Charge sensitivity pC/(m/s²)*1	40	0.47	—	0.18	0.102	0.29	7.65	4.59	7.14
Voltage sensitivity mV/(m/s²)*1	—	—	5.1	—	—	—	—	—	—
Vibration frequency range (±1 dB) Hz*2	1 to 3 000	20 to 1 000 (±1%) Secondary calibration range.	3 to 8 000	1 to 25 000	1 to 25 000	1 to 20 000	1 to 10 000	1 to 8 000	1 to 9 000
Mounting resonance frequency kHz*2	9	30	24	70	52	60	28	26	25
Temperature range for use °C	-50 to +160	-50 to +200	-20 to +100	-50 to +160	-50 to +160	-50 to +250	-50 to +260	-20 to +300	-50 to +260
Supplied cable	VP-51A	VP-51A	Direct-mount cable 5 m (no connector)	VP-51L	VP-51J 38 cm*3	VP-51LB	VP-51B	VP-51I	VP-51B
Dimensions mm									

\*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 To extend cable run, VP-52A and VP-51A are required. \*4 Max. 100 °C, max. 1000 m/s² \*5 1 Hz to 2 Hz (±15%) at 150 °C to 170 °C \*6 0.6 Hz to 20 kHz (±20%), 0.5 Hz to 20 kHz (±30%)

**Note** ● The piezoelectric element in a piezoelectric accelerometer may be damaged by excessive shock. Do not drop the accelerometer, and handle the magnetic attachment with care.

Attachments	<b>BNC Adapter VP-52C</b> 	<b>Magnet Attachment VP-53S</b> 	<b>Magnet Attachment VP-53T</b> 
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## For active control systems sensor applications

### Servo Accelerometer LS-40C



### Servo Accelerometer LS-10C



- Capable of measurement in the ultra-low frequency range from gravitational acceleration (DC) to about 100 Hz with flat frequency response
- Sensitivity and phase characteristics remain flat down to DC, suitable for seismographic measurements as well as measurements on large structures in control systems, architecture, civil engineering, and machine tool applications
- Dedicated power supply LF-20 enables direct connection of accelerometer output to FFT analyzer, data recorder or similar device
- LS-10C can be directly connected to Vibration Meter VM-83

#### Specifications LS-40C

Maximum measurable acceleration	±20 m/s <sup>2</sup>
Voltage sensitivity	0.5 V/(m/s <sup>2</sup> ) ±1 % (DC)
Measurement frequency range	DC to 100 Hz (±10 %)
Power supply voltage	±15 V DC (±11 V to ±18 V)
Temperature/humidity range for operation	-20 °C to +60 °C, max. 85 %RH
Dimensions, Weight	37 (H) × 37 (W) × 40 (D) mm, approx. 230 g (including cable)

#### Specifications LS-10C

Maximum measurable acceleration	±30 m/s <sup>2</sup>
Voltage sensitivity	0.3 V/(m/s <sup>2</sup> ) ±1 % (DC)
Measurement frequency range	DC to 100 Hz (±10 %)
Power supply voltage	±15 V DC (±11 V to ±18 V)
Temperature/humidity range for operation	-20 °C to +60 °C, max. 85 %RH
Dimensions, Weight	37 (H) × 37 (W) × 40 (D) mm, approx. 220 g (including cable)

### Servo Accelerometer Power Supply LF-20



- Dedicated power supply for servo accelerometers
- Continuous operation with three LS-40C units approx. 50 hours, with three LS-10C units approx. 100 hours (using alkaline batteries)

#### Specifications

Supplied voltage	±15 V
Output sensitivity	Using LS-40C 0.5 V/(m/s <sup>2</sup> ) Using LS-10C 0.3 V/(m/s <sup>2</sup> )
Power	Six IEC R20 (size D) batteries, AC adapter (NC-97A, option)
Dimensions, Weight	140 (H) × 240 (W) × 120 (D) mm, approx. 2.7 kg

## Reference accelerometer for comparative calibration of various accelerometers

### Reference Piezoelectric Accelerometer PV-03



- Specially designed piezoelectric element and internal construction assure high resistance to external noise, unlike other compression type accelerometers. Flat response and excellent thermal characteristics are assured.
- Only reference accelerometer made in Japan capable of using the back to back principle for comparative calibration with a wide range of accelerometers

#### Specifications

Charge sensitivity	0.47 pC/(m/s <sup>2</sup> ) (80 Hz)
Measurement frequency range	20 Hz to 1 000 Hz (±1 %), 5 Hz to 10 000 Hz (+10, -1 %)
Maximum measurable acceleration	5 000 m/s <sup>2</sup>
Dimensions, Weight	Approx. 16 (hexagonal width across flats) × approx. 29 (H) mm, approx. 38 g

## For calibration of accelerometers and vibration meters on-site

### Calibration Exciter VE-10



- Single-frequency (sine wave) reference vibration source for calibrating piezoelectric accelerometers and vibration meters or vibration measurement systems using accelerometers
- Small size and light weight make the unit easy to carry, and battery powered operation is convenient for mobile use
- Servo circuit enables calibration of accelerometers of up to 70 grams

#### Specifications

Exciter frequency	159.2 Hz ±1 %
Exciter acceleration	10 m/s <sup>2</sup> (rms) ±3 %
Exciter velocity	10 mm/s (rms) ±4 %
Exciter displacement	10 μm (rms) ±5 %
Dimensions, Weight	Approx. dia.51×134 (H) mm, approx. 600 g (including batteries)

## For dynamic force measurements

### Force Pickup PF-31



- Designed for connection to charge amplifier for dynamic force measurements
- Converts force acting on quartz element into an electrical signal
- Small dimensions, light weight, sturdy construction

#### Specifications

Charge sensitivity	4 pC/N (80 Hz)
Measurement frequency range	2 Hz to 10 000 Hz (±1 dB)
Measurable force range	0.01 N to 5 000 N
Dimensions, Weight	Approx. 18 (hexagonal width across flats) × approx. 15 (H) mm, approx. 23 g

## For mechanical impedance measurements

### Impedance Head PF-60A



- Integrated accelerometer and force pickup configured as impedance head
- Unit is inserted between vibrator and specimen, and excitation is applied. Signals from accelerometer and force pickup are input to an analyzer for determining mechanical impedance.

#### Specifications

Charge sensitivity	Accelerometer 3.20 pC/N (80 Hz) Force sensor 260 pC/N (80 Hz)
Measurement frequency range	1 Hz to 10 000 Hz (±1dB)
Maximum measurable acceleration	5 000 m/s <sup>2</sup>
Maximum measurable force	1 000 N
Dimensions, Weight	Approx. 16 (hexagonal width across flats) × approx. 32 (H) mm, approx. 37 g

### Vibration Meter Preampifier VP-26A



## For extension between accelerometer and vibration meter

- Prevents sensitivity degradation by accelerometer cable
- Prevents increase in external noise
- Suitable for low-output accelerometers

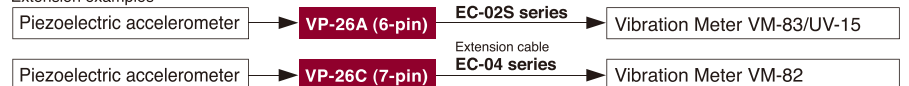
#### Specifications

	VP-26A	VP-26C
Sensitivity	1 mV/pC	1 mV/pC
Frequency range	0.16 Hz to 30 kHz	1 Hz to 25 kHz

### Vibration Meter Preampifier VP-26C



#### Extension examples



## Support for CCLD (Constant Current Line Drive)

### Charge Converter VP-40

(For direct connection to BNC input)



### Charge Converter VP-42

(Compact relay type)

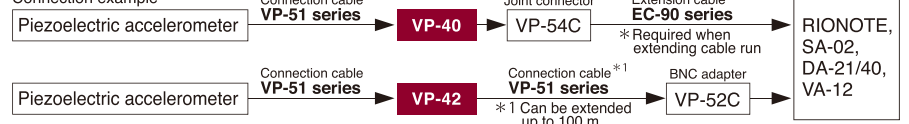


- Simplifies the configuration of a vibration measurement system using a piezoelectric accelerometer with charge output

#### Specifications

	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 %)

#### Connection example



# Vibration Meter (Vibration Level Meter/3-Axis Vibration Meter)

Twin LCD panels for wide range of vibration measurements

## Vibration Level Meter

### VM-53A

Designated manufacturer of special measurement instrument  
Designation number: 351301

Type certification number  
(The Japan Measurement Act): W-031



- Vibration level meter compliant with the Japan Measurement Act and JIS C 1510: 1995
- Designed for measuring ground vibrations to evaluate vibration pollution. Vibration levels measurement can be weighted according to human vibration sensitivity characteristics. Also suitable for measurement of minute vibrations in structural objects.
- Support for long-term automated measurements provided by sophisticated auto store and timer functions, and the capability to store measurement data in internal memory and on Compact Flash memory cards (with VM-53A)
- Separate X, Y, Z signal outputs, an interface for connection to a printer or computer, plus comparator output functions make the VM-53/53A suitable for a wide range of measurement system applications.

## Vibration Level Meter

### VM-53

Type certification number  
(The Japan Measurement Act): W-031

Common specifications for VM-53/53A

Applicable standards	Vibration Level Meter according to the Japan Measurement Act JIS C 1510: 1995
Measurement functions	Vibration level ( $L_v$ ), vibration acceleration level ( $L_{va}$ ), maximum value hold
Processing functions	Power average ( $L_{eq}$ ), percentile level ( $L_5, L_{10}, L_{50}, L_{90}, L_{95}$ ), maximum level ( $L_{max}$ ), minimum level ( $L_{min}$ ); calculated for a selected axis or all 3 axes
Measurement frequency range	Vibration level 1 Hz to 80 Hz, vibration acceleration level 1 Hz to 80 Hz
Measurement level range	Vibration level $L_v$ 25 dB to 120 dB (Z axis), Vibration level $L_v$ 30 dB to 120 dB (X/Y axis) Vibration acceleration level $L_{va}$ 30 to 120 dB
Manual store (CF card/internal memory)	Vibration level ( $L_v$ ) or vibration acceleration level ( $L_{va}$ ) at store point and processing values ( $L_{veq}, L_{vaeq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}$ ) are saved. When measurement mode is Max Hold, maximum level and processing values are saved.
Auto store 1	Continuous store of vibration level ( $L_v$ ) or vibration acceleration level ( $L_{va}$ ) Store sampling 100 ms or 1 s, selectable Timer start/stop time setting function
Auto store 2	Continuous store of processing values ( $L_{veq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}$ ) as one set of data Timer start/stop time setting function Interval store on every hour possible
Power	Four IEC R14 (size C) batteries, AC adapter (NC-98C, option), battery pack (BP-21A, option)
Dimensions, Weight	Approx. 56 (H) × 203 (W) × 175 (D) mm, approx. 1 kg (including batteries)

#### Options

Vibration Level Meter/Vibration Accelerometer Cable	EC-02S (3 m and up)
Printer	DPU-414
Printer Cable	5WCD2320
Interface Cable	5WKR4030
AC Adapter (100 to 240 V)	NC-98C

#### Specifications Triaxial Accelerometer PV-83C (supplied)

Sensitivity	60 mV/(m/s <sup>2</sup> )
Waterproofing specifications	JIS C 0920, Class 7 (sealed)
Temperature range for operation	-10 °C to +50 °C
Dimensions, Weight	Approx. dia. 67 × 41 (H) mm, approx. 335 g



Supported by VM-53A only

Adds 1/1 and 1/3 octave real-time analysis functions to vibration level meter

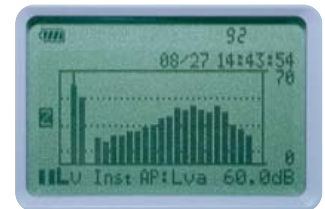
## 1/1 and 1/3 Octave Real-Time Analysis Card

### VX-53RT



#### specifications

Compatible model	VM-53A
Applicable standard	JIS C 1514: 2002 Class 1
Frequency analysis bands	1/1 Octave band filter: 1 Hz to 63 Hz (7 bands), $L_{va}, L_v$ 1/3 Octave band filter: 1 Hz to 80 Hz (20 bands), $L_{va}, L_v$
Measurement modes	Inst, $L_{eq}, L_{max}, L_5, L_{10}, L_{50}, L_{90}, L_{95}$ (One measurement mode can be selected at a time)
Data store format	Text file (CSV format)



1/3 octave band analysis screen

Adds support for handling data measured with VM-53A to AS-60

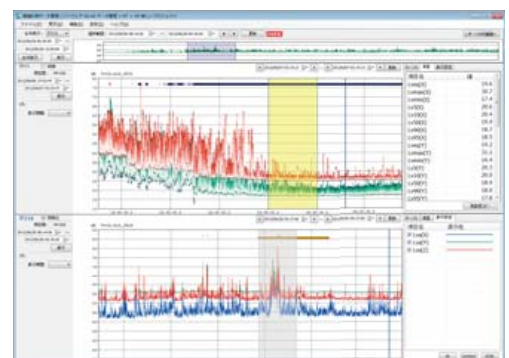
## Data Management Software for Environmental Measurement (Includes the vibration level data management software)

### AS-60VM

See p. 9 for AS-60 specifications

Supported models

- VM-53A



Signal outputs for 3 directions allow connection of frequency analyzer and waveform recording on data recorder

## 3-Axis Vibration Meter VM-54



- Can be used with a variety of accelerometers and vibration pickups to configure a 3-axis acceleration measurement system
- Various modes can be implemented by installing the respective software from program cards

### Specifications

Inputs	3 channels (with 3-channel vibration input preamplifier)
Measurement frequency range	0.5 Hz to 5 000 Hz
Measurement mode (instantaneous 3-axis value)	Acceleration $m/s^2$
Outputs	Separate AC outputs for 3-axis signals
Power	Four IEC R14 (size C) batteries, continuous operation 16 hours
Temperature/humidity range for operation	-10 °C to +50 °C, max. 90 %RH
Dimensions, Weight	56 (H) × 200 (W) × 175 (D) mm, approx. 1 kg (including batteries)

## FFT Analysis card VX-54FT



Sub screen

- Functions as a memory card and allows storing FFT analysis result data in CSV format
- Supplied Excel macro makes it easy to generate a graph display from stored data (VX-54WS, VX-54WB, VX-54WH FFT analysis also supported)

## 3-ch Preamplifier VP-80



### Specifications

Input selection	Switch-selectable input (for 3 channels together)
Available settings	Charge amplifier x1: Sensitivity 1 mV/pC Charge amplifier x1/10: Sensitivity 0.1 mV/pC CCLD

### Specifications

Display items	1. FFT processed spectrum display 2. Effective value (O.A.) calculated from time domain 3. O.A. value * calculated from frequency domain (FFT result) * Partial overall value for specified frequency range can also be calculated.
Display functions	Dependent on respective program card
Measurement channels	X, Y, Z (3 channels simultaneous analysis)
Window types	Hanning, Rectangular
Analysis lines	400
Processing	Instantaneous value, RMS method, maximum value
Data store function	Manual store on VX-54FT card 3-channel FFT spectrum data stored in CSV format Max. 100 data sets per file (3-channel data form 1 set) Max. 50 files

## Vibration measurement system for evaluating comfort in passenger vessels and merchant vessels

### Marine Vibration Card VX-54WS



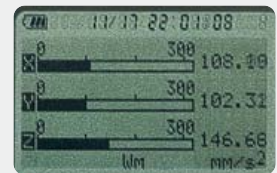
- Measure and evaluate vibrations occurring in crew and passenger accommodation sections of ships, to evaluate suitability and comfort according to ISO 6954, JIS F 0907
- Measurement system for marine vibrations consists of Triaxial Accelerometer PV-83CW (for floor positioning, supplied), 3-Axis Vibration Meter VM-54, and Marine Vibration Card
- Measurement data can be stored on memory card (CF card)

### Specifications

Applicable standards	ISO 6954: 2000, JIS F 0907: 2003
Input	Piezoelectric Accelerometer PV-83CW (triaxial), Piezoelectric Accelerometer PV-57A (single axis, option)
Measurement frequency range	1 Hz to 80 Hz (with FLAT characteristics of PV-57A up to 1 kHz)
Frequency weighting	Wm (ISO 2631-2: 2003, bandwidth limiting characteristics)
Processing functions	RMS, max (MTVV), min
Measurement time settings	10 sec, 1 min, 2 min, 10 min

\* Power requirements, temperature/humidity range for operation, dimensions and weight same as for VM-54

### PV-83CW (supplied)



Graphic screen

## Evaluate vibrations affecting the whole body

### Whole Body Vibration Card VX-54WB1



- Measure and evaluate vibrations as specified in ISO 2631 and JIS B 7760 regarding vibration perception
- Whole-body vibration measurement system consists of Seat Measurement Accelerometer PV-62, 3-Axis Vibration Meter VM-54, and Whole Body Vibration Card
- Measurement data can be stored on memory card (CF card)

### Specifications

Applicable standards	ISO 2631-1: 1997, ISO 2631-2: 2003, ISO 8041: 2005, JIS B 7760-1: 2004, JIS B 7760-2: 2004
Input	Seat Accelerometer PV-62 (triaxial), Piezoelectric Accelerometer PV-83CW (triaxial)
Measurement frequency range	0.5 Hz to 80 Hz
Frequency weighting	Wk, Wd, Wb, Wc, Wj, Wm, Wg, bandwidth limiting characteristics
Processing functions	RMS, MTVV, VDV, Synthesized Value, PEAK, Crest Factor
Measurement time settings	1 sec to 30 sec in 1-sec units 1 min, 10 min, 30 min, 1 hour, 4 hours, 8 hours, 12 hours (max. 12 hours)

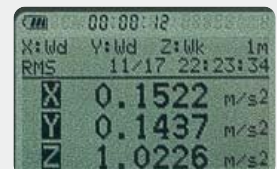
\* Power requirements, temperature/humidity range for operation, dimensions and weight same as for VM-54

## Disc-shaped tri-axial accelerometer for whole-body vibration measurement and evaluation according to ISO 2631

### Seat Accelerometer PV-62



Specifications	
Number of components	3 axes
Charge sensitivity	3.5 pC/(m/s <sup>2</sup> ) (16 Hz)
Measurement frequency range	1 Hz to 100 Hz (±0.5 dB)
Dimensions, Weight	Approx. dia. 210 × approx. 12 (H) mm, approx. 400 g



Numeric screen

## Evaluate vibrations transmitted through hands and arms

### Hand-Arm Vibration Card VX-54WH



- Measure and evaluate exposure to hand-arm vibrations as specified in ISO 5349-1, ISO 5349-2, JIS B 7761-1, JIS B 7761-2
- Hand-arm vibration measurement system consists of Accelerometer PV-97C, 3-Axis Vibration Meter VM-54, and Hand-Arm Vibration Card VX-54WH
- Measurement data can be stored on memory card (CF card)

### Specifications

Applicable standards	ISO 5349-1: 2001, ISO 5349-2: 2001, ISO 8041: 2005, JIS B 7761-1: 2004, JIS B 7761-2: 2004, JIS B 7761-3: 2007
Input	Piezoelectric Accelerometer PV-97C/97I (triaxial), etc
Measurement frequency range	8 Hz to 1 000 Hz
Frequency weighting	Wh
Processing functions	RMS, MTVV, VDV, Synthesized Value, PEAK, Crest Factor
Measurement time settings	1 sec to 30 sec in 1-sec units 1 min, 10 min, 30 min, 1 hour, 4 hours, 8 hours, 12 hours (max. 12 hours)

\* Power requirements, temperature/humidity range for operation, dimensions and weight same as for VM-54

### PV-97C



### PV-97I

For specifications, see page 20.



FFT screen (using VX-54FT)

# Vibration Meter (General-Purpose Vibration Meter)

Simply press against the measurement object

## Pocketable Vibration Meter (RIOVIBRO)

VM-63A 



- Ultra compact vibration meter with integrated accelerometer. Weighs only 250 g and easily fits into a pocket.
- Designed for quick and easy use in the field
- Suitable for preventive maintenance of industrial equipment, on-site quality control, product development, and many other applications

### Specifications

Measurement range	Acceleration	0.1 m/s <sup>2</sup> to 199.9 m/s <sup>2</sup> Peak (RMS × √2)	10 Hz to 15 000 Hz
	Velocity	0.1 mm/s to 199.9 mm/s RMS	10 Hz to 1 000 Hz
	Displacement	0.001 mm to 1.999 mm P-P (RMS × 2√2)	10 Hz to 1 000 Hz
Display	3 1/2 digit digital display, refresh rate once per second		
Power	One IEC 6F22 battery, operation approx. 25 hours		
Dimensions, Weight	Approx. 185 (H) × 68 (W) × 30 (D) mm, approx. 250 g		

### Options

Attachment (L)	VP-53Y
Earphone (for VM-63A)	VP-37

Convenient 3-mode measurement for acceleration, velocity, and displacement with storage capacity for up to 1 000 data

## General-Purpose Vibration Meter

VM-82A 



- Designed mainly for maintenance and inspection of industrial machinery, with particular emphasis on rotational machinery
- Acceleration, velocity, and displacement can be easily measured using a suitable frequency range, allowing comprehensive and precise evaluation of machine vibrations.

### Specifications

Measurement range	(Using Shear-type Piezoelectric Accelerometer PV-57I, supplied)		
	Acceleration	0.02 m/s <sup>2</sup> to 200 m/s <sup>2</sup> EQ PEAK	1 Hz to 5 kHz
	Velocity	0.3 mm/s to 1 000 mm/s RMS	3 Hz to 1 kHz
		0.1 mm/s to 1 000 mm/s RMS	10 Hz to 1 kHz
Displacement	0.02 mm to 100 mm EQ PEAK	3 Hz to 500 Hz	
	0.001 mm to 100 mm EQ PEAK	10 Hz to 500 Hz	
Output	AC output, DC output		
Power	4 IEC R6 (size AA) batteries AC adapter (NC-98C, option)		
Dimensions, Weight	Approx. 171.5 (H) × 74 (W) × 25.5 (D) mm, Approx. 270 g (including batteries)		

### Options

Charge converter	VP-40
Charge converter	VP-42
Printer	DPU-414
Printer Cable	CC-42P
BNC-RCA output cable	CC-24



Supports connection of Servo Accelerometer LS-10C for 3-mode measurement of acceleration, velocity, and displacement

## General-Purpose Vibration Meter VM-83



- Measure and evaluate vibrations using a piezoelectric accelerometer or the Servo Accelerometer LS-10C
- Display characteristics can be switched to rms, equivalent peak, and equivalent peak-to-peak, with maximum value hold and peak hold capability
- Four types of input connectors allow selection of acceleration, velocity, and displacement measurement. With optional servo accelerometer LS-10C, even very low frequency vibrations from 0.1 Hz upwards can be measured.
- Comparator function allows level evaluation

### Specifications

Vibration frequency range	Piezoelectric accelerometer	Acceleration	1 Hz to 20 kHz $\pm 5\%$
		Velocity	1 Hz to 3 Hz $\pm 10\%$ , 3 Hz to 3 kHz $\pm 5\%$
	Servo accelerometer	Displacement	1 Hz to 3 Hz $\pm 20\%$ , 3 Hz to 500 Hz $\pm 10\%$
		Acceleration	0.1 Hz to 100 Hz $\pm 5\%$
Power	Velocity	0.1 Hz to 0.3 Hz $\pm 10\%$ , 0.3 Hz to 100 Hz $\pm 5\%$	
	Displacement	0.1 Hz to 0.3 Hz $\pm 20\%$ , 0.3 Hz to 100 Hz $\pm 10\%$	
Dimensions, Weight		Four IEC R14 (size C) batteries, AC adapter (NC-98C, option) 171 (H) $\times$ 120 (W) $\times$ 234 (D) mm, approx. 1.8 kg	

### Options

Vibration level meter/vibration accelerometer cable	EC-02S series (3 m and up)
Vibration Meter Preamplifier	VP-26A
Printer	DPU-414
Printer cable	5WCD2320
Interface cable	5WKR4030

# Vibration Meter (Vibration Analyzer/Data Collector)

Portable vibration analyzer for equipment diagnosis and on-site measurements

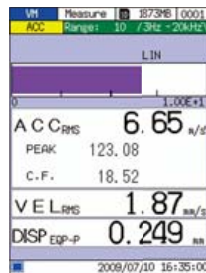
Vibration Meter VA-12 with FFT analysis function

## Vibration Analyzer

VA-12 CE



SD-CARD Memory card compatible model  
For details, see "Memory Card" on page 16.



### Vibration Meter Mode

- Allows simultaneous measurement of acceleration, velocity, displacement, and acceleration crest factor

### FFT Analyzer Mode

- Real-time analysis frequency 20 kHz
- Time waveform display and spectrum display with up to 3 200 spectral lines. Envelope processing also supported.
- Vibration waveform data recording function (10 seconds at analysis frequency 20 kHz)  
Data stored in WAVE file format on memory card (SD card).
- Timer controlled automatic measurement

### Menu Mode

- The color TFT display (240 x 320 dots) is easy to read, whether outdoors, indoors, or in a dark location.



### Specifications

Standard compliance	CE marking (EMC Directive 2004/108/EC) Chinese RoHS (export model for China only) WEEE Directive
Input section	
Number of measurement channels	1
Connector type etc.	BNC, CCLD 18 V 2 mA, (CCLD24 V 4 mA available as factory option)
Sensor	Piezoelectric Accelerometer PV-571 (supplied)
Input range	
At sensitivity 1.00 to 9.99 mV/(m/s <sup>2</sup> ), using PV-571	
ACC (Acceleration)	1, 3.16, 10, 31.6, 100, 316, 1 000 m/s <sup>2</sup> (rms)
VEL (Velocity)	3.16, 10, 31.6, 100, 316, 1 000, 3 160 mm/s (rms)
DISP (Displacement)	0.089, 0.283, 0.894, 2.83, 8.94, 28.3, 89.4 mm (EQp-p)
Measurement range (using PV-571, High-pass filter 3 Hz, Low-pass filter 20 kHz)	
ACC (Acceleration)	0.02 to 141.4 m/s <sup>2</sup> (rms) Continuous measurement, 1 Hz to 5 kHz
Instantaneous maximum acceleration	700 m/s <sup>2</sup>
VEL (Velocity)	0.2 to 141.4 mm/s (rms) at 159.15 Hz
DISP (Displacement)	0.02 to 40.0 mm (EQp-p) at 15.915 Hz
Measurement frequency range (electrical characteristics)	
ACC (Acceleration)	1 Hz to 20 kHz
VEL (Velocity)	3 Hz to 3 kHz
DISP (Displacement)	3 Hz to 500 Hz
Acceleration envelope curve	1 kHz to 20 kHz
Filters	
Prefilters	
High-pass filter	1 Hz (acceleration only), 3 Hz, 10 Hz, 1 kHz (−10 % point), cutoff slope −18 dB/oct
Low-pass filter	1 kHz, 5 kHz, 20 kHz (−10 % point), cutoff slope −18 dB/oct
Acceleration envelope curve filter	
High-pass filter	1 kHz (−10 % point), cutoff slope −18 dB/oct
Vibration meter mode	
ACC (Acceleration)	m/s <sup>2</sup> rms value, waveform peak value, crest factor
VEL (Velocity)	mm/s rms value
DISP (Displacement)	mm EQp-p
FFT mode	
Time waveform, spectrum, Acceleration envelope curve	
Analysis points	512, 1 024, 2 048, 4 096, 8 192 (3 200 lines)
Time window functions	Rectangular, Hanning, Flat-top
Processing	Linear average, maximum, exponential averaging, instantaneous value
Frequency span	100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz

Trigger	
Trigger source	
External signal	Triggered at falling edge of signal at external trigger input
Input level	Triggered when time waveform crosses a preset level Trigger level can be set in steps of 1/8 of full scale on one-sided amplitude
Trigger operation	
Free-run	Processing always carried out, regardless of trigger condition
Repeat	Processing carried out whenever triggering occurs
Single	Processing carried out once only when triggering occurs
Time	Data are stored according to the setting of Trigger Start Time, Store Interval, Store number.
Memory	
Memory media	SD cards (max. 2 GB)*
Store files	Sets of measurement values and parameters can be stored on memory card 1 000 data saved as one store name. Max. number of store names: 100
Parameter setting memory	Up to 5 parameter sets can be stored in unit Parameter settings can be stored on memory card
Wave files	Up to 10 seconds per file (frequency range 20 kHz) Vibration waveform recorded during FFT processing available when using a computer.
BMP files	Screen capture can be saved as BMP files.
Recall function	Measurement data can be read from memory card and redisplayed on screen.
Input/output section	
Trigger input connector	TTL level, BNC-mini plug, 2.5 mm dia. (for CC-24)
USB port	Removable disk function
Power	
DC12 V (11 to 15 V)	AC adapter NC-99, eight IEC R6 (size AA) batteries
Battery life	Approx. 12 hours (23 °C, normal operation, backlight off)
Dimensions, Weight	214 (H) x 105 (W) x 36 (D) mm (without protective cover), approx. 850 g (incl. batteries, with protective cover, PV-571 connected)

### Options

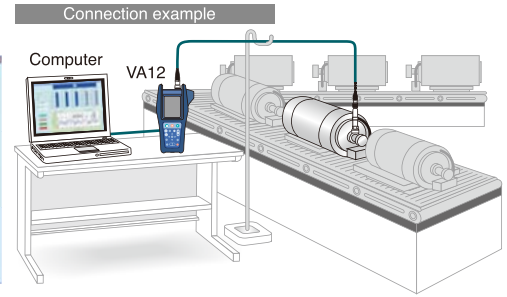
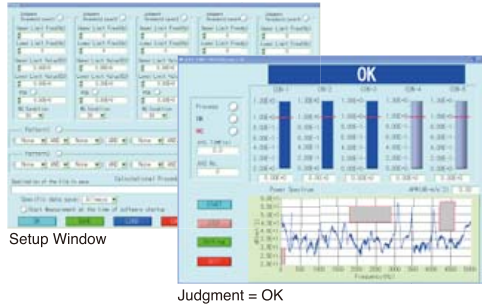
Wave Analysis Software	AS-70	Charge converter	VP-40
Waveform Analysis Software	CAT-WAVE	SD-CARD 512 MB*	MC-51SS1
Piezoelectric accelerometer	Various	SD-CARD 2 GB*	MC-20SS2
BNC Adapter	VP-52C	AC Adapter	NC-99

\*Use only RION supplied cards for assured operation

# VA-12 Comparator System

## CAT-VA12-CMP01

- For power spectrums that are measured by using VA-12, up to five conditions are established to determine whether the product is acceptable.
- AP levels or FFT calculations can be used to determine whether the product is acceptable.



## Accurate and simple equipment diagnosis

### Data Collector VA-11C



Memory card

\* Dedicated memory card is required for VA-11C/11B/11M. Please contact RION for details.

- Adds data collection function to VA-11 and comes with route management software
- Data collector function is designed for convenience and ease of use, using preset parameters and simple operation steps

#### Specifications

Power	For IEC R14 (size C) batteries, AC adapter (NC-94B, supplied)
Dimensions, Weight	174 (H) x 156 (W) x 45.7 (D) mm, approx. 770 g (including batteries)

#### Options

Piezoelectric Accelerometer	PV-57A
Magnet Attachment	VP-53S
Accelerometer Cable	VP-51K
Printer Cable	5WCD2320
Interface Cable	5WKR4030



## Vibration analyzer with added field balancer function

### Field Balancer VA-11B

No English Manual



Memory card compatible model  
See above

- Implements balancing functions through precision diagnosis using vibration measurement and FFT analysis
- Balance adjustments in the field (using the single-plane method) are essential for reducing vibrations in rotating machinery. The VA-11B reliably analyzes all elements required for correction.

## Analyzer designed for high-level automotive servicing by certified mechanics

### Automotive Vibration Analyzer VA-11M

No English Manual



Memory card compatible model  
See above

- Modified version of Field Balancer VA-11B for automotive servicing applications
- Allows numeric quantitative assessment of car sounds (using optional equipment) and vibrations, and supplied balancer unit also enables balance adjustment of rotating parts
- Can be powered from cigarette lighter socket to allow in-car use

#### Common Specifications for VA-11B and VA-11M

Vibration meter mode	Acceleration, velocity, displacement
Analyzer mode	Processing items: time waveform, spectrum
Balancer mode	Single-plane method
Mechanical rotation speed range	300 rpm to 12 000 rpm
Memory	Manual store: 500 data sets; measurement parameters: 10 data sets
Inputs/outputs	Serial interface, printer output
Power	Four IEC R14 (size C) batteries, AC adapter (NC-94B, supplied)
Dimensions, weight	Approx. 174 (H) x 156 (W) x 45.7 (D) mm, approx. 770 g (including batteries)



System carrying case  
(Magnetic stand is optional)

Options	
Printer cable	5WCD2320
Interface cable	5WKR4030

#### Basic configuration

- Balancer Unit VA-11W
- Piezoelectric Accelerometer PV-85
- Optical Fiber Sensor FS-11

Options	
Magnetic stand	7010
System carrying case (for VA-11B)	CF-23
Memory card (CF card)	MC-12CF1

## Unbalance and bearing problem simulator Mamemaster

- Simulator for training basic skills of vibration related equipment diagnosis



#### Specifications

Power	100 V AC (50 / 60 Hz)
Dimensions, weight	80 (H) x 270 (W) x 200 (D) mm, approx. 4.5 kg

# Vibration Meter (Vibration Meter Unit/2-Channel Charge Amplifier)

Flexible unit configuration allows simultaneous sound and vibration measurement

## Vibration Meter Unit UV-15

CE TEDS compliant



Front View



Rear View

- Vibration Meter Unit UV-15 and Sound Level Meter Unit UN-14 can be linked in a measurement system with up to 16 channels
- Supports connection of piezoelectric accelerometers, accelerometers with integrated preamplifier, and TEDS compliant accelerometers
- Display shows parameters, measurement value, and bar graph indication
- Linking with Interface Unit UV-22 allows setup and control from a computer, and transfer of measurement values
- Backlit LCD and LED warning indicators
- Optional CF-27 base allows JIS standard rack mounting
- Can be powered from AC adapter or Battery Pack Unit BP-17

### Specifications

Inputs	Microdot connector	For piezoelectric accelerometer (Maximum input charge 100 000 pC)
	CCLD (Constant Current Line Drive)	Accelerometer with integrated preamplifier (24 V 4 mA)
	7-pin preamp connector (Connector type PRC-03)	Accelerometer with TEDS compliant integrated preamplifier (24 V 4 mA)
Measurement frequency range	Acceleration (ACC)	For piezoelectric accelerometer connected via preamplifier (VP-26A) (Maximum input voltage ±10 V)
	Velocity (VEL)	1 Hz to 15 kHz (AC output tolerance ±5 %), 0.5 Hz to 30 kHz (AC output tolerance 10 %)
	Displacement (DISP)	3 Hz to 3 kHz (AC output tolerance ±5 %)
Filters	HPF (attenuation -18 dB/oct) (-10 % drop)	3 Hz to 500 Hz (AC output tolerance ±10 %)
	LPF (attenuation -18 dB/oct) (-10 % drop)	3, 5, 10, 15, 20, 30, 50, 100, 150, 200 Hz, Off (User filter supported with UV-22)
		300, 500, 1 k, 1.5 k, 2 k, 3 k, 5 k, 10 k, 15 k, 20 kHz, Off (User filter supported with UV-22)
Power		9 V to 15 V DC, suitable AC adapter NC-97A (for up to 10 units), NC-99 (for up to 16 units), Battery Pack Unit BP-17, Cigarette plug adapter CC-82 (option, up to 16 units*) *Depending on car battery capacity
Dimensions, Weight		150 (H) × 36 (W) × 179 (D) mm (not including protruding parts), approx. 500 g

### Options

Piezoelectric accelerometer	Various	Vibration Meter Preamplifier	VP-26A
Accelerometer cable	Various	Vibration Level Meter/Vibration Accelerometer Cable	EC-02S (3 m and up)
BNC-BNC Cable	NC-39A		

Dedicated interface unit for UN-14 / UV-15

## Interface Unit UV-22



Front View



Rear View

- USB and Ethernet interface provide flexible connectivity for controlling UN-14 and UV-15 units via commands sent from a computer
- Supplied UV-22Viewer software allows UN-14 and UV-15 setup, measurement value checking, and user-specified cutoff frequency setting for HPF and LPF (user filter\*) on the computer
- Master/Slave function simplifies measurement operation when multiple UN-14/UV-15 units are connected

※2-Channel Charge Amplifier UV-16 cannot be connected.

\* Can be set in 1/3 octave band steps within the specified frequency range.

### Specifications

Settings control (for UN-14 and UV-15)	Input selection, sensitivity, HPF, LPF, user filter
UN-14 only	Frequency weighting, level range, time weighting
UV-15 only	Measurement mode, range, display characteristics
Measurement values	UN-14: instantaneous value every 100 ms, maximum value, Peak, L <sub>eq</sub> UV-15: instantaneous value every 100 ms, maximum value, ±Peak
UN-14/UV-15 interface	
Number of supported unit connections	Up to a combined total of 16 UN-14/UV-15 units
Computer interfaces	
USB	USB 1.1 (one UV-22 per computer supported)
Connector	Mini B
Ethernet	10/100 Base-TX (one UV-22 per computer supported)
Temperature/humidity range for operation	-10 °C to 50 °C, max. 90 %RH
Power	9 V to 15 V DC, suitable AC adapter NC-97A/NC-99, Battery Pack Unit BP-17, Cigarette plug adapter CC-82 (option, up to 16 units*) *Depending on car battery capacity
Current consumption	Approx. 240 mA (12 V DC, LAN operating)
Dimensions, Weight	150 (H) × 36 (W) × 179 (D) mm, approx. 500 g
Supplied accessories	UV-22 Viewer software × 1 (CD-ROM), USB cable

## UV-22 Sound and Vibration Monitoring System CAT-UV22-MS

- The system enables you to monitor or record the time data for sound and Vibration that are measured by using UN-14 or UV-15.
- Up to 16 UN-14 or UV-15 units can be connected to UV-22, allowing you to use the system to perform multipoint measurements.



Graph (All Channel) Tab



Configuration Tab

**Measure machine vibrations in power stations, industrial plants, or engines and motors during product development**

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



Front View



Rear View

- Designed for connection of piezoelectric accelerometers or accelerometers with integrated preamplifier
- Link the chassis of up to 16 units to create a multi-channel configuration with up to 32 channels
- Equipped with LCD panel, overload alarm LEDs, operation panel, input/output connectors, power jack, and link connector
- JIS standard rack mounting supported (max. 12 units/24 channels)
- Can be powered from an AC adapter or Battery Pack BP-17

**Specifications**

Inputs		Piezoelectric accelerometer Accelerometer with integrated preamplifier (24 V 4 mA)
Measurement frequency range	Acceleration (ACC)	1 Hz to 15 kHz (AC output tolerance ±5 %) 0.5 Hz to 30 kHz (AC output tolerance ±10 %)
	Velocity (VEL)	3 Hz to 3 kHz (AC output tolerance ±5 %)
	Displacement (DISP)	3 Hz to 500 Hz (AC output tolerance ±10 %)
Filters		HPF 10 Hz, LPF 1 kHz compliant with JIS B 0907: 1989 frequency response compensation filter characteristics
		HPF OFF, 10 Hz, 20 Hz, 50 Hz
		LPF 1 kHz, 3 kHz, 10 kHz, OFF
Power		9 V to 15 V DC, suitable AC adapter NC-97A (for up to 10 units), NC-99 (for up to 16 units), Battery Pack Unit BP-17, Cigarette plug adapter CC-82 (option, up to 16 units*) * Depending on car battery capacity
Dimensions, Weight		150 (H) × 36 (W) × 179 (D) mm (not including protruding parts), approx. 500 g

**Options**

Piezoelectric accelerometer	Various
Accelerometer cable	Various
BNC-BNC Cable	NC-39A

**Option**

**Link to UV-15/UV-16/UN-14 to provide power for mobile measurement** (Required one of sources listed below)

**Battery Unit BP-17** 

- Battery power can be used to drive up to three units (AC adapter connection allows connection of 1 to 16 units)
- Holds eight IEC R14 (size C) batteries
- Continuous operation time: approx. 8 hours (with alkaline batteries, using UV-15/UN-14) approx. 17 hours (with alkaline batteries, using UV-16)

※3 linked units, ambient temperature 25 °C, with CHARGE setting, normal operation.  
Actual time will differ depending on ambient conditions and operation settings.



Front View



Rear View



Example for linkup with UV-15 units

**AC adapter NC-97A**



- 100 V to 240 V AC, 12 V DC, 3.3 A (can power up to 10 units)

**AC adapter NC-99**



- 100 V to 240 V AC, 12 V DC, 5 A (can power up to 16 units)

**Rack Mounting Base CF-27 (JIS compliant)**

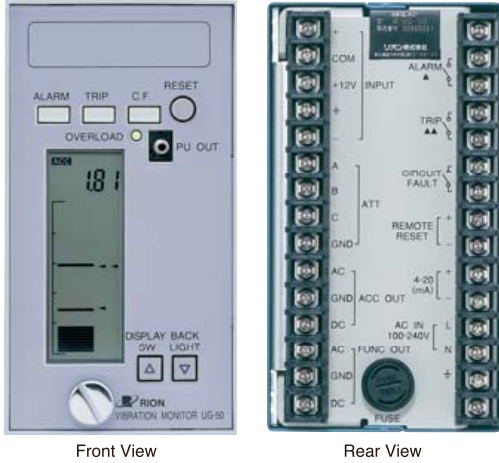


- Dimensions: 149 (H) × 480 (W) × 320 (D) mm

# Vibration Meter (Vibration Monitor)

Monitor machine vibrations in power stations, industrial plants, or production facilities

## Vibration Monitor UG-50



Front View

Rear View

For enhanced connection flexibility between piezoelectric accelerometer and vibration monitor



### Pre-amplifier UG-20

Charge amplifier for cable runs up to 300 meters

### Pre-amplifier UG-21

Junction box pre-amplifier for cable runs up to 400 meters

### Junction Box UG-23

For transmission of signals from piezoelectric accelerometer with built-in pre-amplifier

### 4-20 mA Isolation Unit UG-33

4-20 mA current output  
\* Factory option

### Rack Mount Panel UG-90





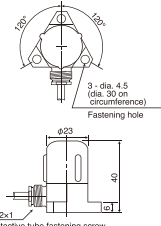
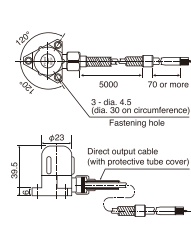
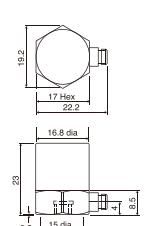
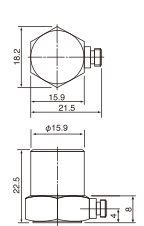
For mounting of up to 5 units

Adds one user-definable high-pass filter and low-pass filter to main circuit

### User Filter NX-50

- HPF: Setting range 3.15 Hz to 500 Hz, 1/3 octave band steps (Velocity, displacement HPF: setting range 6.3 Hz to 500 Hz)
- LPF: Setting range 50 Hz to 10 kHz, 1/3 octave band steps

## Piezoelectric Accelerometers

External view and features	 Waterproof, insulated accelerometer with integrated pre-amplifier <b>PV-10B</b>	 Waterproof, insulated accelerometer (For vibration measurements at nuclear power plants and similar; rated for gamma radiation resistance up to 1x10 <sup>5</sup> R) <b>PV-10T</b>	 Shear-type accelerometer with high temperature resistance, light weight, and high sensitivity (Radiation resistant, suitable for use at nuclear power plants under medium and high temperatures) <b>PV-63</b>	 For machine vibration measurements at high temperature <b>PV-65</b>
Charge sensitivity pC/(m/s <sup>2</sup> ) ※1	—	9.18	4.59	7.14
Voltage sensitivity mV/(m/s <sup>2</sup> ) ※1	5.1	—	—	—
Measurement frequency range Hz ※2	3 to 8 000 (±1 dB) 3 to 10 000 (±2 dB)	3 to 8 000 (±1 dB) 3 to 10 000 (±2 dB)	1 to 8 000 (±1 dB) 1 to 15 000 (±3 dB)	1 to 9 000 (±1 dB)
Mounting resonance frequency kHz ※2	24	24	26	25
Temperature range for operation °C	-20 to +100	-50 to +150	-20 to +300	-50 to +260
Maximum measurable acceleration m/s <sup>2</sup> (peak)	500	2 000	4 000	4 000
Standard mounting method ※3	M4 screw (supplied) 1.5 N·m	M4 screw (supplied) 1.5 N·m	M6 screw (supplied with VP-56A) 3.5 N·m	M6 screw (supplied with VP-56A) 3.5 N·m
Waterproofing specifications	JIS C 0920 Protection Class 8 (sealed), 2 atm	JIS C 0920 Protection Class 8 (sealed), 2 atm	—	—
Cable	Integrated type, 5 m (no connector)	Integrated type, 5 m	VP-51I (supplied)	VP-51B (supplied)
Mass g	120	120	28	26
Dimensions (mm)				

※1 Representative value; actual sensitivity as noted on calibration chart supplied with accelerometer ※2 Representative value when using standard mounting method (※3) on flat surface

**Note** ● The piezoelectric ceramic element of these accelerometers can be damaged if subject to a strong shock. Take care not to drop the accelerometer, and use magnet attachments with care.

- Suitable for constant monitoring of machine vibrations in power stations, industrial plants, or production facilities, using piezoelectric accelerometers
- Separate main monitoring circuit (switchable to acceleration, velocity, displacement mode) and dedicated acceleration circuit. This allows combination of vibration measurement and monitoring tasks.
- Separate alarm and trip threshold vibration levels can be set for main circuit, to trigger suitable actions when levels are exceeded
- High-pass filter and low-pass filter settings can be made separately for main circuit and acceleration circuit

### Specifications

Input switching	Unbalanced input 1	For piezoelectric accelerometer with integrated pre-amplifier				
	Unbalanced input 2	For unbalanced connection via UG-20 or UG-21				
	Balanced input	For balanced connection via UG-20 or UG-21				
Monitoring modes	Acceleration (m/s <sup>2</sup> )	EQ PEAK (EQ PEAK= $\sqrt{2}$ ×RMS)				
	Velocity (mm/s)	RMS				
	RMS Displacement (mm)	EQ P-P (EQ P-P= $2\sqrt{2}$ ×RMS)				
Measurement frequency range	Acceleration	5 Hz to 30 kHz				
	Velocity	5 Hz to 2 kHz				
	Displacement	5 Hz to 100 Hz				
Filters (main circuit)	HPF	Off (5 Hz), 10 Hz, 30 Hz, 50 Hz, 500 Hz (-3 dB)				
	LPF	Off (30 kHz), 50 Hz, 100 Hz, 500 Hz, 2 kHz (-3 dB)				
Filters (acceleration circuit)	HPF	Off (5 Hz), 10 Hz, 30 Hz, 50 Hz, 500 Hz (-3 dB)				
	LPF	Off (30 kHz), 50 Hz, 100 Hz, 500 Hz, 2 kHz (-3 dB)				
DC output voltage		+10 V (at range full-scale point)				
AC output voltage	Acceleration 2 Vpeak Velocity 2 Vrms					
	Displacement 2 Vp-p (at range full-scale point)					
Alarm functions		Alarm, trip, circuit fault				
Alarm output		Relay contacts close when alarm is triggered, and alarm LED lights up				
Level range (main circuit, dedicated acceleration circuit)*	Relation between dedicated acceleration range and main circuit range	Main circuit			Dedicated acceleration range (Range depends on setting range of main circuit)	
		Acceleration	Velocity	Displacement		
		1 000	1 000	100		1 000
		300	300	30		
		100	100	10		
		30	30	3		
10	10	1				
3	3	0.3	10			
1	1	0.1		1		
Power	Input voltage range	85 V to 265 V AC, 47 Hz to 440 Hz				
Temperature/humidity range for operation		-10 °C to 50 °C, max. 90 %RH				
Dimensions, Weight		Approx. 148 (H) x 80 (W) x 235 (D) mm, approx. 1.5 kg				

\*When input charge for pre-amplifier UG-24 is set to 10 000 pC or higher, the above level range figures must be multiplied by 10.

# Vibration Meter Selection Examples

## 1 Mechanical Vibration

\* For product details, refer to the indicated pages.

\* For details on product combinations, refer to the section "Measuring Instrument Combinations" starting on page 47.



























Specific purpose		Model		See page	
Vibration measurement	Point measurement	On-site measurement		VM-63A, VM-82A	24
		Test chamber measurement		VM-83 + PV series	20, 25
	Multi-point measurement	Vibration meter		UV-15 + PV series	20, 28
		Charge amplifier		UV-16 + PV series	20, 29
Vibration analysis	FFT analysis		VA-12	26	
			SA-02	34	
			RIONOTE	40	
	Octave analysis		SA-02, RIONOTE	34, 40	
	Transfer function		RIONOTE	40	
	Mode analysis		SA-02	34	
Tracking analysis		SA-02 + Mode analysis software + Impulse hammer	34, 38		
Equipment diagnosis	Vibration monitoring	Online		UG-50	30
		Trend management	Small-scale	VM-82A	24
			Large-scale	VA-11C	27
		Vibration diagnosis	Simple diagnosis	Vibration magnitude measurement	VM-63A, VM-82A
	Precision diagnosis		Fault analysis	VA-12, RIONOTE	26, 40
			Visualization of vibrations	SA-02 + Mode analysis software	34, 38
			Balance correction	VA-11B	27
	Quality management	Product quality management		VM-83 + PV series	20, 25
SA-02, RIONOTE				34, 40	
SA-02 + CAT-SA02-CMP03				34, 39	
Low-Frequency Micro-vibrations		LS-40C, LS-10C	21		
Damping material loss factor		SA-02 + AS-14PA5	34, 35		
Vibration meter calibration		VE-10, PV-03	21		

## 2 Vibrations affecting human body

Specific purpose		Model		See page
Vibration measurement	Road traffic vibrations, construction sites, work environment		VM-53, VM-53A	22
	Marine vibration		VM-54 + VX-54WS + PV-83CW	23
	Whole-body vibration		VM-54 + VX-54WB1 + PV-62	23
			SA-02 + LS-10C + LF-20	21, 34
	Hand-arm vibration		VM-54 + VX-54WH + PV-97I/97C/93	20, 23
SA-02 + PV-97I + CAT-SA02-HT			20, 34, 38	
Vibration level recording		VM-53/53A + LR-07	22, 43	

# Vibration Meter





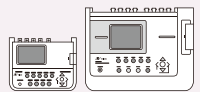
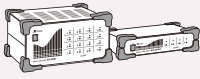

## Accelerometer Selection

	Piezoelectric Accelerometer	Connection cable	Vibration meter
Standard piezoelectric	 Piezoelectric Accelerometer <b>PV-03</b>	Standard Cable <b>VP-51A</b>	 General-Purpose Vibration Meter <b>VM-83</b>
	 Piezoelectric Accelerometer <b>PV-41</b>	Standard Cable <b>VP-51A</b>	
With integrated amplifier	 Piezoelectric Accelerometer <b>PV-90T</b> <b>Compact, TEDS compliant</b>	Ultra-compact Accelerometer Cable <b>VP-51LC</b> *TEDS compliance only with UV-15	 Vibration Meter Unit <b>UV-15</b> Interface Unit <b>UV-22</b>
	 Piezoelectric Accelerometer <b>PV-91C</b> <b>Compact, high-temperature resistant</b>	Ultra-compact Accelerometer Cable <b>VP-51LC</b>	
	 Piezoelectric Accelerometer <b>PV-91CH</b> <b>High sensitivity, Compact, high-temperature resistant</b>	Ultra-compact Accelerometer Cable <b>VP-51LC</b>	
General-purpose	 Piezoelectric Accelerometer <b>PV-85/86</b>	Standard Cable <b>VP-51A</b>	 2-Channel Charge Amplifier <b>UV-16</b> Battery Unit <b>BP-17</b>
	 Piezoelectric Accelerometer <b>PV-94/95</b>	Standard Cable <b>VP-51A</b>	
Compact/lightweight	 Piezoelectric Accelerometer <b>PV-08A</b>	PV-08 Cable <b>VP-51J</b>	 Multi-channel Signal Analyzer <b>SA-02</b>
	 Piezoelectric Accelerometer <b>PV-90B</b>	Ultra-compact Accelerometer Cable <b>VP-51L</b>	
High-output	 Piezoelectric Accelerometer <b>PV-87</b>	Standard Cable <b>VP-51A</b>	 4 channel Data Recorder <b>DA-21</b> 8 channel Data Recorder <b>DA-40</b>
High-temperature	 Piezoelectric Accelerometer <b>PV-90H</b> <b>Compact</b>	Ultra-compact Accelerometer Cable <b>VP-51LB</b>	
	 Piezoelectric Accelerometer <b>PV-44A</b>	Heat-resistant Cable <b>VP-51B</b>	
	 Piezoelectric Accelerometer <b>PV-65</b>	Heat-resistant Cable <b>VP-51B</b>	
	 Piezoelectric Accelerometer <b>PV-63</b>	Heat-resistant Cable <b>VP-51I</b>	
Triaxial type	 Piezoelectric Accelerometer <b>PV-93</b>	Tri-axial Standard Cable <b>VP-51C</b>	 Portable Multi-function Measuring System <b>RIONOTE</b>
	 Piezoelectric Accelerometer <b>PV-97C</b>	Ultra-compact Accelerometer Cable <b>VP-51L x3</b>	
	 Piezoelectric Accelerometer <b>PV-97I</b> <b>With built-in amplifier</b>	PV-97I Tri-axial Accelerometer Cable <b>VP-51W</b>	
Servo type	 Servo Accelerometer <b>LS-10C</b>	Integrated	 General-Purpose Vibration Meter <b>VM-83</b>
	 Servo Accelerometer <b>LS-40C</b>	Integrated	



SD-CARD CF-CARD Memory card compatible model  
 For details, see "Memory Card" on page 14.

# Vibration Meter Connection Examples

AC adapter	Vibration meter	Connection cable	Peripheral equipment
AC Adapter <b>NC-98C</b>  Battery Pack <b>BP-21A</b>	Vibration Level Meter <b>VM-53/53A</b> <small>CF cards supported by VM-53A only</small>	Interface Cable <b>5WKR4030</b> → Computer Printer Cable <b>5WCD2320</b> → Printer <small>* Conversion adapter 5ZTD1000 required separately</small> BNC-BNC Cable <b>NC-39A</b> → Peripheral device with BNC connector BNC-BNC Coaxial Cable <b>EC-90A/90B</b> → Peripheral device with BNC connector <small>* For information on comparator output connection, contact RION distributors.</small>	Computer  <b>Computer</b> <small>* For supported software, see page of respective vibration meter.</small>
AC Adapter <b>NC-99</b>	Vibration Analyzer <b>VA-12</b> <small>SD-CARD</small>	USB A-mini B Cable → Computer BNC-mini plug Cable <b>CC-24</b> → Peripheral device with BNC connector	Printer  <b>Printer DPU-414</b>
AC Adapter <b>NC-98C</b>	General-Purpose Vibration Meter <b>VM-82A</b>	Interface Cable <b>CC-87E</b> → Computer Printer Cable <b>CC-87</b> → Printer <small>* Conversion adapter 5ZTD1000 required separately</small> BNC-mini plug Cable <b>CC-24</b> → Peripheral device with BNC connector	External device  <b>Rotating light, alarm etc.</b>
AC Adapter <b>NC-98C</b>	<small>Accelerometer sold separately</small> <small>* For details, see "Accelerometer Selection" on page 32.</small> General-Purpose Vibration Meter <b>VM-83</b>	Interface Cable <b>5WKR4030</b> → Computer Printer Cable <b>5WCD2320</b> → Printer <small>* Conversion adapter 5ZTD1000 required separately</small> BNC-BNC Cable <b>NC-39A</b> → Peripheral device with BNC connector BNC-BNC Coaxial Cable <b>EC-90A/90B</b> → Peripheral device with BNC connector <small>* For information on comparator output connection, contact RION distributors.</small>	Peripheral device with BNC connector  <b>Level Recorder LR-07</b>
AC Adapter <b>NC-97A/99</b>	Vibration Meter Unit <b>UV-15</b> Interface Unit <b>UV-22</b>	USB A-mini B Cable → Computer LAN Cable → Computer BNC-BNC Cable <b>NC-39A</b> → Peripheral device with BNC connector BNC-BNC Coaxial Cable <b>EC-90A/90B</b> → Peripheral device with BNC connector	Data Recorder <b>DA-21/40</b> 
Battery Unit <b>BP-17</b>	2-Channel Charge Amplifier <b>UV-16</b> Battery Unit <b>BP-17</b>	BNC-BNC Cable <b>NC-39A</b> → Peripheral device with BNC connector BNC-BNC Coaxial Cable <b>EC-90A/90B</b> → Peripheral device with BNC connector	Multi-Channel Signal Analyzer <b>SA-02M/02A4</b>   Portable Multi-function Measuring System <b>RIONOTE</b> 

Sound Level Meter  
 Vibration Meter  
 Frequency Analyzer  
 Recorder  
 Related Products  
 Measuring Instrument Combinations  
 External view drawings  
 Outline  
 Knowledge In a Nutshell  
 Quality Documentation  
 Company Outline

# Frequency Analyzer (Multi-Channel Signal Analyzer/Software)

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

Versatile multi-channel configuration suits many applications

Multi-Channel Signal Analyzer SA-02M

4ch 8ch 12ch 16ch



- Up to 32 channels supported (using two SA-02M units)
- Allows high frequency analysis in multiple channels
- Direct sensor connection **TEDES compliant**
- Wide range of analysis software available
- Customizing of analysis software also possible
- Easy operation



Features 4 fixed channels  
4-Channel Signal Analyzer SA-02A4

4ch

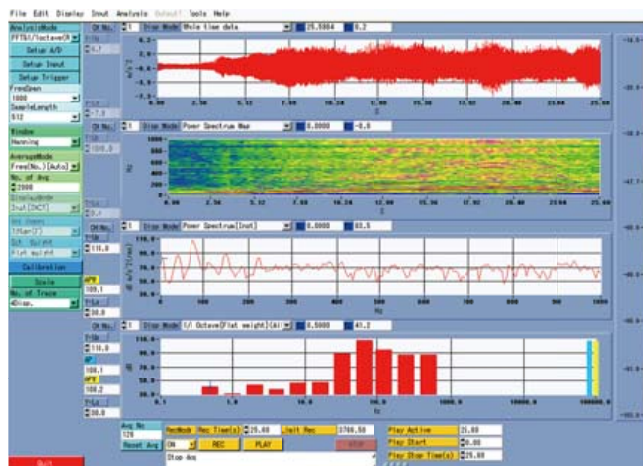


By linking two SA-02M units, up to 32 channels are supported



## Standard Software

- Time waveform display / FFT analysis /
- Time waveform recording / Power spectrum map, octave map /
- Transfer function, coherence function /
- Octave band analysis / Recall processing / Overlay display /
- Auto-correlation function / Cross-correlation function
- Amplitude probability density function



Basic screen layout

### Specifications

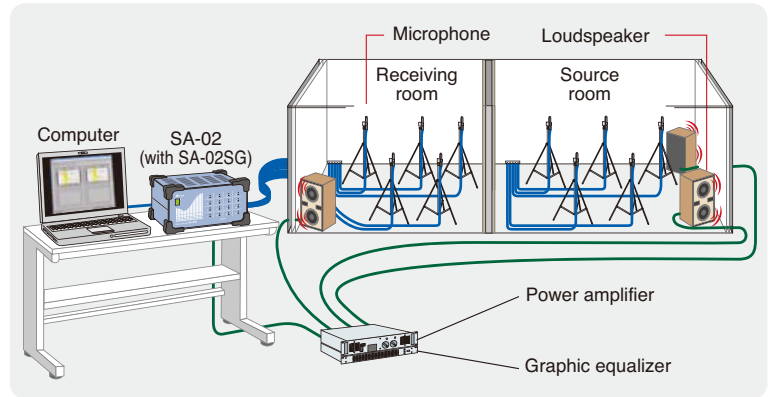
Standard compliance	1/1, 1/3, 1/12 octave band filters: IEC 61260 Class 1 (JIS C 1514 Class 1), WEEE Directive, RoHS Directive, Chinese RoHS Directive			
Frequency range	DC to 40 kHz			
FFT analyzer section	Analysis frequencies	100 Hz / 200 Hz / 500 Hz / 1 kHz / 2 kHz / 5 kHz / 10 kHz / 20 kHz / 40 kHz		
	Number of analysis points	64 / 128 / 256 / 512 / 1 024 / 2 048 / 4 096 / 8 192 / 16 384 / 32 768		
	Time window functions	Rectangular / Hanning / Flat-top / Exponential / Force Exponential		
	Functions	Frequency domain	Spectrum, cross-spectrum, transfer function, coherence	
	Time domain	Autocorrelation, cross-correlation, amplitude probability density, amplitude probability distribution		
Octave band analyzer section	Analysis band range			
	Number of channels used	1 to 4	5 to 8	9 to 16
	Analysis mode	1/1	0.5 Hz to 16 kHz	
		1/3	0.4 Hz to 20 kHz	
1/12	0.36 Hz to 22 kHz*	0.36 Hz to 11 kHz*	0.36 Hz to 5.5 kHz*	
*Depending on number of channels used per unit				
Input/output section	AC output connectors / Trigger input connector / Rotary pulse input connector			
Dimensions, Weight	SA-02A4	58 (H) x 260 (W) x 210 (D) mm (without protruding parts and rubber feet), approx. 2.5 kg		
	SA-02M	151 (H) x 290 (W) x 249 (D) mm (without protruding parts and rubber feet), approx. 5.4 kg (4 channels installed)		

### Options

4-Channel Input Unit	SA-02E4
Signal Output Unit	SA-02SG

Dedicated Analysis Software

# Airborne Noise/Floor Impact Noise Insulation Measurement Software AS-20PE5



Designed for sound insulation measurement of buildings and building materials based on ISO specifications. Measurement and evaluation for the categories of reverberation time, floor impact sound and attenuation, airborne sound, and sound absorption in a reverberation room are possible.

Applicable standards  
ISO 354 / ISO 140-1 / ISO 140-3 / ISO 140-4 / ISO 140-7 / ISO 140-8 / ISO 717-1 / ISO 717-2

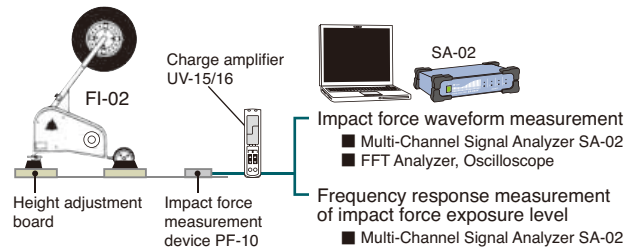
For impact force measurement of standard heavy impact sources, and octave band measurements of impact force exposure levels

## Impact Force Measurement System PF-10

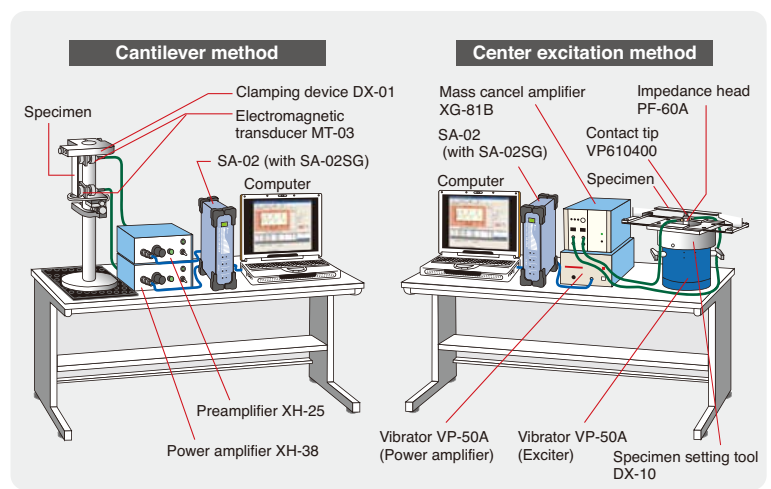
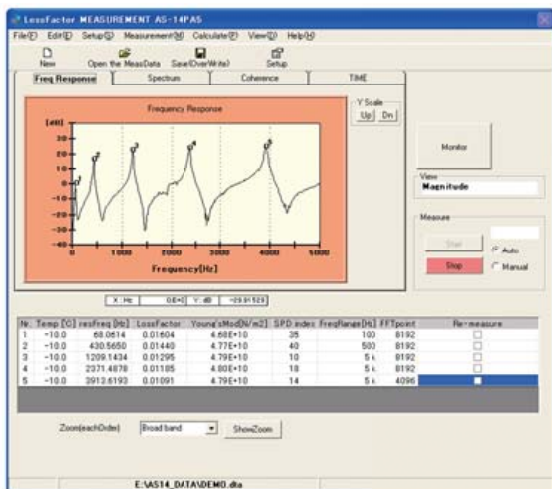
Impact force measurement using an impact ball



Configuration example for measuring impact force characteristics of a bang machine (Height adjustment board optional)



# Loss Factor Measurement Software AS-14PA5



Using the center excitation method or cantilever method, the frequency response of a strip specimen is measured, and the resonance characteristics are used to determine the loss factor and Young's modulus (or shear coefficient) of the specimen according to the half-power bandwidth method.  
Automatic measurement including temperature control of a thermostatic chamber is supported.

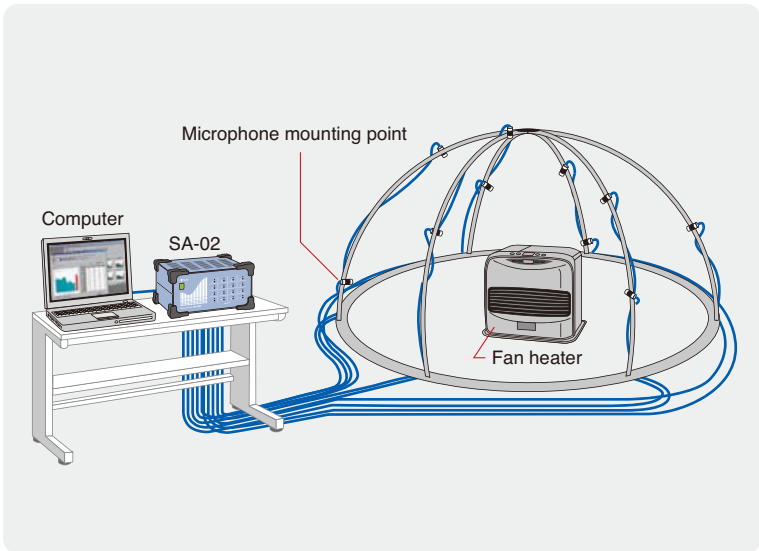
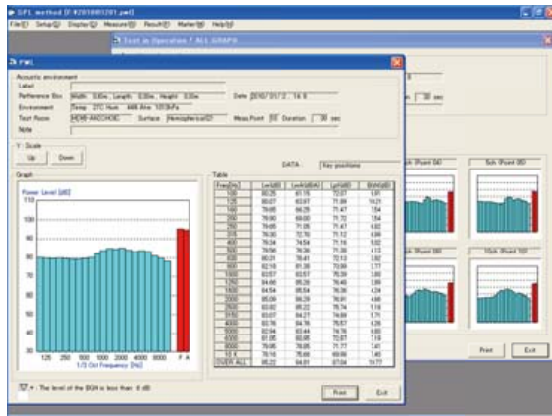
Applicable standards  
ISO 10112 / ISO 16940 / ASTM E756-05

\* When performing vibration attenuation testing for non-constraint compound damping, "Monogram display of damping material characteristics" is supported with optional software.

# Frequency Analyzer (Software/Intensity Probe)

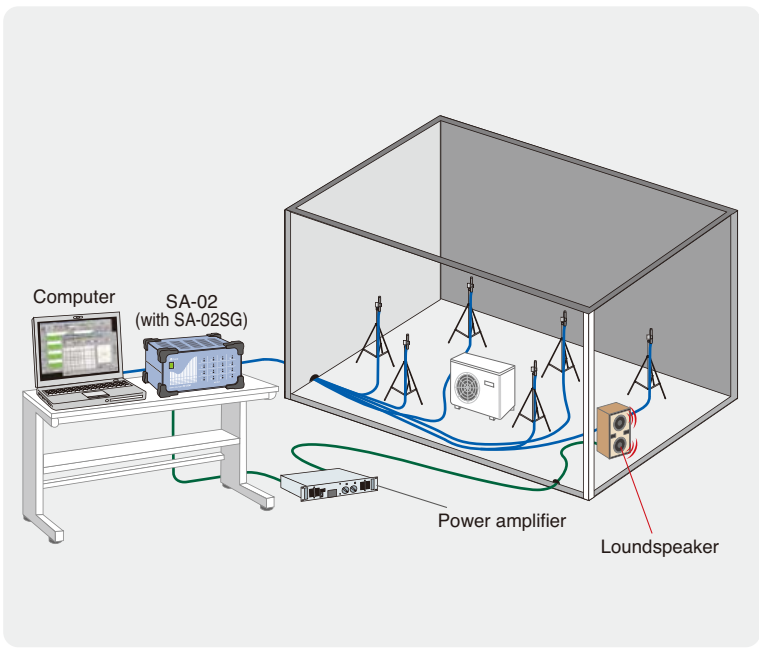
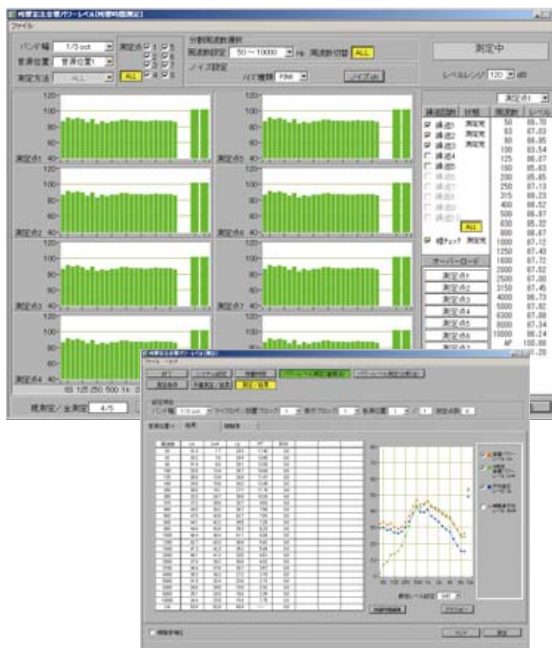
Dedicated Analysis Software

## Hemi-Anechoic Sound Power Level Measurement Software AS-30PA5



- Allows 1/3 octave band sound power level measurements, according to specifications for sound power level measurements in hemi-anechoic chambers.
- Sound pressure level values are measured in a hemi-anechoic chamber using measurement points arranged on a virtual measurement surface (hemispheric, cuboid). While applying background noise compensation for the sound pressure level at the sound source, the Z-weighted sound power level and A-weighted sound power level values are determined.
- Applicable standards ISO 3745 Acoustics - Determination of sound power levels of noise sources using sound pressure - Precision methods for anechoic and hemi-anechoic rooms  
ISO 3744 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane

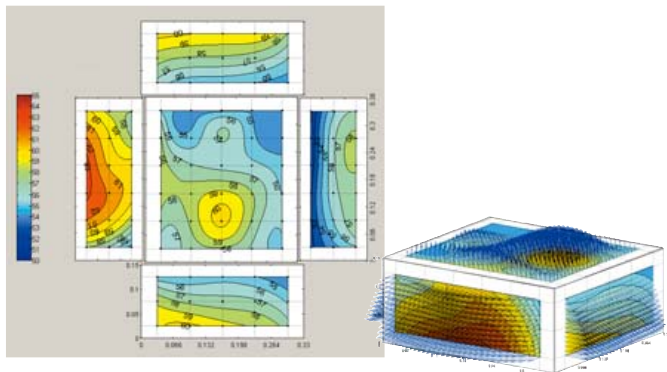
## Anechoic Sound Power Level Measurement Software AS-31PA5



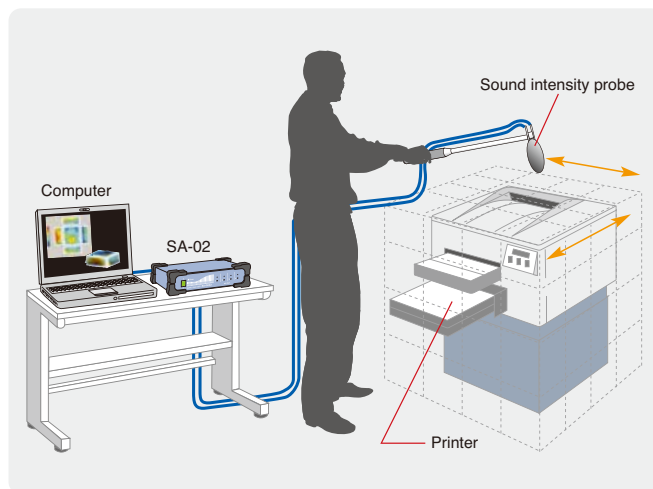
- Supports direct and comparative measurement. Also allows reverberation time measurement.
- Supports multi-channel measurement and microphone rotator use.
- Simultaneous power level measurement for up to 32 channels possible (up to 8 channels for reverberation time measurement).
- Applicable standards ISO 3741 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms

Dedicated Analysis Software

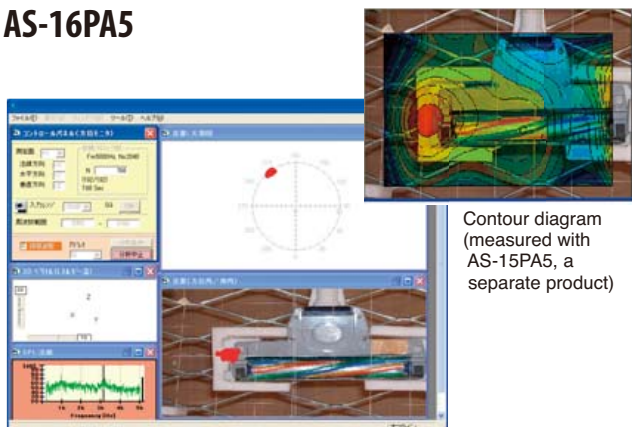
## Sound Intensity Measurement Software AS-15PA5



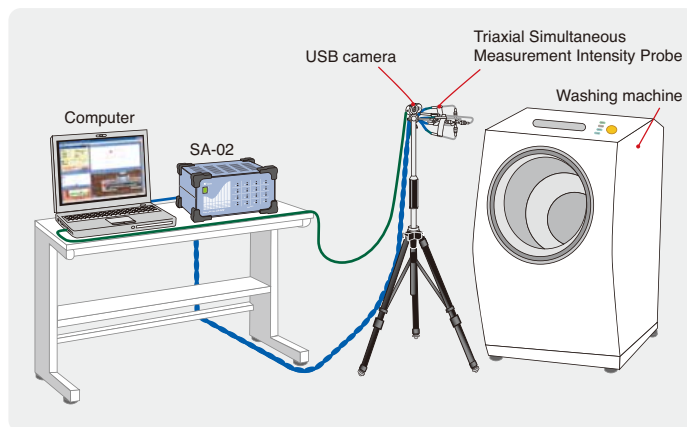
- Calculates sound intensity and performs graphics processing.
- Displays frequency spectrum, band level, and intensity spectrum information as spectrum line diagram, contour diagram, or mesh diagram, and shows sound power levels.



## Sound Source Location Software AS-16PA5



Contour diagram (measured with AS-15PA5, a separate product)



- Determines sound incident direction using a 3-axis sound intensity probe, and displays it on screen along with a camera image.
- Overlays presumed sound source location with captured image and allows selecting the frequency (range) to analyze.
- Also supports moving sound source measurement on video (option).

Intensity Probe (CCLD (Constant Current Linear Drive) principle)

### Sound intensity measurement sensor

## Sound Intensity Probe SI-31I



- For sound intensity measurements, the sound pressure and the sound particle velocity must be determined. The sound particle velocity is approximated from the pressure gradient between two microphones positioned in close proximity.
- This dedicated probe determines the sound pressure gradient with high accuracy, using a spacer arrangement with two condenser microphones.

Specifications

Construction principle		Face to face, with integrated preamplifier
Shape	Effective acoustic distance	12 mm: 200 Hz to 5 kHz 50 mm: 50 Hz to 1.2 kHz

### Measure sound intensity in three dimensions

## Triaxial Simultaneous Measurement Intensity Probe SI-33I



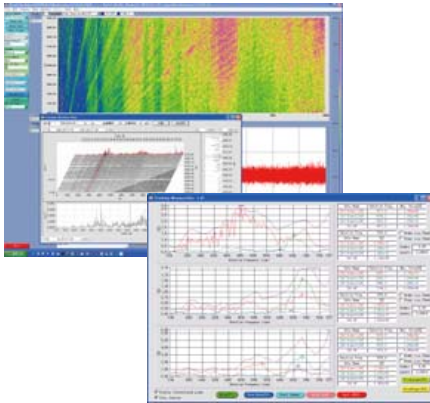
- Allows simultaneous measurement of sound intensity in all directions of a three-dimensional orthogonal coordinate system
- Dedicated microphones capable of capturing an intensity vector as a three-dimensional spatial vector
- Three sets of 1/2 inch electret microphone pairs UC-53I with matching phase frequency response characteristics and two preamplifiers are combined with the Multi-Channel Analyzer SA-02

Specifications

Construction principle		Face to face, with integrated preamplifier
Shape	Effective acoustic distance	31 mm: 100 Hz to 2 kHz 50 mm: 50 Hz to 1.2 kHz

# Frequency Analyzer (Software/System)

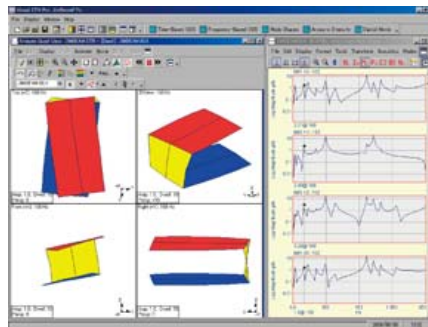
## Dedicated Analysis Software



### Tracking Analysis Software CAT-SA02-Order

(This software is a product of Catec Inc.)

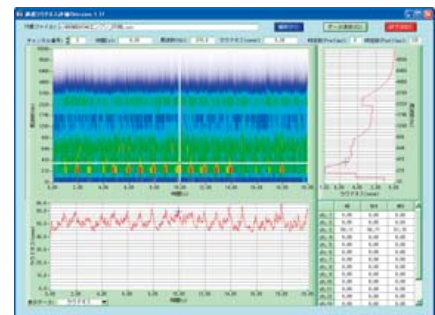
- Rotation data and sound/vibration data are recorded simultaneously to analyze the rotation order ratio.
- Available display formats include three-dimensional mapping, Campbell diagram, rpm-level display and more.



### Mode Analysis Software ME' Scope VES

(This software is a product of Vibrant Technology Inc.)

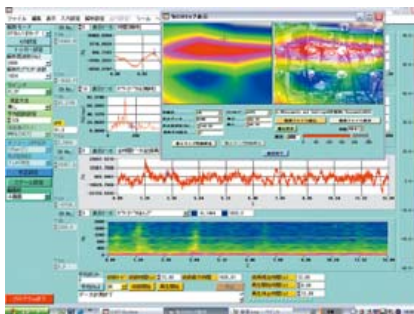
- Allows direct linking of SA-02 and mode analysis software
- Measurement points and direction for each channel can be displayed on screen using arrows, making it easy to check the next measurement point.
- Analysis using animated display can be generated in a few steps.



### Sound Quality Evaluation Software CAT-SA02-SQ

(This software is a product of Catec Inc.)

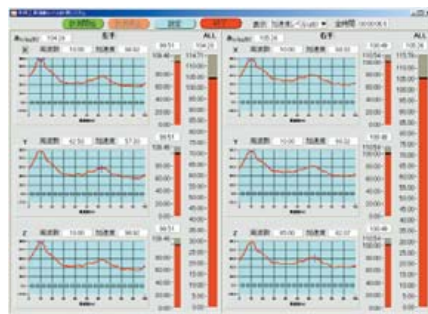
- WAVE data collected with the SA-02 and similar data can be imported into a measurement data file and used to calculate psychoacoustic evaluation quantities.
  - Calculates loudness (steady-state and transient\*), sharpness, roughness, intensity fluctuation, and tonality evaluation parameters.
- \*Calculation of transient loudness available as an option.



### Array Type Visualization Software CAT-SA02-AR

(This software is a product of Catec Inc.)

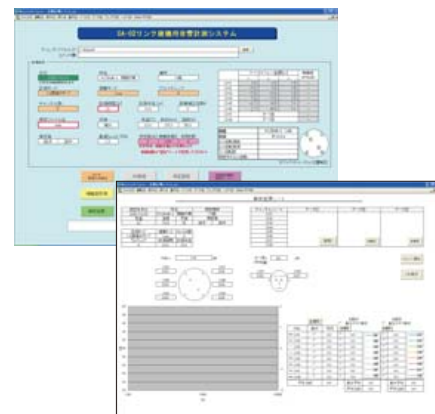
- Sound pressure level fluctuations and changes are made visible using a 32-microphone array.
- Visualization can be performed separately by frequency or overall. Microphone frequency analysis results can be displayed for each mode.
- Power spectrum and 3-D spectrum map can be observed for each array element, based on sound pressure level at the measurement position. Overlay with image data from a digital camera or similar is also possible.



### Hand-arm Vibration Measurement Software CAT-SA02-HT

(This software is a product of Catec Inc.)

- Frequency-weighted acceleration rms values are measured for the X, Y, Z axes simultaneously. From these values ( $a_{hwX}$ ,  $a_{hwY}$ ,  $a_{hwZ}$ ), the software determines the triaxial combined value  $a_{hw}$ .
- Applicable standards  
ISO 8041 / ISO 5349-2

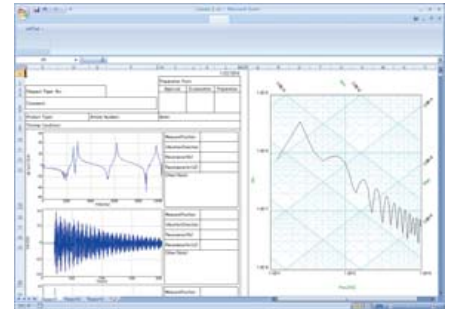
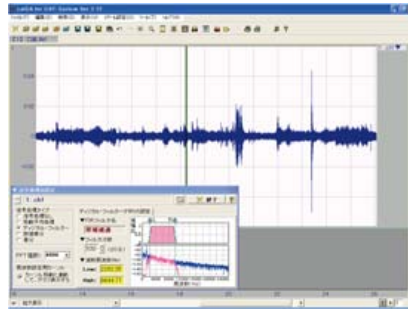
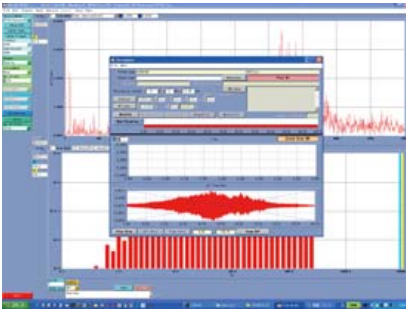


### Construction Machinery Sound Power Level Measurement System CAT-SA02-CPWL

(This software is a product of Catec Inc.)

- Using an Excel macro, the sound power level of construction machinery can be measured.
- Applicable standards  
ISO 6395 / ISO 6393

## Dedicated Analysis Software



### Throughput Disk CAT-SA02-TH

(This software is a product of Catec Inc.)

- Long-term time waveform recording

### Waveform Data Manipulation Software CAT-SA32

(This software is a product of Catec Inc.)

- Versatile data manipulation
- FFT processing
- Arithmetic processing
- Overlay display
- Storing manipulated data
- Data import function

### Report Creation Support Tool CAT-Report

(This software is a product of Catec Inc.)

- Excel add-on
- Ease of operation
- XY graph
- Cell linking function

## Detection and evaluation of abnormal sounds and vibrations on a manufacturing line

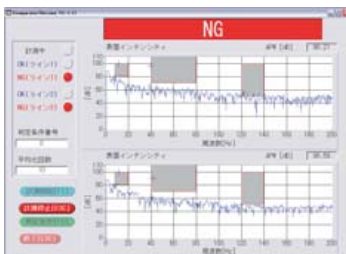
### Sound / Vibration Evaluation System (This software is a product of Catec Inc.)

- Evaluation results can be stored in a computer (selectable for Pass/Fail/All)
- I/O board in computer can be used to perform external sequence control

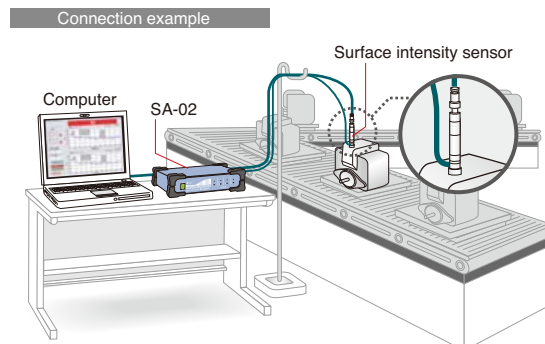
### Surface Intensity Evaluation System CAT-SA02-CMP03

- Allows detection and evaluation of abnormal sounds even in environments with a high level of background noise
- Simultaneously measures sound pressure level and vibration velocity and calculates surface intensity from these two values. The result is then used for evaluation.

\* When using the system in a clean room, care is required because airconditioning sound and vibrations are generated within the same spectrum.  
\* In some environments, use of the system may not be possible.



Sample screen (evaluation in progress)



# Frequency Analyzer Portable Multi-function Measuring System

Compact design, easy and intuitive operation  
 Wireless connections  
 Use it anytime anywhere!

## Portable Multi-function Measuring System RIONOTE



**SD-CARD Memory card compatible model**  
 For details, see "Memory Card" on page 16.



### TENTATIVE

- RIONOTE consist of a Main Control Unit SA-A1 which can be configured to up to 16 channels and allowing you to perform measurements anywhere wireless. The Main Control Unit is easy and intuitive to operate, with the dedicated program of your choice. All on a large color touch screen.

#### Specifications (Main control unit and 4ch amplifier)

Number of channels	4(2), BNC connectors
CCLD	2 mA 24 V (4 mA Factory option)
Frequency Range	DC to 20 kHz or 0.25 Hz to 20 kHz
Dynamic range	100 dB or better (0 dB range, $f_s = 51.2$ kHz, 400 line FFT noise level)
A/D converter	24 bit, delta-sigma type, simultaneous sampling
Display	10.1 inch TFT color LCD
Touch panel	Multi-touch (2 points), projected capacitive type
SD card	SDHC support, max. 32 GB
Power supply	Li-Ion battery, AC adapter
Dimensions, Weight	40 (H) x 275 (W) x 188 (D) mm SA-A1: 1 200 g (incl. 280 g battery, SA-A1B4 mounted)

### Main Control Unit SA-A1 and Amplifier SA-A1B4/B2

Supports direct connection of microphones and piezoelectric accelerometers.

RIONOTE also enables the use of a wireless dock or wireless sensor amplifiers to avoid the cost and hassle of cables. A plurality of wireless docks and wireless sensor amplifiers can be used simultaneously, up to 16 channels, to store the measured data in the Main Control Unit as well as in the memory of wireless dock or wireless sensor amplifiers.



Sensor amplifier slides into the underside of main unit



**Wireless Dock SA-A1WD (and Amplifier)**  
 Separate type wireless dock and amplifier (2 channel or 4 channel configuration)



**Wireless Sensor Amplifier SA-A1WL1**  
 Integrated type wireless dock and amplifier (single channel configuration)

### Optional Program

#### Program for FFT Analysis SX-A1FT

FFT analysis can be performed.



Arithmetic functions	Time domain waveform for 1 frame, Power spectrum, Cross spectrum, Transfer function, Coherence
Window functions	Rectangular, Hanning, Flat-top, Exponential, Force
Analysis frequencies	20 kHz, 10 kHz, 5 kHz, 2 kHz, 1 kHz, 500 Hz, 200 Hz, 100 Hz
Number of analysis points	256, 512, 1 024, 2 048, 4 096, 8 192, 16 384

#### Program for 1/3 Octave Analysis SX-A1RT

Octave band and 1/3 octave band analysis can be performed.



Standard compliance	IEC 61260:1995 Class1, ANSI S1.11-2004 Class1
Band filter center frequencies and number of bands	
Octave bands	0.5 to 16 000 Hz, 16 bands Max. 3 channels
1/3 octave bands	0.4 to 20 000 Hz, 48 bands Max. 4 channels
Instantaneous value data (every 100 ms)	Time weighted level $L_p$ , Time averaged level $L_{eq}$ , Time weighted maximum level $L_{max}$
Processing value data	Time averaged level $L_{eq}$ , Sound exposure level $L_E$ , Time weighted maximum level $L_{max}$ , Time weighted minimum level $L_{min}$ , Time percentile level $L_N$ (5, 10, 50, 90, 95, 33.3), max. 5 values

#### Program for Waveform Recording SX-A1WR (Installed in SA-A1 main unit)

It is possible to display and record the time waveform.



Frequency range	20 kHz, 10 kHz, 5 kHz, 1 kHz, 500 Hz, 100 Hz
Quantization	16 bit/24 bit
Voice memo marker function	Yes
Monitor output (playback)	Allows listening to recorded data (51.2 kHz, 25.6 kHz, 12.8 kHz only)
Recorded data	WAVE format



# Recorder (Data Recorder)

8 channel Data Recorder DA-40 and 4 channel Data Recorder DA-21 are compact, portable products designed to record various types of electronic signals and waveform data for on-site measurement of sound and vibration. Measured data are stored on memory card (CF card, SD card) in WAVE format. Stored data can be reproduced as analog signals and directly imported into a computer for detailed waveform analysis.

## 8 channel Data Recorder DA-40

**CF-CARD Memory card compatible model**  
For details, see "Memory Card" on page 16.

- Incorporates support for CCLD (Constant Current Line Drive) 2 mA, 4 mA (factory option)
- DC to 20 kHz frequency range
- Light weight: only 1.2 kg (excluding batteries)
- 180 minutes recording time (4 channels, 20 kHz x 2.4)\*

\*Using 4 GB memory card



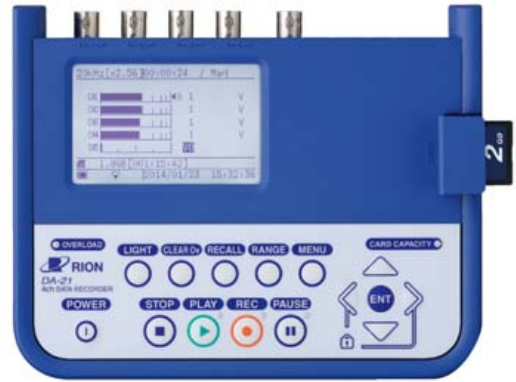
## 4 channel Data Recorder DA-21

**SD-CARD Memory card compatible model**  
For details, see "Memory Card" on page 16.



- Incorporates support for CCLD (Constant Current Line Drive) 2 mA
- DC to 20 kHz frequency range
- Inter-unit synchronization (max.8 channels)
- Light weight: only 450 g (excluding batteries)
- 180 minutes recording time (2 channels, 20 kHz x 2.4)\*

\*Using 2 GB memory card



Specifications	8 channel Data Recorder DA-40	4 channel Data Recorder DA-21
Input section	8 channels (BNC)	4 channels (BNC), 1 channel (BNC rotation speed)
CCLD (Constant Current Line Drive)	2 mA, 18 V (4 mA supported as factory option)	2 mA, 24 V
Frequency response	DC coupling DC to 1 Hz: ±1.0 dB, 1 Hz to 12.5 kHz: ±0.5 dB, 12.5 kHz to 20 kHz: ±1.0 dB AC coupling 1 Hz: ±1.0 dB, 1 Hz to 12.5 kHz: ±0.5 dB, 12.5 kHz to 20 kHz: ±1.0 dB	DC to 20 kHz
Output section	8 channels, BNC (using input connectors)	4 channels, φ2.5 monaural jacks
Recording section	Media CF card [up to 4 GB (FAT32)] (Use RION supplied cards for assured operation)	SD card [up to 32 GB (FAT16/32)] (Use RION supplied cards for assured operation)
Trigger section	Trigger mode Free, single, repeat (split files in repeat mode)	
Power supply section	Power Six IEC R14 (size C) batteries, AC adapter (NC-99, option), Cigarette plug adapter CC-82 (option)	Power IEC R6 (size AA) batteries, AC adapter (NC-98C, option), Cigarette plug adapter CC-82 (option)
Dimensions, Weight	Approx. 270 (H) x 210 (W) x 50 (D) mm, approx. 1.2 kg (not including batteries), approx. 2.0 kg (including batteries)	Approx. 140 (H) x 175 (W) x 45 (D) mm, approx. 450 g (not including batteries), approx. 770 g (including batteries)

### Options

Memory card (CF card)* 2 GB (for DA-40)	MC-20HS2	Memory card (2 GB SD card*)	MC-20SD2
Memory card (CF card)* 4 GB (for DA-40)	MC-40HS2	Memory card (32 GB SD card*)	MC-32SD3
AC adapter	NC-99	Inter-unit sync cable	CC-43
BNC-BNC Coaxial Cable	EC-90 series (2 m and up)	Battery Pack	BP-21A
BNC-BNC Cable	NC-39A	AC adapter	NC-98C
		BNC-BNC Coaxial Cable	EC-90 series (2 m and up)
		BNC-BNC Cable	NC-39A

\*Use RION supplied cards for assured operation

- Maximum recording times with 4 GB CF card (approximate)

Sampling frequency: frequency range x 2.56 (2.4 also supported)

Number of channels	Frequency range (Hz)					
	100	500	1 000	5 000	10 000	20 000
1	2 133 h 20 m	426 h 40 m	213 h 20 m	42 h 40 m	21 h 20 m	10 h 40 m
2	1 066 h 40 m	213 h 20 m	106 h 40 m	21 h 20 m	10 h 40 m	5 h 20 m
4	533 h 20 m	106 h 40 m	53 h 20 m	10 h 40 m	5 h 20 m	2 h 40 m
8	266 h 40 m	53 h 20 m	26 h 40 m	5 h 20 m	2 h 40 m	1 h 20 m

- \*Actual times may differ slightly depending on number of files
- \*Maximum recording time per file is 744 hours
- \*Use RION supplied cards for assured operation

- Maximum recording times with 2 GB SD card (approximate)

Sampling frequency: frequency range x 2.56 (2.4 also supported)

Number of channels	Frequency range (Hz)					
	100	500	1 000	5 000	10 000	20 000
1	1 066 h 40 m	213 h 20 m	106 h 40 m	21 h 20 m	10 h 40 m	5 h 20 m
2	533 h 20 m	106 h 40 m	53 h 20 m	10 h 40 m	5 h 20 m	2 h 40 m
3	355 h 32 m	71 h 06 m	35 h 33 m	7 h 06 m	3 h 33 m	1 h 46 m
4	266 h 40 m	53 h 20 m	26 h 40 m	5 h 20 m	2 h 40 m	1 h 20 m

- \*Actual times may differ slightly depending on number of files
- \*Maximum recording time for one file is approx. 1 000 hours
- \*Use RION supplied cards for assured operation

### Memory cards (for DA-40)



2 GB



4 GB

## Multi-Channel Signal Analyzer SA-02M/02A4

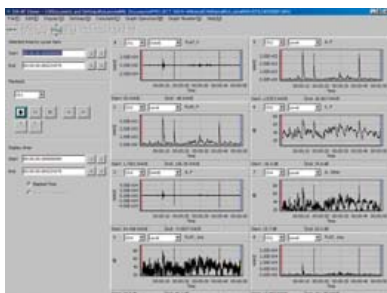
DA-21 recorded data file can be analyzed by this unit with the software Throughput Disk also.



# Recorder (Data Recorder/Software)

Provides various display and analysis functions for DA-40 data

## Viewer software DA-40 Viewer (supplied with DA-40)



8-channel display screen

- Enables waveform display, level display, and file output (WAVE format/CSV format) using data files (WAVE format) created with DA-40

### Specifications

Waveform	Display functions	Time waveform, time-weighted level, time percentile level, equivalent continuous sound pressure level, sound exposure level
	Weighting functions	Frequency weighting (A, C, G, L <sub>v</sub> (vertical), L <sub>w</sub> (horizontal), Wk/Wd (whole body), Wh (hand-arm), time weighting (1 ms, 10 ms, F [Fast], 630 ms, S [Slow])

\*Supported operating systems: Microsoft Windows XP Professional/Vista Business

Provides various display and analysis functions for WAVE file

## Viewer software AS-70 Viewer (supplied with DA-21)



4-channel display screen

Supported models : RIONOTE, NX-42WR, NX-28WR, SA-78WR DA-21/40, VA-12

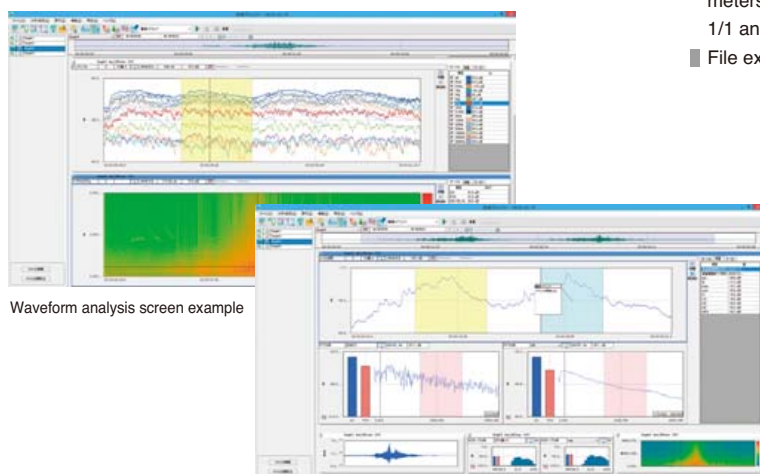
- WAVE files can be displayed as Time waveform and Time-weighted level waveform, replayed and exported (WAVE or CSV format).

### Specifications

Waveform	Display functions	Amplitude waveform, level waveform
	Weighting functions	10 ms, F (Fast), 630 ms, S (Slow), 10 s

\*Supported operating system: Microsoft Windows XP Professional 32 bit, 7 Professional 32 bit/64 bit, 8 Pro 32 bit/64 bit

## Waveform Analysis software AS-70



Waveform analysis screen example

Waveform analysis screen example

Supported models : RIONOTE, NX-42WR, NX-28WR, SA-78WR DA-21/20/40, VA-12

- Allows importing waveform data from Rion sound level meters, vibration meters, data recorders and similar to a computer as WAVE files, to perform 1/1 and 1/3 octave band analysis and FFT analysis.
- File export and playback are also supported.

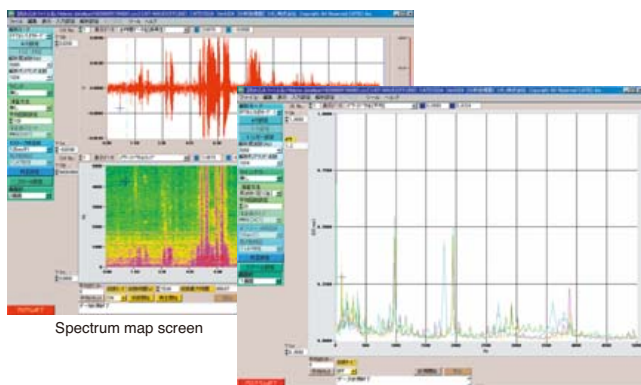
### Specifications

Waveform analysis	Processing	Maximum value, minimum value, average value, effective value, distribution, differentiation and integration, HPF, LPF
	Frequency weighting characteristics	Z, A, C, G, C to A, vertical vibration characteristics, horizontal vibration characteristics
FFT analysis	Number of analysis points	32 to 65 536
	Data view	Power spectrum, power spectrum density, spectrogram
Time weighting characteristics	Applicable standards	JIS C 1514 (IEC 61260)
	Frequency range	1/1 octave band 0.5 Hz to 16 kHz (16 bands) 1/3 octave band 0.4 Hz to 20 kHz (48 bands)

### Recommended operation environment

CPU	Intel Core i5 2 GHz or faster
RAM	2 GB or more, 4 GB recommended
HDD	20 GB or more (free space), 100 GB or more recommended
DISPLAY	XGA (1024 x 768 pixels) resolution or higher
OS	Microsoft Windows XP Professional 32 bit, 7 Professional 32 bit/64 bit, 8 Pro 32 bit/64 bit

## Waveform Analysis Software CAT-WAVE (This software is a product of Catec Inc.)



Spectrum map screen

Overlay screen (Power spectrum map)

Applicable to : NX-42WR, NX-28WR, SA-78WR, DA-21/20/40, VA-12

- Signals recorded in WAVE file can be analyzed, and the result of analysis can be stored.
- FFT analysis or Octave analysis can be selected.

### Specifications

Waveform	Display	Scaled time axis, Differential and integral calculus available
	Sampling points	64 to 32 768 points
FFT analysis	Display function	Power spectrum, Cross spectrum, Transfer function, Coherence, Power spectrum map, Octave map, Differential and calculus for spectrum area
	Applicable standard	JIS C 1514 (IEC 61260) Class 1
Octave band analysis	Frequency range	Octave band 0.5 Hz to 8 kHz (15 bands),
		1/3 octave band 0.4 Hz to 10 kHz (45 bands),
		1/12 octave band 0.36 Hz to 11 kHz (180 bands)

### Operating environment requirements

CPU	Intel Core i5/i7 1.4 GHz or more (Core2 Duo 2 GHz or more)
RAM	2 GB or more
HDD	60 GB (free space) or more
DISPLAY	SXGA (1280 x 1024) or more
OS	Microsoft Windows XP Professional 32 bit, Vista Business 32 bit, 7 Professional 32 bit/64 bit

## Level recorder featuring simple operation

### Level recorder

**LR-07** Type certification number: JR-9



- Besides sound and vibration level recording, this automatic balancing level recorder is suitable for performance characteristics testing of acoustic devices and transducers, DC voltage linear recording, and more
- Paper speed control function increases feed rate while level exceeds a preset threshold, for easier reading of recorded results

#### Specifications

Applicable standard	JIS C 1512 : 1996
Level range	10 dB, 25 dB, 50 dB, Linear
Measurement frequency range	1 Hz to 100 000 Hz
Paper feed rate	0.01, 0.03, 0.1, 0.3, 1, 3, 10, 30 mm/s
Power	Six IEC R20 (size D) batteries, AC adapter (NC-97A, option), external DC input (12 V)
Dimensions, Weight	Approx. 122 (H) × 250 (W) × 325 (D) mm, approx. 3.6 kg (including batteries)

#### Options

Recording Paper	RP-01D (6 rolls)
Level Recorder Pen (Red)	LB-25B (set of 5)

## Automatically takes up recorded data, convenient for unattended measurements

### Printer

**DPU-414** CE



- Produces hard copy of sound level meter, vibration meter, and vibration level meter screens, and also allows printout of numeric data
- Autoloading function makes it a snap to load and replace paper

#### Specifications

Printing method	Thermal serial dot printer
Temperature/humidity range for operation	0 °C to +40 °C, 30 % to 80 %RH (no condensation)
Recording paper	TP-14
Power	AC adapter (supplied), battery pack (integrated in main unit) ※One full charge allows about 3 000 lines of character printing
Connection cable	Various (See pages 19 and 33, Some models require conversion adapter 5ZTD1000)
Dimensions, Weight	66.5 (H) × 170 (W) × 160 (D) mm, approx. 580 g

## Allows Easy Measurement of Fluid Viscosity

### Viscotester

**VT-06** CE



- Designed for quality control applications in the manufacturing process of industrial products such as petrochemicals, paint, and adhesives, as well as foodstuffs.
- Measurement is performed by simply submerging a rotor in the fluid. The resistance to rotor movement caused by the viscosity (torque) is measured to obtain direct readings.

#### Specifications

Measurement range	No. 3 rotor: 0.3 to 13 dPa.s (with No. 3 cup) No. 1 rotor: 3 to 150 dPa.s (with JIS 300 mL beaker*1) No. 2 rotor: 100 to 4000 dPa.s (with JIS 300 mL beaker*1)
Sample fluid capacity	No. 1 and No. 2 rotor (with JIS 300 mL beaker*1) approx. 300 mL No. 3 rotor (with No. 3 cup) approx. 170 mL Clearance between rotor end and cup bottom: about 15 mm
Measurement accuracy	±10 % ±1 digit of indicated value, reproducibility ±5 %
Rotor speed	62.5 rpm
Power supply	IEC LR6 (size AA) alkaline batteries, nickel-hydrate rechargeable batteries, AC adapter VA-05J
Dimensions, Weight	175 (H) × 77 (W) × 40 (D) mm (without protruding parts), Approx. 260 g (without batteries)
Supplied accessories	No. 1 rotor (dia. 24 × 53 × 166 mm) SUS304 1 No. 2 rotor (dia. 15 × 1 × 113 mm) SUS304 1 No. 3 rotor (dia. 45 × 47 × 160 mm) SUS304 1 No. 3 Cup (dia. 52.6 × 75 mm) SUS304 1 Extension rod (900 mm·300×3) SUS304 1 IEC LR6 (size AA) alkaline batteries 4

#### Options

Stand	VA-04
AC adapter	VA-05J

# Related Products

Check the performance characteristics of floor surface materials

## Tapping Machine Light Floor Impact Sound Generator

FI-01



- Light and hard impact source imitating walking with shoes, designed for on-site use in measuring impact sound levels of flooring
- Allows checking insulation performance of floor surface materials mainly in medium and high frequency range

JIS A 1418-1: 2000 Standard Light Impact Sound Source

### Specifications

Applicable standard	JIS A 1418-1
Impact cycle	100 ±5 ms
Hammers	Cylindrical, linear arrangement of 5 hammers spaced 10 cm apart
Hammer material	Stainless steel
Power	100 V AC (50/60 Hz), approx. 80 VA
Dimensions, Weight	Approx. 260 (H) x 520 (W) x 260 (D) mm, approx. 17.5 kg

For testing the acoustic properties of floor construction

## Heavy Floor Impact Source

FI-02



- Heavy and soft impact source suitable for floor impact sound level measurement, simulating events such as children jumping up and down
- Can be used to evaluate mainly the medium and low frequency range insulation aspect in the acoustic performance of floor structures

JIS A 1418-2: 2000 Standard Heavy Impact Source (impact force characteristics 1)

### Octave band impact force exposure level and tolerance values for impact force characteristics 1

Octave band center frequency Hz	Octave band impact force exposure level dB	Tolerance dB
31.5	47.0	±1.0
63	40.0	±1.5
125	22.0	±1.5
250	11.5	±2.0
500	5.5	±2.0

For sound insulation testing of floors in buildings

## Impact Ball

YI-01

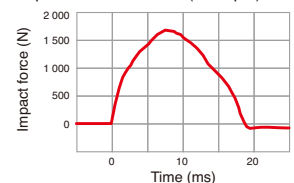


- Designed for sound insulation testing in lightweight structures where a standard heavy impact sound source (bang machine) with characteristics (1) would create too much impact force
- By performing a free drop from a height of 1 meter, a stable impact force of about 1 500 N (Newton) can be created
- Light mass of 2.5 kg allows for easy carrying

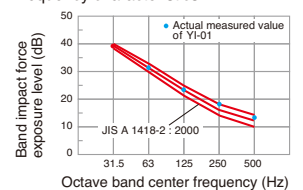
### Specifications

Equivalent mass	2.5 ±0.1 kg
Drop height	1 m
Major rubber compound	Silicone rubber
Shape	Hollow sphere with 32 mm thick wall and 178 mm external diameter
Rebound coefficient	0.8 ±0.1

Impact force waveform (example)



Impact force exposure level frequency characteristics



Sound source for all kinds of acoustic measurements

## Random Noise Generator

SF-06



- Generates white noise and pink noise and uses a 1/1 octave filter to produce band noise
- White noise and pink noise covers the 20 Hz to 20 kHz frequency range, and octave band noise uses center frequencies from 31.5 Hz to 8 kHz
- Applications include architectural acoustic measurements, sound absorption factor measurements in anechoic chambers, and sound insulation measurements

### Specifications

Output frequency range	White noise, Pink noise (bandwidth 20 Hz to 20 kHz) Octave band noise
Output signal level	Approx. 5.6 Vrms
Output level range	0 dB to -60 dB
Octave bands	31.5 Hz to 8 kHz
Power	100 to 250 V AC (50/60 Hz), approx. 20 VA
Dimensions, Weight	168 (H) x 198 (W) x 270 (D) mm, approx. 3 kg

※Contact RION distributors for recommendations on suitable powered speakers.

Carefully controlled acoustic properties provide a stable and quiet environment for measurements

## Anechoic Box (Compact Type) RKB Series



- Suitable for use in testing and developing small size precision instruments
- Wall reflections are damped for enhanced measurement accuracy
- Wedge-shaped absorber layer provides high sound absorption efficiency
- Compact dimensions and casters provide mobility
- Available as standard Type L, or Type H with higher sound insulation and absorption characteristics

### Sound insulation performance (Type L)

● Measured according to JIS A 1417. Results may differ slightly, depending on construction of installation location (floor, walls, ceiling) and ambient noise level.

Frequency	(63 Hz)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Sound insulation	10 dB	15 dB	23 dB	30 dB	35 dB	40 dB	40 dB

\*Deviation -3 dB or more \*Figures in brackets are reference values

### Dimensions, Weight (Type L)

Model	External dimensions	Internal dimensions	Weight
RKB-11L	945 (H) × 905 (W) × 705 (D) mm	500 (H) × 600 (W) × 400 (D) mm	125 kg
RKB-22L	1185 (H) × 1105 (W) × 905 (D) mm	700 (H) × 800 (W) × 600 (D) mm	150 kg
RKB-33L	1385 (H) × 1305 (W) × 1105 (D) mm	900 (H) × 1000 (W) × 800 (D) mm	200 kg

## Anechoic Room RKA Series



- Can be assembled on site in existing buildings, which helps to keep costs low
- Enhanced sound insulation performance and additional facilities available as options
- Available as standard Type L, or Type H with higher sound insulation and absorption characteristics

### Sound insulation performance (Type L/Type H)

● Measured according to JIS A 1417. Results may differ slightly, depending on construction of installation location (floor, walls, ceiling) and ambient noise level.

Frequency	(63 Hz)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Sound insulation	32 dB	39 dB	43 dB	44 dB	56 dB	62 dB	64 dB

\*Deviation -3 dB or more \*Figures in brackets are reference values

### Dimensions, Weight (Type L)

Model	External dimensions	Internal dimensions	Weight
RKA-11L	2 860 (H) × 2 520 (W) × 1 720 (D) mm	2 200 (H) × 2 000 (W) × 1 200 (D) mm	3 400 kg
RKA-22L	2 860 (H) × 3 320 (W) × 2 720 (D) mm	2 200 (H) × 2 800 (W) × 2 200 (D) mm	5 200 kg
RKA-33L	2 860 (H) × 4 320 (W) × 3 520 (D) mm	2 200 (H) × 3 800 (W) × 3 000 (D) mm	7 200 kg

## Sound Proof Chamber RKC Series



- Can be assembled on site in a short time
- Suitable for many applications, including acoustic measurements of small machinery and equipment, sound-shielded environment configuration, acoustic testing and more
- Enhanced sound insulation performance and additional facilities available as options

### Sound insulation performance

● Measured according to JIS A 1417. Results may differ slightly, depending on construction of installation location (floor, walls, ceiling) and ambient noise level.

Frequency	(63 Hz)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Sound insulation	25 dB	32 dB	38 dB	50 dB	53 dB	55 dB	58 dB

\*Deviation -3 dB or more \*Figures in brackets are reference values

### Dimensions, Weight

Model	External dimensions	Internal dimensions	Weight
RKC-71	2 410 (H) × 2 080 (W) × 2 080 (D) mm	1 925 (H) × 1 830 (W) × 1 830 (D) mm	1 340 kg
RKC-81	2 410 (H) × 3 075 (W) × 2 080 (D) mm	1 925 (H) × 2 825 (W) × 1 830 (D) mm	1 750 kg

External dimensions include air duct.

Perform precise measurements in air for any shape object

## Acoustical Volumeter (For combustion chamber volume measurement)



- Regardless of its shape, the combustion chamber volume can be measured by simply placing the volume meter on the combustion chamber cavity of the cylinder head.
- For assembled engines, a dedicated adapter can be used to connect the volume meter to the spark plug hole, to measure the combustion chamber volume.
- In the process of engine manufacturing or maintenance, the combustion chamber volume can be measured in a short time (about two seconds) in a dry state.



## Acoustical Volumeter (Densimeter)

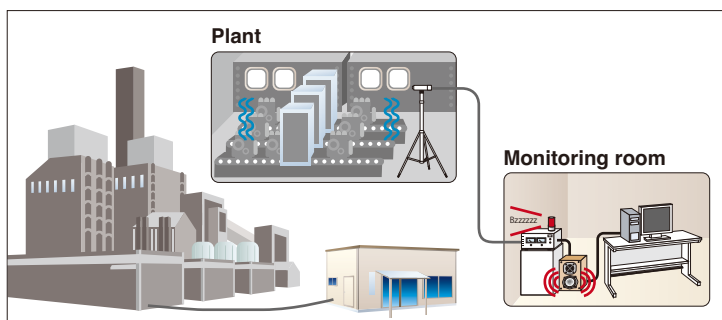


- Unlike the conventional method using the Archimedes principle (where the target object is immersed in water), the volume meter system allows volume and density measurement of the target object in a dry state.
- Even the volume of objects with complex shape can be measured accurately in a short time (about two seconds).
- In combination with an electronic precision balance, the volume and density can be measured quickly.



For noise measurement and monitoring at large-scale facilities such as industrial plants and power stations

## Remote Noise Monitoring System



Example for Remote Noise Monitoring System setup

- Monitor noise levels in a plant or similar from a remote location
- Set noise thresholds and limit values for triggering audible or visual alarms
- Single measurement range covering 100 dB eliminates the need for range switching
- Alarm level can be set to any value within the measurement range
- Alarm response delay time can be set (alarm is triggered after noise has continuously exceeded threshold level for this interval)
- Relay contacts for operation of external equipment
- Integrated power amplifier allows monitoring of noise at measurement point

## Other Products

- Oblique incident sound absorption coefficient measurement system
- Multi-channel selector
- PWL measurement microphone tool
- Parabola type sound collector MY-11
- Omnidirectional sound-source SS-05T

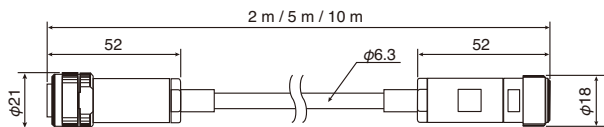
Besides the products described in this catalog, RION Co., Ltd. also has experience with systems such as listed at left. We also build custom-designed measurement systems to order.

# External view drawings of measurement microphone and accelerometer cables

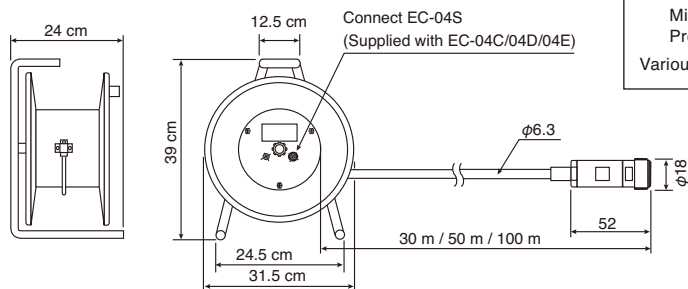
Units: mm

## Sound level meter cables

### EC-04/04A/04B

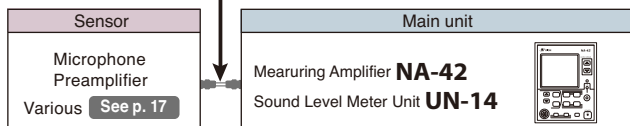


### EC-04C/04D/04E (with reel)



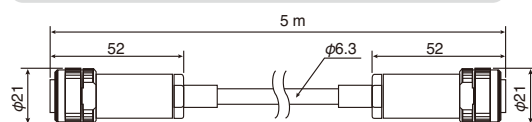
Type	Model	Length
7P microphone extension cable	<b>EC-04</b>	2 m
	<b>EC-04A</b>	5 m
	<b>EC-04B</b>	10 m
	<b>EC-04C</b>	30 m (with reel)
	<b>EC-04D</b>	50 m (with reel)
	<b>EC-04E</b>	100 m (with reel)

● EC03001



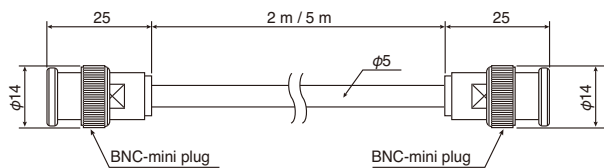
Can also be used as extension cable for these sound level meters  
**NA-28, NA-42, NL-62/52/42**

### EC-04S (for connection of sound level meter to reel)

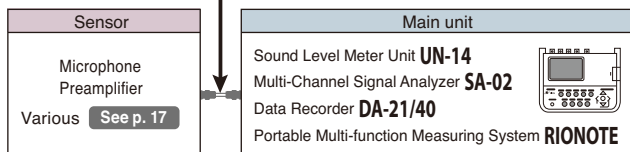


## BNC-BNC Cable

### EC-90A/90B

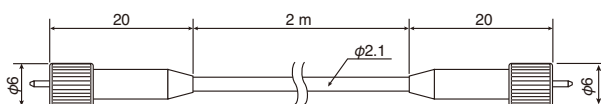


Type	Model	Length
BNC-BNC Coaxial Cable	<b>EC-90A</b>	2 m
	<b>EC-90B</b>	5 m

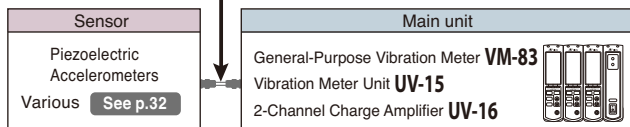


## Accelerometer cables

### VP-51A

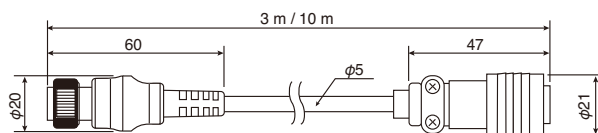


Type	Model	Length
Standard Cable	<b>VP-51A</b>	2 m~

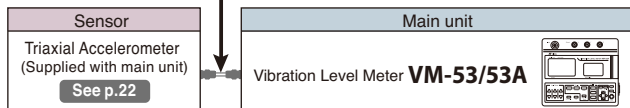


## Vibration level meter cables

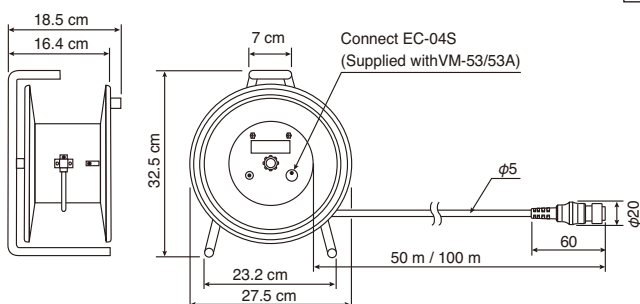
### EC-02S/02SB



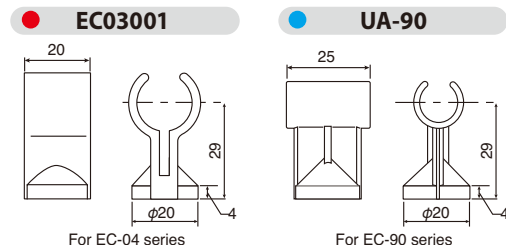
Type	Model	Length
Vibration level meter/ vibration meter accelerometer cable	<b>EC-02S</b>	3 m
	<b>EC-02SB</b>	10 m
Vibration level meter/ vibration meter cables	<b>EC-02SD</b>	50 m (with reel)
	<b>EC-02SE</b>	100 m (with reel)



### EC-02SD/02SE (with reel)



## Microphone holders



Sound Level Meter

Vibration Meter

Frequency Analyzer

Recorder

Related Products

Measuring Instrument Combinations  
External view drawings

Outline

Knowledge  
In a Nutshell

Quality  
Documentation

Company  
Outline

# Measuring Instrument Combinations

Before starting an acoustic or vibration measurement, three factors must be considered:

- What kind of sound/vibration is to be measured?
- For what purpose?
- Which kind of processing is required (recording, analysis etc.)?

Depending on these factors, the measurement method, type of measuring instrument, and choice of peripheral equipment will differ. Selecting the right combination of products is essential for achieving accurate and reliable results. The following pages are intended to help with the selection of equipment, by describing some representative configurations and showing connection examples.

## INDEX

1	Acoustic Measurement	48
2	Calibration of Sound Level Meters and Vibration Meters	48
3	Sound Level Meters and Vibration Level Meters in the Field	49
4	Sound Level Monitoring	49
5	Noise Measurement at Working Places	40
6	Low-Frequency Sound Measurement	50
7	Quality Management Based on Sound and Vibrations	50
8	Sound-Proof Chambers, Anechoic Chambers, Echo Chambers	51
9	Measurement of Sound Insulation and other Performance Parameters of Buildings	51
10	Acoustic Intensity · Sound source location	51
11	Acoustic Power Level	52
12	Sound quality evaluation	52
13	Pure tone evaluation	52
14	Measurement of Mechanical Vibrations	53
15	Vibration Monitoring	53
16	Industrial Machinery Equipment Diagnosis	53
17	Whole-Body Vibration Measurement	54
18	Hand-arm Vibration Measurement	54
19	Mode Analysis	54
20	Tracking Analysis System	55
21	Measurement of Low-Frequency Microvibrations	55
22	Vibration measurement with sound level meter	55

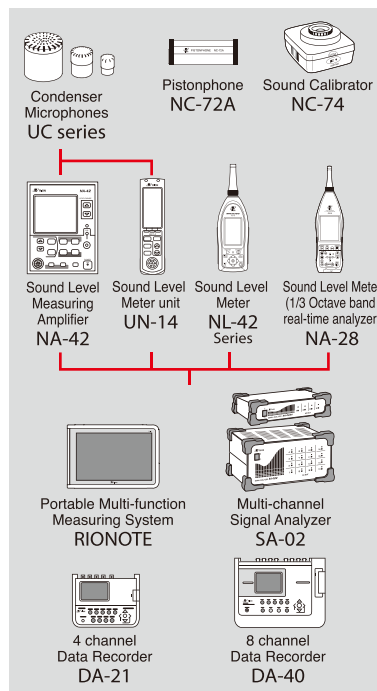
## 1

### Acoustic Measurement

In acoustic measurements requiring high accuracy, the basic instrument combination consists of a condenser microphone and preamplifier. To this, other equipment, such as a frequency analyzer and data recorder, is added as needed.

The type of condenser microphone will be determined by factors such as the target sound pressure level, frequency range, and sound field conditions. (See selection examples on page 17.) The general-application Sound Level Measuring Amplifier NA-42 is suitable as an amplifier for these microphones. Frequency analyzers come in two types: constant-ratio type real-time analyzers and constant-amplitude type FFT analyzers. In the former category, RION offers the Precision Sound Level Meter NA-28 with the 1/3 octave band real-time analyzer function. In the FFT category, there is the Portable Multi-function Measuring System RIONOTE. The Multi-Channel Signal Analyzer SA-02 and Portable Multi-function Measuring System RIONOTE provides both 1/1, 1/3, 1/12<sup>\*\*</sup> octave band real-time analysis\* and FFT analysis\* capability.

※ SA-02 only  
\* RIONOTE is optional



## 2

### Calibration of Sound Level Meters and Vibration Meters

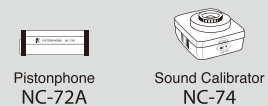
#### ● Calibration of sound level meters and similar devices

For overall checking of sound level meters and acoustic measurement systems, RION offers the Sound Calibrator NC-74 (1 kHz, sound pressure level 94 dB), as well as the Pistonphone NC-72A (250 Hz, 114 dB).

#### ● Calibration of vibration meters and similar devices

In order to make it possible for users to easily calibrate vibration meters and vibration accelerometers, RION offers the Calibration Exciter VE-10 (159.2 Hz, acceleration 10 m/s<sup>2</sup>, velocity 10 mm/s, displacement 10 μm).

#### Calibration of sound level meters and similar devices



#### Calibration of vibration meters and similar devices





# 3

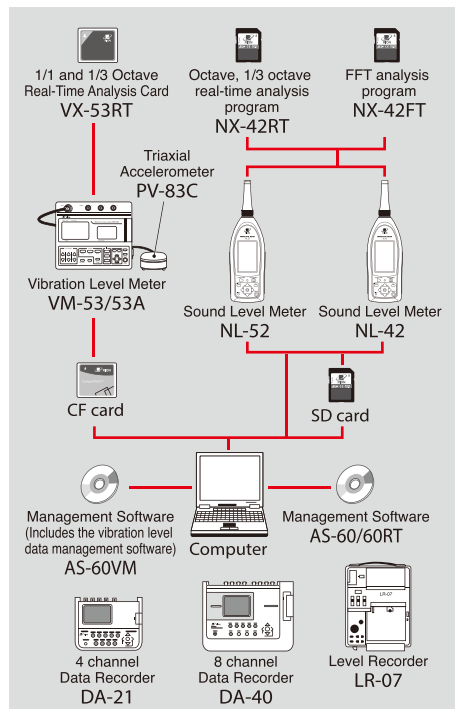
## Sound Level Meters and Vibration Level Meters in the Field

The basic model lineup for JIS and IEC standard compliant sound level meters is the NL series. For on-site measurements of vibration levels, the Japan Measurement Law and JIS compliant Vibration Level Meters VM-53/53A are suitable. The NL-42 series (SD cards) and the VM-53A series (CF cards) use memory cards to allow long-term recording of vibration level data and calculated data. Data stored on memory cards can be utilized by the dedicated software applications AS-60 and AS-60VM for data graph display, editing, further processing, and creating daily and weekly reports.

The NL-42 series supports use of the Octave Band and 1/3 Octave Band Real Time Analysis Program NX-42RT and the FFT Analysis Program NX-42FT. The Data Management Software AS-60 allows playback of real sound files. Analysis data saved with the NX-42RT can be displayed, edited, and processed using the Data Management Software (With Octave and 1/3 Octave Data Management Software) AS-60RT.

The VM-53A allows use of the 1/1 and 1/3 Octave Real-Time Analyzer Card VX-53RT for frequency analysis.

For recording of sound level and vibration level data, RION level recorder LR-07 is useful. Sound pressure waveform and vibration acceleration waveform information can be recorded using a data recorder (4 channel type: DA-21, 8 channel type: DA-40), allowing for later analysis with waveform processing software.



# 4

## Sound Level Monitoring

Aircraft noise, factory noise and other types of noise that have an influence on the living environment require constant level monitoring in order to devise efficient countermeasures. For short-term monitoring, the Sound Level Meter NL-42 series along with the level recorder LR-07 and a suitable all-weather windscreen is a convenient arrangement (Figure 1).

For constant monitoring on a long-term basis, a system built around the Environmental Sound Monitor NA-37 is optimal. Such a system can use the public telephone network or another suitable online link to send data to a monitoring facility. The optional Aircraft Noise Identifier Unit AN-37 provides the capability of determining sound incident direction while the Environmental Noise Data Processing Software AS-50PA1 handles the obtained data.

The Aircraft Noise Processing Program NX-37C and Aircraft Noise Data Processing Software AS-50PA2 including support for ground-level sound events\* are also available. Environmental Noise Data Processing Software AS-40PA1 is also available that allows to process the collected data of environmental noise (Figure 2).

\* Ground-level sound event refers to noise produced by aircraft on the ground, within the airport area. This includes noise from take-off and landing, taxiing, engine trial runs, APU etc.

Figure 1

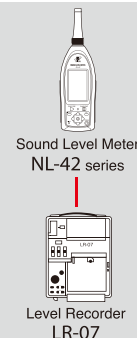
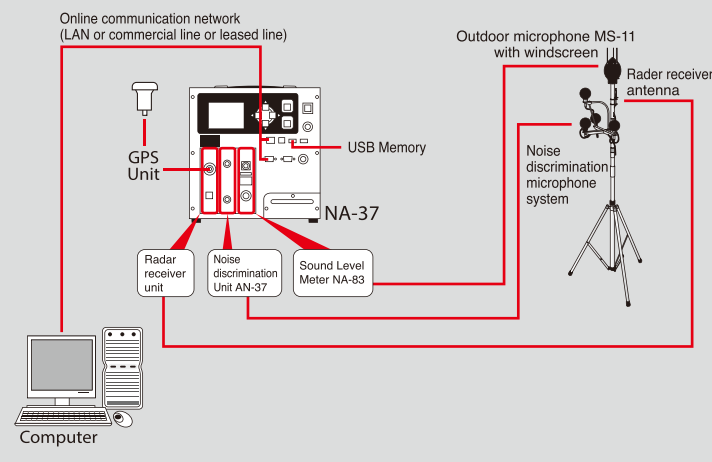


Figure 2

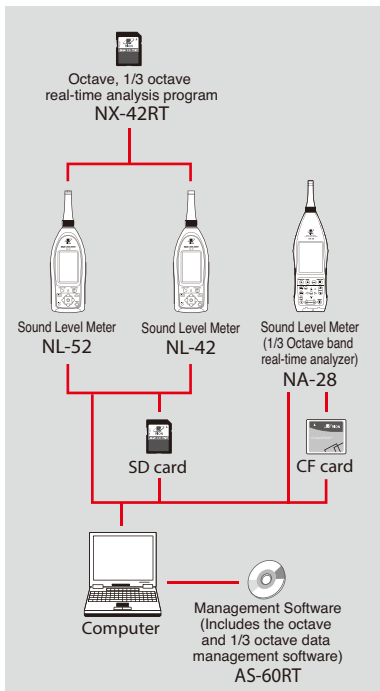


# Measuring Instrument Combinations

## 5

### Noise Measurement at Working Places

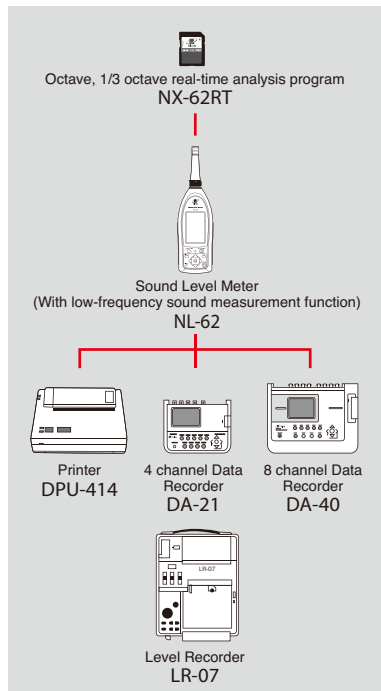
The measurement of sound exposure levels is an important prerequisite for protecting personnel working in an environment with high sound level from hearing damage. Regulations to control generation of noise at work places have come into force in many countries. For instance, The Noise Prevention Guideline issued by the Japanese Labor Ministry (currently the Health, Labor and Welfare Ministry) in 1992 provides the framework for measurement and evaluation of equivalent continuous sound pressure levels. The Sound Level Meter NL-42 series is suitable for such measurements. When the NL-42 series is used, the results can be stored on a SD card and later exported to a spreadsheet application for easy processing. The Octave Band and 1/3 Octave Band Real Time Analysis Program NX-42RT can also be used to analyze the frequency ranges that are critical for noise countermeasures. The Sound Level Meter NA-28 with the 1/3 octave band real-time analyzer function is also a highly useful tool. Analysis data saved with the NX-42RT and NA-28 can be displayed, edited, and processed using the Data Management Software (With Octave and 1/3 Octave Data Management Software) AS-60RT.



## 6

### Low-Frequency Sound Measurement

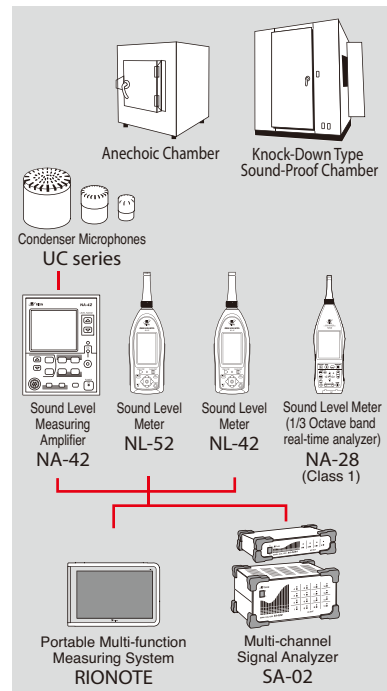
So-called infrasound in the range below the human hearing threshold, from 1 Hz to about 20 Hz, can have a physiological impact on humans if sound pressure levels are very high. It can also cause other unwanted effects such as window rattling and develop into an environmental problem. To measure sound in this range, the Sound Level Meter NL-62 + NX-62RT which provides G characteristics as defined by ISO 7196 and 1/3 octave band analysis can be used. By connecting the Level Recorder LR-07 or a Data Recorder (DA-21 with 4 channels or DA-40 with 8 channels), the level changes and sound pressure signal condition can be recorded, and the Printer DPU-414 allows printout of measurement results.



## 7

### Quality Management Based on Sound and Vibrations

Measuring the noise level and vibrations produced by machinery and other equipment can often provide valuable data for quality control. Depending on the characteristics of the measurement target, UC series microphones or PV series accelerometers are used as sensors connected to equipment such as the Sound Level Meter Unit UN-14, Vibration Meter VM-83 or Charge Amplifier UV-15/16. When only the sound or vibration Level is to be measured, the NL-42 series, NA-42, or VM-83 with comparator function are suitable. If detection of unusual sound or other frequency analysis processing is required, the Multi-Channel Signal Analyzer SA-02, Portable Multi-function Measuring System RIONOTE, or High-Precision Sound Level Meter NA-28 (with 1/3 octave band analysis capability) are useful. For pass/fail evaluation of products in a manufacturing process, the Multi-Channel Signal Analyzer SA-02 series and evaluation software of the CAT-SA02-CMP03 series, or the Portable Multi-function Measuring System RIONOTE and dedicated evaluation software (under development) are suitable.

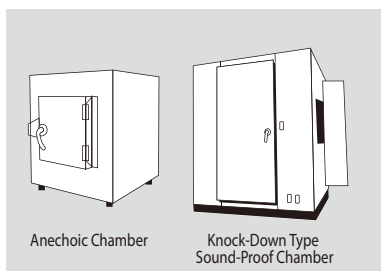


# 8

## Sound-Proof Chambers, Anechoic Chambers, Echo Chambers

When performing acoustic measurements, special conditions must often be established, such as low-noise environment, semi-free sound field, free sound field, or diffuse sound field.

- **Low-noise environment**  
Using a sound-proof chamber or box, when the sound level emitted by equipment is low, ambient noise can influence a measurement. To prevent this, place the measurement target in a sound-proof chamber or box. In some cases, using an anechoic chamber or box where the influence of reflections is minimized can also be useful. For acoustic power level measurements according to the sound pressure method or for measuring the sound insulation characteristics of building materials, a semi-free sound field, free sound field, or diffuse sound field must be realized, according to standard stipulations. This can be achieved by using suitable RION products.
- **Semi-free sound field**  
Using a semi-anechoic chamber  
Except for the floor, all surfaces of such chambers are specially treated for sound absorption to minimize the influence of reflections.
- **Free sound field**  
Using an anechoic chamber  
All surfaces including the floor of such chambers are specially treated for sound absorption to minimize the influence of reflections.
- **Diffuse sound field**  
Using an echo chamber or type I test chamber  
For sound insulation measurements, JIS prescribes the use of a so-called Type I chamber which provides an environment with uniform energy distribution.
- **Insulation measurement environment**  
Using a type II test chamber  
This refers to a cuboid test chamber with specially adjusted reverberation times for specific frequencies.

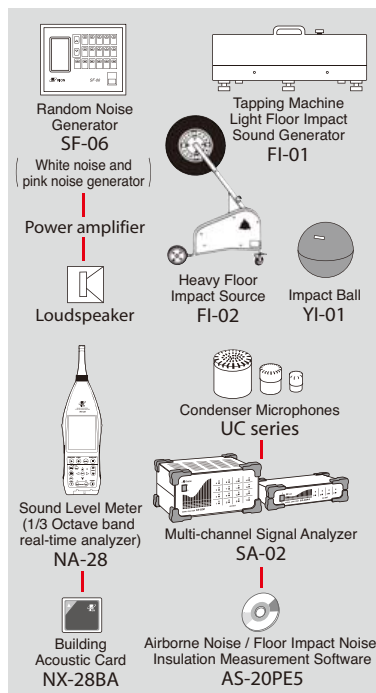


# 9

## Measurement of Sound Insulation and other Performance Parameters of Buildings

The acoustic properties of dividing walls, floor slabs, and other building elements are usually measured and evaluated according to the JIS specifications or methods recommended by the Architectural Institute of Japan, as listed below.

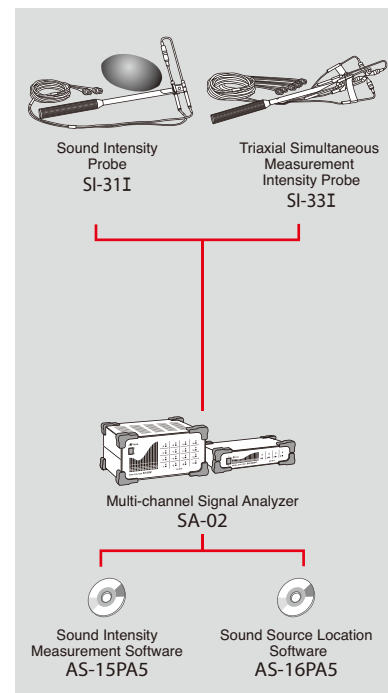
- **ISO 140-1**  
Acoustics - Measurement of sound insulation in buildings and of building elements - Part 1: Requirements for laboratory test facilities with suppressed flanking transmission
  - **ISO 140-3**  
Part 3: Laboratory measurements of airborne sound insulation of building elements
  - **ISO 140-4**  
Part 4: Field measurements of airborne sound insulation between rooms
  - **ISO 140-7**  
Part 7: Field measurements of impact sound insulation of floors
  - **ISO 140-8**  
Part 8: Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor
  - **ISO 717-1**  
Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation
  - **ISO 717-2**  
Part 2: Impact sound insulation
- To create the white / pink noise required for these measurements, the Random Noise Generator SF-06 is used. Suitable impact sound sources are the Tapping Machine FI-01, the Bang Machine FI-02, and the Impact Ball YI-01. For evaluation complying with the standard stipulations, frequency analysis must also be performed. The required measurement results are reliably obtained with the Precision Sound Level Meter NA-28 in combination with the Building Acoustic Card NX-28BA. Rion also offers the Multi-Channel Signal Analyzer SA-02 series and the Airborne/Floor Impact Sound Insulation Measurement Software AS-20PE5.



# 10

## Sound Intensity · Sound source location

Sound intensity is defined as the sound energy coming from a specific direction. By measuring sound intensity, it is possible to assess the sound power level of a sound source or measure the sound insulation performance of materials without having to use an anechoic chamber or other special equipment. It also is useful when examining from which part of the sound source a given noise emanates or which part of a material allows sound to pass through, and allows visualization of the results. For sound intensity measurement, the Sound Intensity Probe SI-31I is connected to a Multi-Channel Signal Analyzer of the SA-02 series, and the Sound Intensity Measurement Software AS-15PA5 is used. By choosing the 3-Axis Simultaneous Measurement Intensity Probe SI-33I, results for a three-dimensional grid can be obtained in a single operation. Using the sound source location software AS-16PA5, the sound incidence direction can be displayed in combination with a camera image.



# Measuring Instrument Combinations

## 11

### Sound Power Level

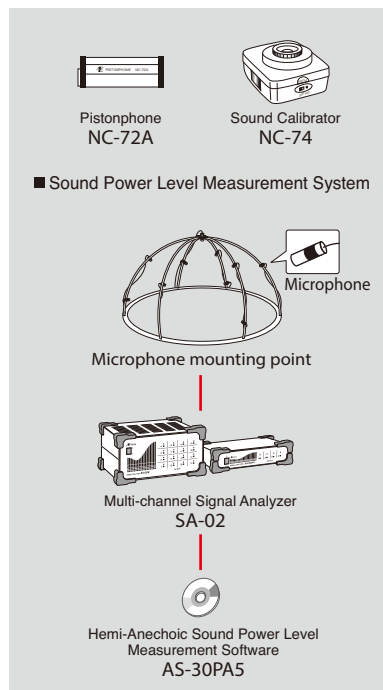
Even if emitting noise of the same energy level, the actual ambient noise level in the vicinity of mechanical or electrical machinery, office equipment etc. will differ, depending on various conditions. When predicting expected noise levels associated with installation or removal of a given piece of equipment, or when assessing the equipment as a single noise source, it is important to determine the sound power level which represents the acoustic energy produced by the equipment per unit of time. The basic components that are required when configuring a system to measure the sound power level of a sound source are suitable microphones and preamplifiers, a Multi-Channel Signal Analyzer of the SA-02 series, and sound power level measurement software.

- Sound power level measurement system using a hemi-anechoic chamber
  - ISO 3745
  - ISO 3744

Calculates the sound power level according to the stipulations of the respective standard.

- Sound power level measurement system using a reverberation chamber, wide-band)
  - ISO 3741

Calculates the sound power level according to the stipulations of the respective standard



## 12

### Sound quality evaluation

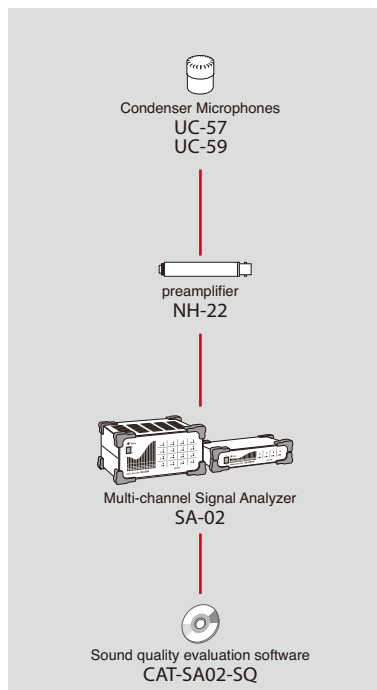
In conventional sound evaluation measurements, frequency weighting using the "A" characteristics is commonly used for measurements intended to express the noise level. However, sound quality is increasingly gaining recognition as an aspect that is significant in evaluating the sound emitted by various kinds of products. Consequently, various parameters expressing sound quality such as loudness, roughness, and sharpness have come to be widely recognized as useful for evaluating sound. To measure these parameters, a system consisting of microphone and preamplifier, Multi-Channel Signal Analyzer of the SA-02 series, and sound quality evaluation software is suitable.

- Loudness
 

Loudness is an aspect that expresses the subjective volume of a sound as perceived by human hearing. ISO 532 defines the standard method which is used to calculate loudness as an evaluation parameter.
- Sharpness
 

Sharpness is an evaluation parameter that expresses the sharp metallic quality of sound in the high frequency range.
- Roughness
 

Roughness is an aesthetic evaluation parameter that expresses the perceived roughness dependent on modulation frequency, modulation rate, and sound pressure level changes.



## 13

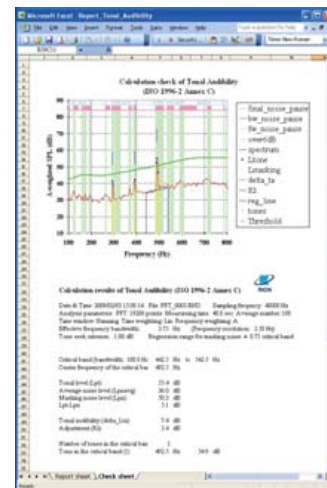
### Pure tone evaluation

The Tonal Audibility Calculation Program (Excel macro) can be used for pure tone evaluation. ISO 1996-2:2007- Annex C

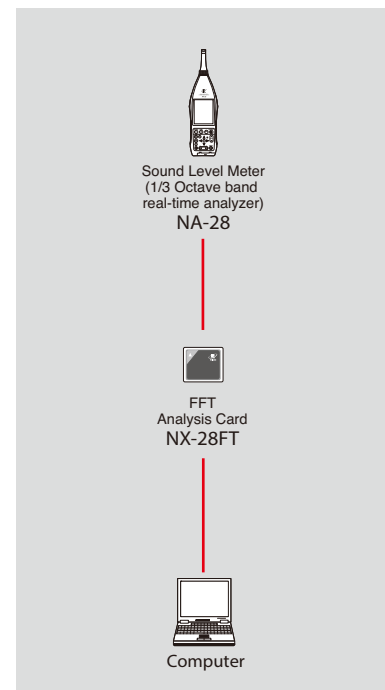
- Assessing the audibility of tones in noise
 

The aim of the objective method is to assess the prominence of tones in the same way as average listeners based on the psychoacoustic concept of critical bands.
- Target sounds
 

Steady and varying tones, narrow-band noise, low frequency tones



Tonal Audibility Calculation Program



# 14

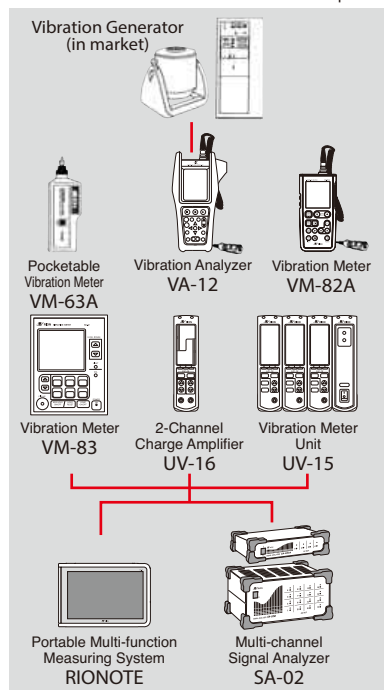
## Measurement of Mechanical Vibrations

Vibration measurements are most commonly carried out using PV series piezoelectric accelerometers as the sensor providing the input signal. Because there will be considerable differences in the magnitude of vibrations, depending on the measurement object, RION offers a wide range of accelerometers with different sensitivity levels and dimensions. Velocity information can be obtained by integrating the acceleration figures. Velocity can then be converted to displacement by further integration. The RION product lineup in the category of portable vibration meters includes the Pocketable Vibration Meter VM-63A, the Vibration Meter VM-82A, and the Vibration Analyzer VA-12 with built-in FFT analysis function. In the larger stationary type unit category, RION offers. The Vibration Meter VM-83, which also supports servo accelerometers, and the UV series charge amplifiers, such as the UV-15 and UV-16, which support a multi-channel configuration for simultaneous measurement.

To perform vibration analysis, the Vibration Analyzer VA-12, the Portable Multi-function Measuring System RIONOTE with FFT analysis\* and 1/1, 1/3, and 1/12\* octave band analysis\* capability, or the Multi-Channel Signal Analyzer SA-02 can be used.

When measuring vibration characteristics of machine parts and facilities, a vibration source is commonly used. Various types of containing, different output levels, are available to match the size of the object under test.

- \* SA-02 only
- \* RIONOTE is optional



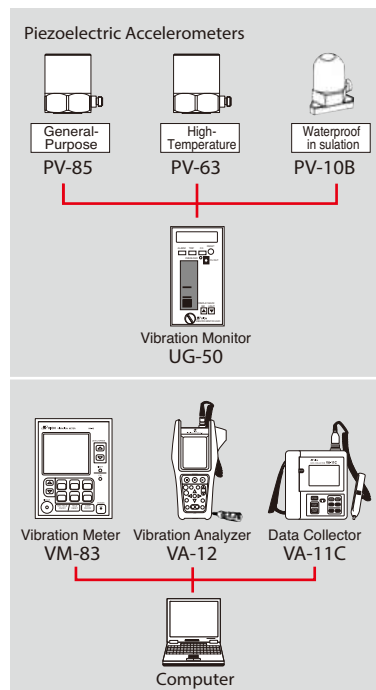
# 15

## Vibration Monitoring

Vibration monitoring is an important tool for detecting symptoms of impending problems in machinery and for implementing preventive maintenance. In the semiconductor industry and other sectors that require high accuracy manufacturing, vibration monitoring helps to improve yield and facilitates quality control. There are two basic patterns for vibration monitoring: continuous monitoring where vibration levels are automatically monitored on an ongoing basis and an alarm is triggered when a certain level is exceeded, and periodic monitoring at regular intervals combined with trend analysis designed to assess and manage the condition of the equipment.

RION offers a range of vibration accelerometers suitable for constant monitoring including general-purpose, high-temperature, water-proof and insulated types, and accelerometers with integrated preamplifiers. The Vibration Monitor UG-50 is suitable for such applications and offers the capability to output an alarm signal.

The Vibration Analyzer VA-12/11C and the Vibration Meter VM-83 can be connected to a computer for configuring a constant monitoring system.



# 16

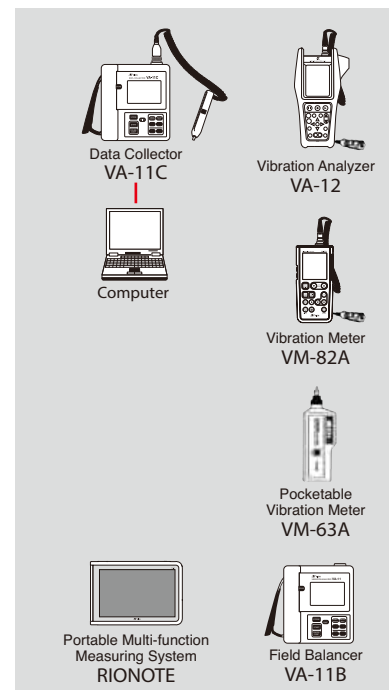
## Industrial Machinery Equipment Diagnosis

All machines use either rotation, reciprocal movement, impact, or some other form of motion to achieve their purpose. If a problem occurs somewhere, unwanted vibration will increase. Normally, simple diagnosis is carried out on a regular schedule to establish the normal/abnormal status of equipment. When a problem is detected, precision diagnosis is performed to obtain in-depth knowledge about the condition.

Products suitable for simple diagnosis include the General-Purpose Vibration Meter VM-82A and the Pocketable Vibration Meter VM-63A. These allow checking multiple pieces of machinery within a short time, using simple procedures.

For precision diagnosis, the Vibration Analyzer VA-12 and Data Collector VA-11C with built-in FFT analysis function are well suited.

Other equipment includes the Field Balancer VA-11B which has an integrated FFT analyzer and can perform balancing functions in the field.



# Measuring Instrument Combinations

## 17

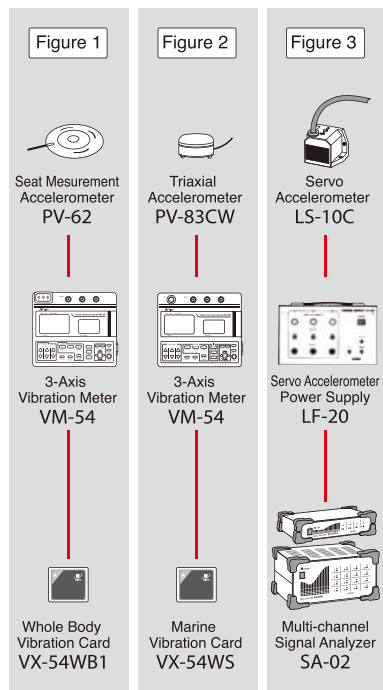
### Whole-Body Vibration Measurement

Vibrations are transmitted to the human body via the feet when standing, via the posterior when seated, and via the back when leaning on a backrest.

The influence of such vibrations on humans can be evaluated under many aspects including vibration perception, comfort, health hazards, and motion sickness. ISO 2631 specifies many different frequency compensation circuits for judging vibration depending on direction as well as rotational vibration. ISO 2631 compliant measurements can be made by using the 3-Axis Vibration Meter VM-54 combined with the Whole Body Vibration Card VX-54WB/VX-54WB1 or Marine Vibration Card VX-54WS.

For measurement of seat vibrations and evaluation of ride quality, the Seat Measurement Accelerometer PV-62 is mounted to the measurement target and connected to the 3-Channel Preamplifier VP-80, as shown in (Figure 1).

For evaluation of buildings and ride quality in ships, vibration measurement can also be carried out with the Accelerometer PV-83CW (supplied with VX-54WS), as shown in (Figure 2). When making motion sickness related measurements, the frequency range from 0.1 to 0.5 Hz is relevant. A suitable measurement setup consists of the Servo Accelerometer LS-10C for detecting vibrations, connected to Multi-Channel Analyzer SA-02 via the Servo Accelerometer Power Supply LF-20 (Figure 3).



## 18

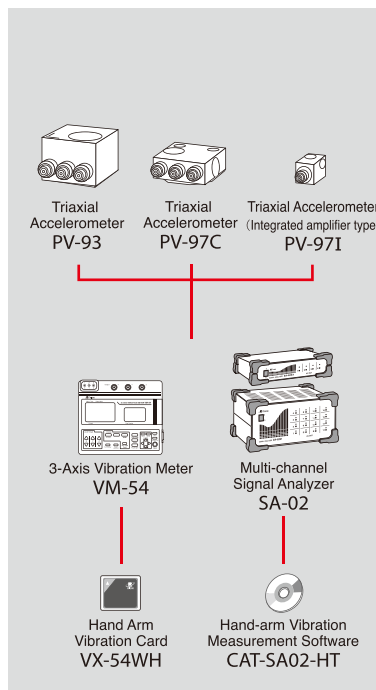
### Hand-arm Vibration Measurement

In the work environment, hand-arm vibration leading to an ailment called Raynaud's disease can pose a serious problem. This kind of vibration-related ailment, where blood circulation in the hand and fingers decreases causing them to appear white, is often due to the use of chain saws, rock drilling machines and other hand-held or hand-guided power tools that produce vibrations.

ISO 5349 compliant quantitative evaluation of such vibrations is possible by using the 3-Axis Vibration Meter VM-54 together with the Hand-Arm Vibration Card VX-54WH.

To devise measures for preventing such vibrations, the vibration exposure can be determined by a Triaxial vibration component measurement performed on the handle of the tool in question. For this purpose, the Triaxial Accelerometer PV-93/97C/97I or multiple single-axis accelerometers PV-90B/90I are combined with the 3-Channel Preamplifier VP-80 and connected to the VM-54 in which the Hand-Arm Vibration Card VX-54WH has been installed.

It is also possible to measure the hand-arm vibration using the Multi-Channel Signal Analyzer SA-02 series with the software CAT-SA02-HT.



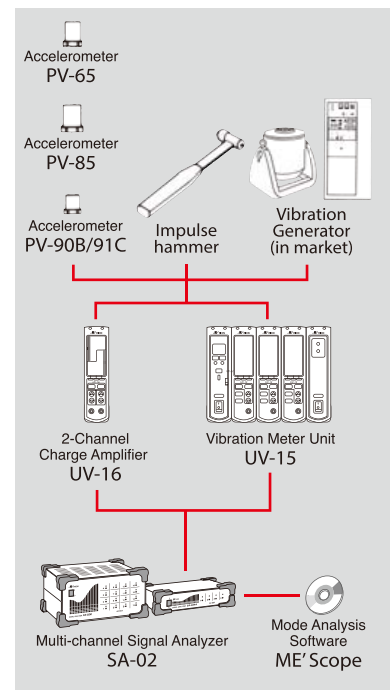
## 19

### Mode Analysis

Analyzing the state and type of vibrations occurring in objects is an important approach that helps to detect early signs of problems, prevent breakdowns, and reduce the emission of noise. Test mode analysis is a method that uses vibration modes for creating models of vibration patterns. It is especially useful in exploring causes and countermeasures for resonance phenomena and other vibration and noise related problems.

An impulse hammer is used to create a controlled impact, and the resulting vibrations are measured in 3 directions on the entire surface, using suitable accelerometers such as the PV-90B/91C. A Multi-Channel Analyzer of the SA-02 series and the Mode Analysis Software ME Scope are then employed to perform the mode analysis. A large number of transfer function peaks can provide information about normal mode vibration frequency, mode shape, attenuation coefficient and other mode parameters.

Separate structure change simulation software makes it possible to study anticipated vibration mode changes that will result from physical changes to the machinery or the supporting structure. External force response analysis is also possible.

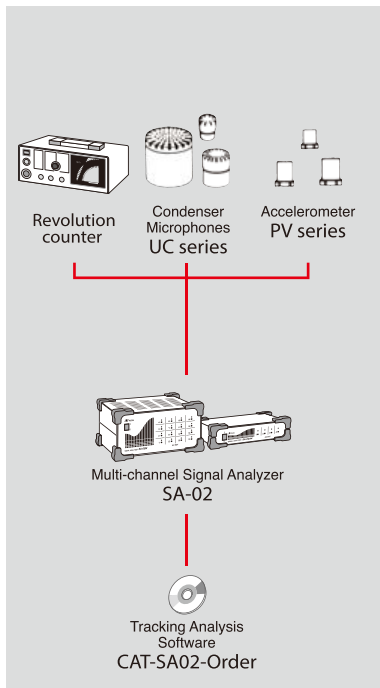


# 20

## Tracking Analysis System

Nearly all kinds of rotating machinery such as car engines and electric motors produce vibrations that depend on their revolution speed and gear ratio. Such vibrations then become the source of noise which contains predominantly frequency components resulting from the vibrations. Because the revolution speed of rotating machinery changes over time, it is effective to perform frequency analysis in sync with the changing revolution speed. This process is called tracking analysis. There are several types of tracking analysis, as described below.

- **Harmonics ratio analysis**  
Using the basic rotation speed as the fundamental, the higher-order harmonics components (2nd order, 3rd order...) are analyzed according to the rotation speed change.
- **RPM tracking analysis**  
This is a special form of harmonics ratio analysis, where the level change at one frequency or harmonic is plotted on a graph pegged to the rotation speed change.
- **Mode circle**  
Another form of harmonics ratio analysis, where the amplitude and phase change at one frequency or harmonic according to the rotation speed change is plotted on a coordinate system.
- **Spectrum map**  
The change in spectral pattern when the rotation speed is changed is plotted continuously and the level change is analyzed in a macro reference frame.
- **Campbell diagram**  
The rpm dependent spectral change is plotted on a graph where the amplitude value is represented by the diameter of a circle.



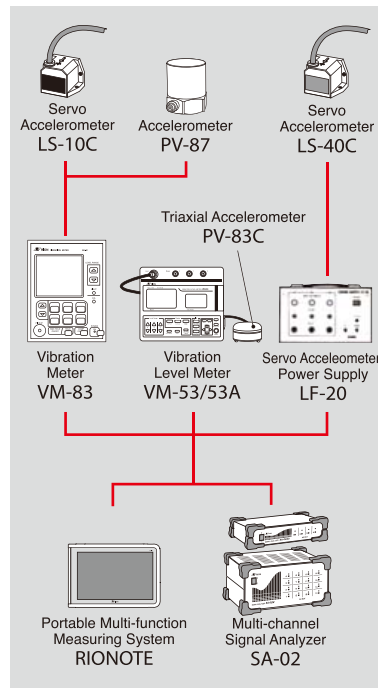
# 21

## Measurement of Low-Frequency Microvibrations

Low-level, low-frequency vibrations must be measured in various instances, such as when measuring minute floor vibrations to assess the occupation comfort of a building, checking for microvibrations in a clean room for semiconductor manufacturing or testing the efficiency of vibration damping systems for precision machinery. The Servo Accelerometer LS-10C/40C, Vibration Level Meter VM-53/53A or the high-output accelerometer PV-87 in combination with the Vibration Meter VM-83 are suitable for such purposes. It is also possible to perform frequency analysis and evaluation with the Multi-Channel Signal Analyzer SA-02 series, Portable Multi-function Measuring System RIONOTE\*.

The evaluation of floor vibrations uses the floor response waveform for determining vibration frequency, displacement, velocity, acceleration and attenuation constants. These are then compared to reference curves for actual evaluation. For testing the efficiency of vibration damping systems, sensors are mounted on the floor and to the mounting bed of the object under test.

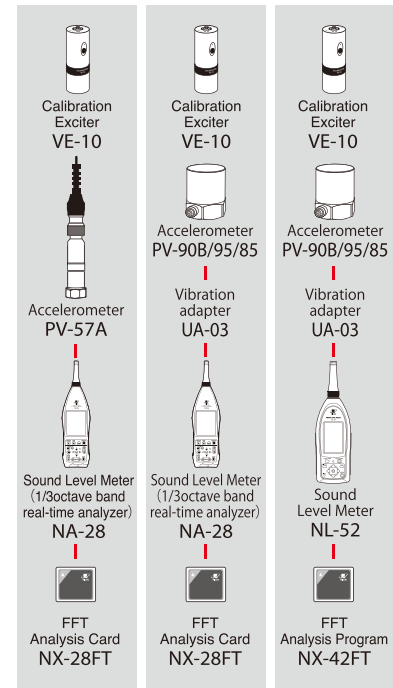
\* RIONOTE is optional (FFT analysis program or 1/3 Octave analysis program can be chosen.)



# 22

## Vibration measurement with sound level meter

By connecting a vibration sensor to the sound level meter, measurement of vibrations becomes possible.



# Outline NOISE AND SOUND LEVEL METERS

## Sound and Noise

What is commonly called "sound" is actually vibrations of air. Various objects, when rubbed or tapped, can become sound sources. The vibration of the sound source object causes the adjacent air to vibrate and these vibrations are transmitted to the ear where they are perceived as sound.

In our everyday environment, there are many different kinds of sounds, but humans do not respond to all of these. Rather, we subjectively make decisions and focus only on certain sounds that we want to hear. Other sounds that are not important, often inconvenient or disturbing, are sounds that are undesirable or unnecessary. Such sounds are called "noise". Rather than containing certain physical properties, what defines noise is a subjective characteristic that is specific to the listener. Sound that is too loud, unpleasant, or that draws attention in a certain direction is commonly judged as noise.

## Physical and Sensuous Value of Sound

The physical magnitude of sound is sound pressure, representing tiny changes in atmospheric pressure, the unit measured by Pascal (Pa). The range of sound pressure that can be detected extends from  $20\mu\text{Pa}$  to  $200\text{ Pa}$ , a difference of a factor of as much as 10 million times. The loudness of a sound as perceived is proportional to the logarithmic value of the sound pressure. The sound magnitude is expressed as a sound pressure level in decibel (dB), using the smallest sound that can be heard ( $20\mu\text{Pa}$ ) as reference, and covering a range from 0 dB to 140 dB.

The sensitivity of the human ear differs depending on the frequency of the sound. The same sound pressure can be perceived differently at different frequencies. When a certain sound is perceived equal to the sound pressure level PdB at 1 kHz, the loudness level of that sound is said to be Pphon. Figure 2 shows the relationship between the loudness level of a pure tone and its frequency. The curves in this graph are called equal loudness curves. As can be seen from the graph, the physical magnitude of a sound and its subjective magnitude are not the same. Rather, there is a complex relationship between the two.

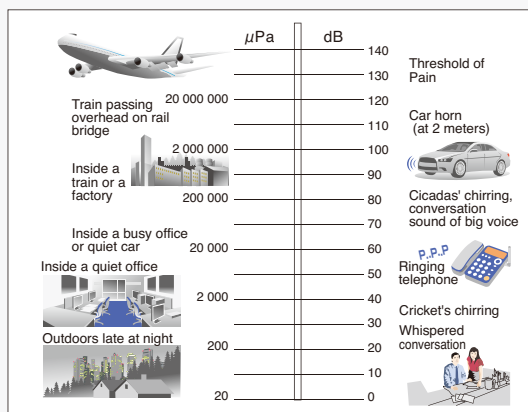


Fig. 1 Sound pressure and sound pressure level

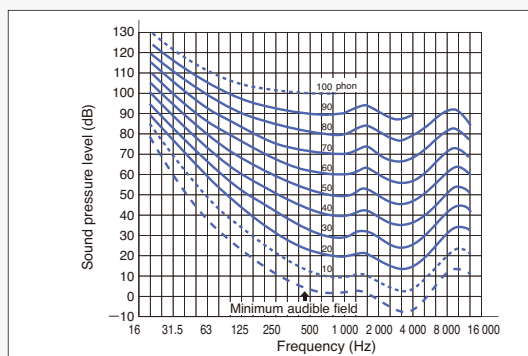


Fig. 2 Equal loudness curves of sound

## Sound Level and Sound Level Meter

Sound Level Meter is a device for turning physical properties of sound into numeric values. Psychological, physiological and subjective aspects cannot be measured. A reverse curve corresponding to the equal loudness curve at 40 phons is applied to the sound pressure (this is called "A"-frequency weighting). The resulting level is called A-weighted sound level and is expressed in dB.

### What is equivalent continuous sound level $L_{eq}$ ?

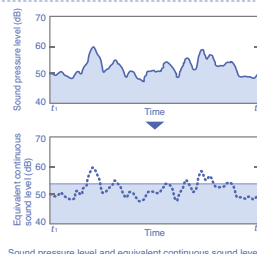
Equivalent continuous sound level  $L_{eq}$  is used for environmental noise evaluation.

#### Equivalent continuous sound level

The equivalent continuous sound level  $L_{eq}$  is the constant sound level which has the total sound energy equivalent to the energy of an actual fluctuating sound produced over a given period of time. As an example, consider the illustration at right. In the top graph, the sound level fluctuates from 47 to 60 dB within the time interval  $t_1$  to  $t_2$ . When the total energy of this sound is equated to a constant sound level over the same period, the 53 dB value (bottom graph) is obtained.

#### $L_{eq}$ measurement

The equivalent continuous sound level can be automatically calculated by a sound level meter with built-in  $L_{eq}$  function.



## Standards of Sound Level Meters

Sound level meters are divided into two categories: Class 1 and Class 2. There is a difference in performance between these classes. Performance specifications and test methods of sound level meters are specified in the international standards IEC 61672 series. Two performance categories, Class 1 and Class 2, are specified in the standard. Basically, specifications for Class 1 and Class 2 sound level meters have the same design goals and differ in the tolerance limits. Tolerance limits for Class 2 specifications are greater than, or equal to, those for Class 1 specifications.

Some common terms used having with special meanings and relating to sound level meters are listed below.

### ① Frequency weightings

The different sensitivity of the human ear at different frequencies is represented by the "A" and "C" weightings as shown in Figure 3. When measured with the "A" weightings, the result is close to the subjective sound level impression. When measured with the "C" weightings, the result is close to the sound pressure level (physical quantity).

### ② Time weightings

Sound level is obtained by averaging the signal corresponding to the sound pressure raised to the second power. Two kinds of time weightings are used, which differ in the time constant used for averaging: F (Fast, time constant 125 ms) and S (Slow, time constant 1 s). For normal noise measurements, the F-time weighting is used. In some countries, a third characteristic called Impulse is used for the measurement of impulsive and impact noise.

### ③ Type approval and test certification (In Japan)

Type approval refers to a process by which the government tests sound level meters provided by domestic manufacturers and importers and ascertains that their construction and performance is in accordance with the stipulations of the Measurement Act. When a sound level meter model has been type approved, most items can be omitted during testing for individual product certification.

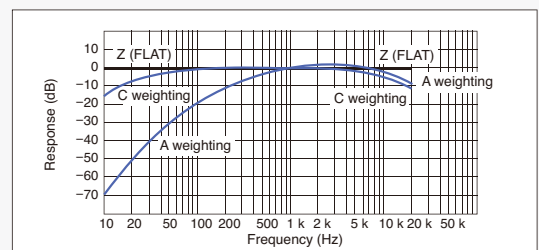


Fig. 3 Frequency weightings of sound level meters

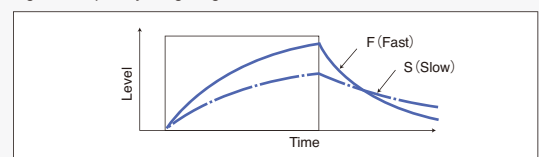


Fig. 4 Time weightings of sound level meters

## Sound Level Meter Types

Many different kinds of sound level meters exist. The optimum device to be chosen will depend on the purpose of the measurement, the required accuracy, and the data processing method that is to be employed. Some of the main categories are listed below:

### ① Sound Level Meter Class 1/Class 2 (NL series)

These are the most common types of sound level meters, whose performance are defined by the applicable standards. The difference is in accuracy.

### ② High-Precision Measuring Amplifier

A wide range of frequency and level range settings make this product suitable for many different measurements.

### ③ Sound Level Meter with Analysis Functions (NA-28, NL-62 with NX-62RT/42FT, NL-52/42 with NX-42RT/42FT)

These are portable sound level meters with real-time analysis or FFT analysis functions.

### ④ Environmental Noise Monitor

This type of device performs data processing according to standards and regulations. It serves for measurements as well as for observation and monitoring of noise.

### ⑤ Sound Level Meter (With low-frequency sound measurement function). (NL-62 with NX-62RT)

Allows G-weighted sound level measurement in conjunction with 1/3 octave real-time analysis.

### ⑥ Sound Level Display

Designed for mounting in outdoor urban locations, this type of device can display the ambient sound level at a specific point.

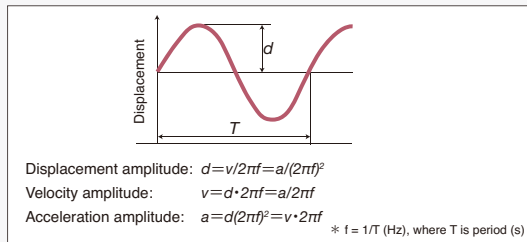


## Importance of Vibration Measurement

Normally, vibrations arising in an industrial or residential environment are clearly an unwanted phenomenon, except in some special cases. Such unwanted vibrations are not only unpleasant to humans but they can also shorten the life of machinery, impair product quality, and cause defects and breakdowns. Sound arising from vibrations is also an environmental problem. Finding solutions to the multi-faceted problems presented by vibrations therefore is an important and pressing task. RION vibration meters are effective tools used to collect information in a wide range of fields. These include the maintenance, monitoring and testing of machinery, product design and research, quality control, noise and vibration countermeasure research, evaluation of tools and vehicles according to labor environment and hygienic regulations, vibration pollution control, and seismographic data collection and disaster prevention.

### How to Measure the Magnitude of Vibrations

There are three vibration parameters which can be used to express the magnitude of vibration: displacement, velocity, and acceleration. Which of these factors is used depends on the type of vibration and the measurement objective. The relationship between them in the case of a sine wave vibration is shown in the illustration below.



Units used for the magnitude of vibration are listed in the table below.

Displacement	mm, $\mu\text{m}$ ( $1 \mu\text{m} = 10^{-3} \text{ mm}$ )
Velocity	mm/s
Acceleration	$\text{m/s}^2$ , $\text{cm/s}^2$ Gal ( $1 \text{ Gal} = 1 \text{ cm/s}^2$ )
Vibration acceleration	$\text{dB}(\text{re } 10^{-5} \text{ m/s}^2)$ : JIS

### Vibration Meters for Mechanical Vibrations

When vibration meters are used for measuring machine vibrations, a suitable accelerometer must be selected depending on the type of mechanical. Accelerometers designed for low frequencies measure low acceleration levels and, thus, are highly sensitive. However, their larger size and mass result in low resonance frequency when mounted. Accelerometers for high frequency measure high acceleration levels and are normally compact and lightweight with low sensitivity. RION offers a selection of piezoelectric accelerometers, covering a wide frequency range. By combining an accelerometer with a vibration meter that is designed to make the best use of its characteristics, a wide range of measurements can be performed with optimum efficiency. Piezoelectric accelerometers are normally used for measuring vibrations with a frequency of more than 1 Hz. This type of accelerometer has good high-frequency characteristics and is especially suited for measuring vibrations in the upper frequency range. Major applications are vibration monitoring and diagnostic checks of mechanical installations in industrial plants. Piezoelectric accelerometers generate a certain amount of low-frequency noise when ambient temperatures change (so-called pyronoise). Depending on the application, the accelerometers must therefore be protected from temperature changes. When velocity and displacement to be used for evaluation are obtained by integrating acceleration, pyronoise will be evaluated as integral products, pyronoise will be amplified and must therefore be given special consideration. With the exception of types containing, piezoelectric accelerometers require a charge amplifier.

### What is the piezoelectric accelerometer?

Certain types of crystals will generate an electrical charge on their surface when mechanical distortion is applied. The amount of the charge is proportional to the external force given to the crystal. This phenomenon is called the piezoelectric effect, and the piezoelectric accelerometer makes use of it. This accelerometer type can be made compact and lightweight, covering a wide vibration acceleration and vibration frequency range. Accuracy and reliability are also very good, and handling is simple. Thanks to these characteristics, piezoelectric accelerometers are widely used from on-site vibration measurements to a reference accelerometer. There are two types of piezoelectric accelerometers which differ in the way the piezoelectric element is used. Figure 1 shows the two construction principles, namely a shear-type accelerometer and a compression-type accelerometer.

Fig. 1 Piezoelectric accelerometer types

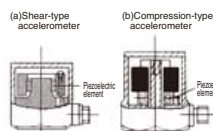
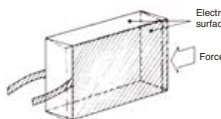


Fig. 2 Principle of shear-type accelerometer



#### Shear-type pickup (accelerometer)

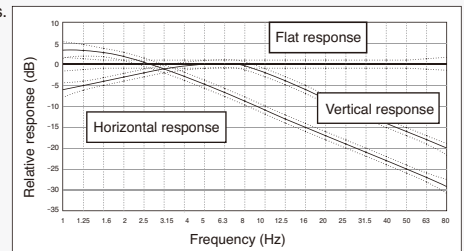
The accelerometer is constructed in such a way that the piezoelectric element is subjected to a shear force. Sensitivity is high, which allows for small dimensions. As shown in Figure 2, pyronoise (pyroelectric output) caused by temperature changes is low, making it possible to measure low-level vibrations and vibrations in the low frequency range. This type is useful for monitoring vibrations in mechanical and buildings, and for seismometer applications.

#### Compression-type pickup (accelerometer)

This type of accelerometer employs a weight on top of the piezoelectric element. The structure is simple and mechanical strength high, making it suitable for high acceleration levels and shock measurements.

### Measurement of Vibration Pollution (Vibration Level Meter)

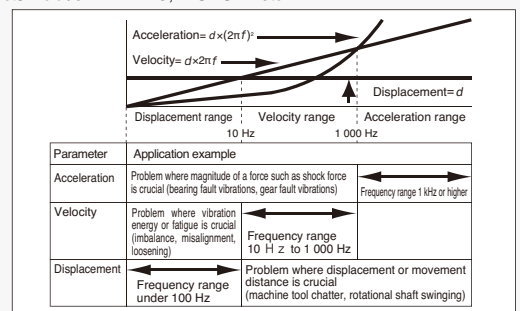
The evaluation of vibrations considered as environmental pollution uses the vibration level (dB), which is based on the pattern of human sensitivity to vibration. This is the same principle employed for the measurement and evaluation of sound pressure levels considered noise. Compensation according to human sensitivity characteristics is applied to the measured physical quantity (acceleration in the case of vibration pollution), and the resulting value forms the basis of evaluation. The illustration below shows the frequency response that is stipulated by JIS C 1510 for vibration level meters.



Allowable response range for vibration level meters

### Equipment Diagnosis

- Types of equipment maintenance
  - Depending on the importance of the equipment, there are various kinds of maintenance, required. In each case, the objective is to achieve maximum efficiency at minimum cost.
    - Breakdown Maintenance (BM)
      - The principle here is to repair equipment when it breaks down.
    - Time-Based Maintenance (TBM)
      - Parts are replaced at regular intervals regardless of breakdown and schedules are established for routine checks, disassembly and repairs. This is a kind of Preventive Maintenance (PM).
    - Condition-Based Maintenance (CBM)
      - The operational condition of machinery is regularly measured to determine the degree of deterioration or the existence of other factors equipment breakdown, Mechanical Checks, disassembly, repairs, and parts replacement are then carried out as a result.
      - This is a kind of predictive maintenance (PRM).
- Equipment diagnosis by vibration measurement
  - The vibration method diagnosis by vibration measurement involves measuring vibrations of the equipment in operation for early detection of problems and taking optimum countermeasures. This is effective for key equipment directly linked to manufacturing facilities, particularly rotating (machines).
- Frequency response on vibration parameter
  - Depending on the vibration frequency, each amplitude response of displacement, velocity and acceleration will be different. During equipment diagnosis, the following distinctions must be made; It is important to have a clear understanding of which type of vibration is likely to increase and should use an appropriate vibration parameter depending on abnormality. In some cases, both velocity and acceleration may have to be measured.
- Diagnosis methods
  - Simple diagnosis
    - For this type of diagnosis, vibration measurements are carried out periodically by service personnel; The trend management of measurement results are then used for preventive maintenance of equipment.
    - Suitable products include VM-82A, VM-63A, VA-12, etc.
  - Precision diagnosis
    - Vibration signals are processed using FFT analysis or other similar techniques to identify problem areas and to initiate checks and repairs.
    - Suitable products include VA-12/11C, RIONOTE etc.



Vibration parameter

# Outline FREQUENCY AND FREQUENCY ANALYZERS

## Frequency Analysis and Frequency analyzers

Normally, sound and vibration phenomena occur with specific frequency characteristics. Multiple frequency components coexist in complex patterns. Determining the respective levels of these frequency components is called frequency analysis.

Countermeasures for noise or vibrations will not be effective over the entire frequency range. Therefore, target values and evaluation criteria must be set separately for the various frequency bands.

### Frequency analysis classification

Frequency analyzers can be grouped in various categories, according to usage purpose, as listed in Table 1.

Table 1 Frequency analysis types

Purpose	Filter	Frequency analyzer
<ul style="list-style-type: none"> <li>● Evaluation of sensory impact of sound and vibration</li> <li>● Evaluation of countermeasures</li> <li>● Materials development and evaluation</li> </ul>	Constant ratio 1/1 octave band 1/3 octave band	NA-28 SA-02 SX-A1RT (RIONOTE) NX-62RT (NL-62) NX-42RT (NL-52/42) VX-53RT (VM-53A)
<ul style="list-style-type: none"> <li>● Identify noise and vibration phenomena</li> <li>● Noise and vibration countermeasures</li> <li>● Materials development and evaluation</li> </ul>	Constant width FFT (narrow-band analysis)	NX-28FT (NA-28) SX-A1FT (RIONOTE) SA-02 NX-42FT (NL-62/52/42) VA-12/11C

#### ① Frequency analyzers

Devices for the frequency analysis of sound and vibrations can be divided into real-time analyzers and FFT analyzers, depending on their purpose. Figure 1 shows the analysis results of the same signal waveform processed on 1/3 octave band analysis and FFT analysis. A real-time analyzer employs a number of bandpass filters with a constant ratio (1/1, 1/3, or 1/N octave bands). Frequency analysis performed with such a device serves mainly to assess the sensory impact of sound or vibration phenomena.

The FFT analyzer is calculated by constant width band. Frequency analysis performed with such a device serves mainly to assess the physical magnitude of sound or vibration phenomena.

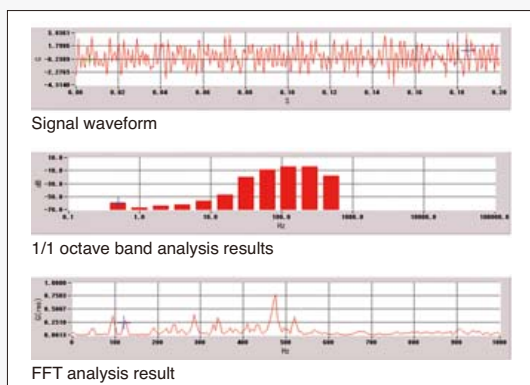


Fig. 1 1/1 octave band analysis results, FFT analysis result

#### ② Constant ratio type filter and constant width type filter

Filters used in frequency analyzers are of two types: constant ratio and constant width. In a constant ratio filter, the width of the passband varies in proportion to the center frequency while in a constant width filter, the passband width is always the same. Figure 2 illustrates the underlying principle. When a logarithmic scale is used for the frequency axis, the bandwidth of the constant ratio filter is shown as a constant, while the bandwidth of the constant width filter is shown as becoming narrower towards higher frequencies. When plotting frequency analysis results on a graph, it is therefore common to use a logarithmic frequency axis for a constant ratio filter and a linear scale for a fixed.

#### ③ Filter specifications

Octave band and 1/3 octave band analyzers for acoustic and vibration measurements are specified in JIS C 1513. Filter characteristics for octave band and 1/N octave band filters are specified in JIS C 1514. Internationally, the IEC 61260 is used.

The fact that filter specifications are governed by international standards means that data can be easily compared. However, for FFT analyzers there are no JIS or international standards. Therefore, different analysis results may be obtained depending on the performance and settings of the analyzer in use.

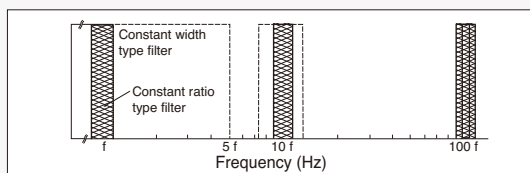


Fig. 2 Bandwidth representation for constant ratio and constant width filter on logarithmic scale

### Different Ways of Using Frequency Analyzers

#### ① Real-time analyzer

The most commonly used method for assessing the sensory impact of noise and vibration and for evaluating countermeasures is 1/1 octave and 1/3 octave analysis. Averaging can be carried out using the same frequency weighting and time weighting as the sound level meter or vibration level meter. This makes it possible to evaluate the actual impact that the noise or vibration phenomenon has on humans. The technique is used for many different tasks such as sound insulation measurements for architectural acoustics, evaluation of indoor noise, sound power level measurements, evaluation of building materials, sound quality evaluation, and propagation characteristics measurement.

#### ② FFT analyzer

An FFT analyzer serves for assessing the physical aspects of sound or vibration phenomena and for devising suitable countermeasures. General applicability is good because analysis can be carried out in the time domain as well as in the frequency domain. Frequency resolution is excellent, which is essential for locating the sources of noise and vibrations, and the relationships between signals in multiple channels (for example, sound and vibration) can also be explored. FFT analyzers are extensively used in sound and vibration analysis of cars, machinery, computers, electric home appliances, etc., and in the development and evaluation of damping materials. Measurement types include mechanical impedance, mode analysis, intensity measurement, tracking analysis, propagation characteristics measurement, and sound quality measurement. FFT analyzers are indispensable tools in the fight against noise and vibrations.

### FFT and Signal Processing

#### ① FFT analyzer

The result of FFT (Fast Fourier Transform) analysis is characterized by constant bandwidth. In the input of an FFT analyzer, a low-pass filter (anti-aliasing filter) is used to remove signal components other than those of the bandwidth to be analyzed. Then, the A/D circuit converts the input into a digital signal, and time window processing is carried out. Finally, FFT processing is performed, resulting in discrete frequency analysis.

#### ② Signal processing

The FFT analyzer can also provide amplitude information and phase information. In the time domain, this includes time waveform, auto-correlation, cross-correlation, amplitude probability density function. In the frequency domain, spectrum, dual-channel cross-spectrum, transfer function, and coherence function can be calculated. Intensity measurement, as well as 1/1 and 1/3 octave band analysis (octave synthesis), can be carried out, and mode analysis and tracking analysis for the entire system are possible.

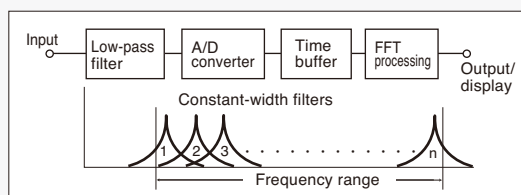
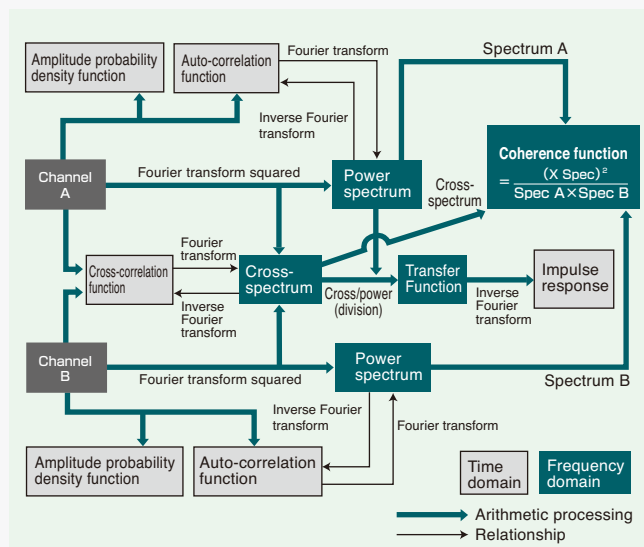


Fig. 3 FFT spectrum analyzer (spectrum analysis)

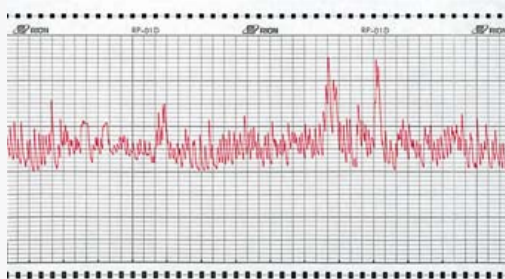
table 2 Relationship between various FFT analyzer functions



# Outline RECORDING SOUND AND VIBRATION

## Sound and Vibration Level Recording

- ① For recording the level of sound and vibrations, a device conforming to JIS C 1512 Level recorders for recording sound level and/or vibration level is used. Such a device uses the output signal of a sound level meter or vibration level meter.  
The operation characteristics of the recording pen can be selected.

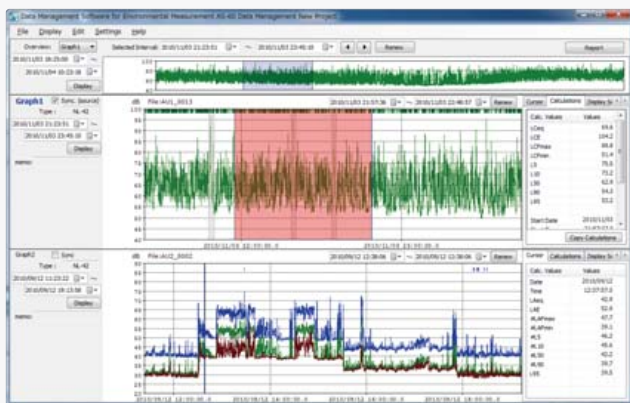


Sound level recording on Recording Paper RP-01D

- ② When a sound level meter or vibration level meter with integrated SD or CF card slot is used, level data can be directly recorded on a memory card, thereby realizing long-term recording. The data stored on the memory card can later be processed on a computer, either using dedicated software or a general application. Sound level and vibration level waveform information can be displayed and stored. Various other Functions are also possible (NL-62/52/42, VM-53A).

■ Memory card capacity and storage time for sound or vibration level (instantaneous value store every 100 ms)

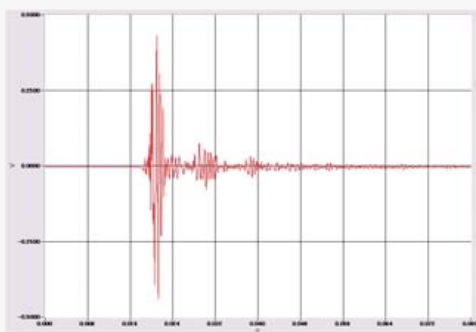
	Sound level meter	Vibration level meter (3-axis)
256 MB	20.8 days	7.1 days



Data management software for environmental measurement AS-60

## Sound and Vibration Waveform Recording

- ① Sound pressure waveform and vibration acceleration waveform information can be recorded for analysis making it possible to examine the transient characteristics of, for example, impulsive noise and vibration from blasting, gun fire, collision impact and other such phenomena. Waveform peak values can be measured, and frequency analysis performed.



Vibration waveform recording example (forging machine)

- ② Suitable products for waveform recording are waveform recorders (NX-28WR/NX-42WR, SA-02/RIONOTE) or data recorders (DA-21/40). These products use CF cards or SD cards as recording media. The recorded data can be played back and post-processed with analyzers or analyzer software and recorders.

- ③ Waveform data recorded on a memory card can be displayed and analyzed using dedicated application software (such as the Waveform Analysis Software AS-70). Recorded sound data (WAVE files) can be played back as real sound using Media Player or other suitable software.

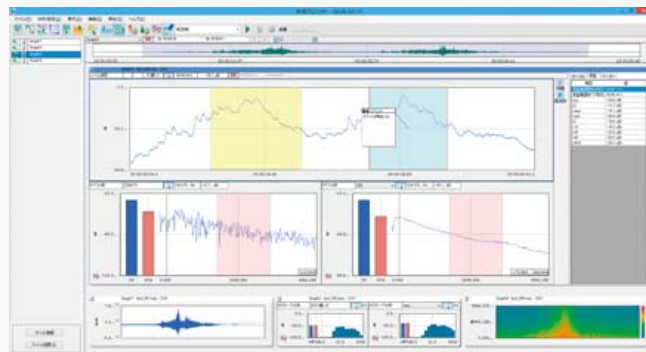
### ■ DA-21

		Frequency range (Hz)					
		100	500	1 000	5 000	10 000	20 000
Number of channels	1	1 066 h 40 m	213 h 20 m	106 h 40 m	21 h 20 m	10 h 40 m	5 h 20 m
	2	533 h 20 m	106 h 40 m	53 h 20 m	10 h 40 m	5 h 20 m	2 h 40 m
	3	355 h 32 m	71 h 06 m	35 h 33 m	7 h 06 m	3 h 33 m	1 h 46 m
	4	266 h 40 m	53 h 20 m	26 h 40 m	5 h 20 m	2 h 40 m	1 h 20 m

Reference for maximum recording time with 2 GB SD card

Sampling frequency: frequency range × 2.56 (or 2.4)

※ Use only RION supplied cards for assured operation.



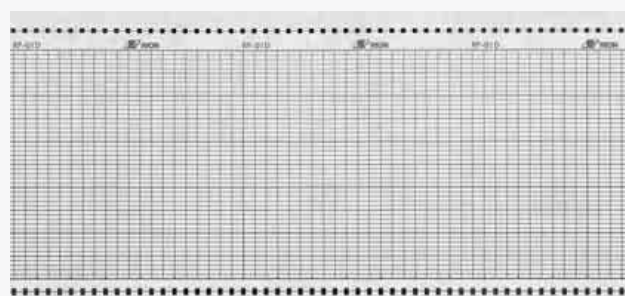
Waveform analysis screen example



Waveform analysis screen example

## Sound Level/Vibration Level Measurement Paper

- ① Recording Paper for level Recorder RP-01D(for 1ch)





# Knowledge in a Nutshell

## What is percentile noise level?

These are evaluation quantities used to measure sound occurrence which is irregular and where its level fluctuates drastically. A certain time period is considered for the measurement. When the sound level exceeds a certain level for  $N$  % of the time under consideration, its level is called the  $N$  percentile level. For example, if the measurement time is 10 minutes and 55 dB was exceeded for a total of 5 minutes, 55 dB is the 50 % percentile sound level (median value). If 55 dB was exceeded for a total of 30 seconds, 55 dB is  $L_5$  (5 % percentile level).

## What is sound in the low frequency range like?

The range from 1 Hz to 100 Hz is commonly referred to as the low frequency range. In particular, acoustic waves between 1 and 20 Hz, i.e. below the threshold of hearing, are called infrasound or subsonic waves. The NL-62 is a sound level meter that covers not only the range of audible noise but also allows measurement of the low-frequency sound range.

Noise in the audible range is often described as noisy or clamorous, referring directly to the quality of the sound, while low-frequency energy in the barely audible or inaudible range is usually described in psychological terms such as being unpleasant or oppressive. Normally, with a 10 Hz infrasound, a sound pressure level of 90 dB or more is said to be noticeable to humans, while at 20 Hz, the threshold is 80 dB. At higher levels, the phenomenon is experienced negatively, and the psychological terms mentioned above tend to be used.

## What is G weighting?

To evaluate the psychological and physiological effects of infrasound in the range from 1 to 20 Hz, the G weighting curve was established as ISO 7196 in March 1995. The curve is referenced to 10 Hz and uses the threshold values for human perception of infrasound. The principle is the same as that for A characteristics weighting employed in sound level meters, which uses 1 kHz as reference and simulates the characteristics of human hearing in the audible range.

## What is frequency analysis?

Sound and vibrations commonly have complex waveforms consisting of many different frequency components. The process of dividing such a complex waveform into discrete frequency components in order to examine the nature of the sound or vibration is called frequency analysis. Commonly used types of frequency analysis are 1/1, 1/3 octave band analysis, and FFT analysis.

## What are 1/1 octave band analysis and 1/3 octave band analysis?

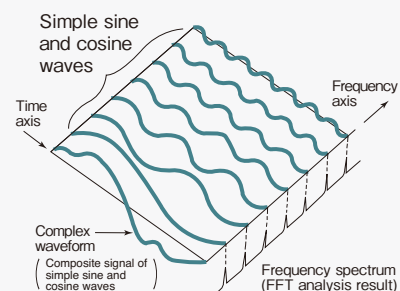
Our perception of the pitch of a sound is mainly determined by its frequency. The perceived difference in pitch between sounds is not proportional to the difference in frequency but to the ratio of the frequency. The bandpass filters used for frequency analysis come in two types: fixed ratio filters, where the ratio between the upper boundary frequency and lower boundary frequency of the filter is constant, and fixed width filter, where the difference between the upper boundary frequency and lower boundary frequency of the filter is constant. (For details, see page 35.) Analysis with the aim of evaluating noise normally uses fixed ratio filters (since these can more easily be made to approximate the subjective hearing impression of humans. A frequency ratio of 2 is called an octave, and a set of filters where the upper boundary frequency is 2 times the lower boundary frequency is called a 1/1 octave bandpass filter. The nominal center frequencies of a 1/1 octave band filter are 31.5, 63, 125, 250, 500, 1 000, 2 000 Hz, and so on. In other words, adjacent filters have a ratio of 2. When detailed frequency is required, 1/3 octave filters are used, which are centered on the frequencies 31.5, 40, 50, 63, 80, 100, 125 Hz, etc. Here, the adjacent filters have a ratio of 1.25 (one third of an octave).

## What is FFT (Fast Fourier Transform) analysis?

This method uses an algorithm called "Fast Fourier Transform" to divide a component signal with a seemingly irregular time cycle into a set of frequency spectrum components that make it possible to detect regularity in the signal.

FFT analysis is widely used for voice analysis, quality evaluation and fault detection in automobiles, electrical appliances and other products using acoustic and vibration signals.

Fourier Transform is named after the French mathematician Fourier (1768 to 1830) who postulated that any periodic function can be expressed as the sum of the trigonometric function. In 1965, Cooley and Tukey developed an algorithm based upon this concept and, several years later, this became available as an FFT program.



## What is an sound intensity measurement?

This kind of measurement allows sound to be considered as a quantity with a direction component (vector quantity).

The instantaneous sound pressure passing a point in a fluid and the instantaneous particle velocity are multiplied, resulting in the intensity vector (vector quantity). In other words, the sound power ( $W/m^2$ ) that passes the unit area in the unit time is the sound intensity. By measuring the sound intensity, the sound distribution on the measurement plane and the depth of the sound source can be visualized.

# Quality Documentation

RION CO., LTD. makes available various documents certifying the quality of its products

## Quality Documentation

- Test Report
- Certificate of Calibration
- Traceability Chart
- Reference Device Test Report or Certificate of Calibration



Anechoic chamber

## Quality Assurance and Reliability Testing

Regarding measuring instruments, high quality and reliability mean not only free of defect or from breakdown, but the product must also return specified measurement values within a specified range and period. In other words, users of the product must always be able to place full trust in its performance as a measurement device. This is the basic tenet of RION as a measurement device manufacturer.

Besides the above quality and reliability requirements, there are various other demands that are rapidly evolving and changing the marketplace for measuring instruments. Some of the characteristics that users desire are compact size, ease of use, and versatile functionality.

In order to create products that meet these demands, RION CO.,LTD. is drawing on lengthy experience and field and reliability data accumulated over the course of many years from the design stage onwards, RION follows a systematic and well thought-out program for ensuring that our products will accomplish exactly what they are designed to. Important aspects of this process are the strict selection and management of parts and materials, extensive testing at every stage of development and production, and a thorough traceability system for ensuring compliance with national and international standards and industry norms.



Environmental test chamber for products



Absolute calibration setup for vibration accelerometers

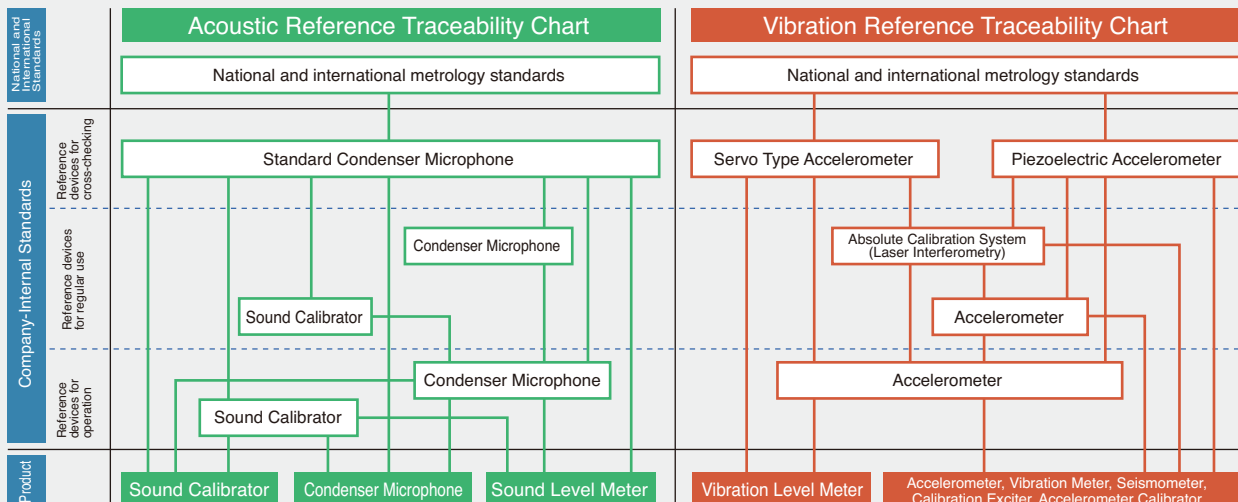
## Absolute Calibration of Vibration Accelerometers

The accuracy of values used for measuring length and weight is always a concern. The same applies for the measurement of vibrations.

RION CO.,LTD. as a manufacturer of vibration meters, has, therefore, developed a system for absolute calibration of vibration accelerometers.

This system uses laser interferometry to assure high calibration accuracy. It is employed in the manufacturing process of standard accelerometers and also serves for quality control of vibration measurement devices.

In 1984, a round-robin test was carried out to determine the calibration accuracy of major research institutions around the world. Kobayasi Institute of Physical Research and RION CO., LTD. participated in this test proving the high accuracy of this calibration system.



## Company Outline



# RSC

## RION Service Center CO., LTD.

<http://www.rion-service.co.jp/>



RION Service Center (RSC) was established with the express purpose of handling service and maintenance tasks for the wide range of measuring instruments produced by RION Co., Ltd, a company that boasts immense technological expertise and continues to develop advanced product technology.

RSC has three technical departments covering the fields of medical testing devices used in otolaryngology, acoustic and vibration measuring instruments including seismometers and particle counters used for measuring airborne and liquid-borne particle density. The administration department is responsible for coordinating overall operations. A separate quality assurance department has also been established, and a thorough quality management system put in place with the aim of ensuring that customers are able to benefit from the outstanding precision and accuracy of RION products for many years to come.

"True service for the 21st century" is our motto.

Foundation date: April 10, 2002  
Start of operations: August 5, 2002  
Capital: JPYen 30 million  
Number of staff: 78

#### Registration and certifications:

Designated service provider for special measurement instrument  
Service provider for medical equipment  
ISO 9001 Certification (JQA-QMA11621)  
JCSS (Japan Calibration Service System) Accredited  
Calibration Laboratory (JCSS 0217)  
Registered for Certification of Measuring Instruments (Sound Pressure Level)

#### Locations:

##### Head Office and Plant

2-22-2 Hyoe, Hachioji-shi, Tokyo, Japan  
Tel +81-42-632-1122 Fax +81-42-632-1140

##### Tohoku Office

25-13 Minami-Onoda, Taihaku-ku, Sendai, Miyagi Pref., Japan  
Tel +81-22-738-7501 Fax +81-22-738-7502

##### West Japan Office

Yokoyama Bldg. 6F, 2-5-5 Umeda, Kita-ku, Osaka, Japan  
Tel +81-6-6346-3771 Fax +81-6-6346-3673

## Areas of Activity

### Repair, checking, and calibration (in-house servicing)

Based on standards and procedure guidelines developed in house, we service, adjust, and calibrate products to bring them to the same condition as when shipped new.



Calibration bench

### On-site servicing

For permanently installed equipment or products that cannot be moved, we offer on-site servicing.

### Instrumental error testing

After performing servicing and calibration in house, we offer application services for official instrumental error testing/public certification \* for sound level meters, vibration level meters, and level recorders. We follow through until the official certification is obtained.

\* Performed at the request of the customer

### ISO compliance documentation

We issue calibration certificates and traceability charts, as well as reference device calibration and inspection certificates.

Reference equipment used for calibration is traceability certified according to national standards.

### Inspection certificates for individual products

Inspection certificates for individual products are issued according to RION specifications.

### Maintenance/service contracts

#### ① Yearly maintenance contract

Based on a yearly maintenance contract, we provide periodic checks as well as emergency repair services in case of a problem.

#### ② Spot maintenance contract

This type of contract covers a one-time maintenance procedure based on procedure manuals (specifications).



### Measurement

We carry out measurements in the areas of general environmental noise, aircraft noise, sound absorption coefficient, transmission loss, and sound power level. Other types of sound and vibration measurements can also be arranged by consultation. All required equipment is provided.

#### Aircraft noise measurement system



### Custom-made cables

We manufacture cables used for RION measuring instruments to custom lengths. Cost is calculated based on cable type and length.

# Kobayasi Institute of Physical Research

E-mail [info@kobayasi-riken.or.jp](mailto:info@kobayasi-riken.or.jp)  
 URL <http://www.kobayasi-riken.or.jp/>

## Research Facilities

The institute consists of a main building, a test chamber block for architectural acoustics, as well as eight other buildings with combined research and testing facilities. There are four test chambers for wall properties, two for floor properties, six reverberation chambers, one anechoic chamber, four semi-anechoic chambers, and one low-frequency test chamber. The building for the architectural acoustics division is counted among the best research facilities in Japan, making an important contribution to deepening the knowledge of architectural acoustics.

### ● Designated by Ministry of Land, Infrastructure and Transport

Designated evaluation facility according to Architecture Basic Law  
 (Boundary sound insulation structure)

### ● Registered as measurement certification facility

Tokyo Metropolitan, No. 549 (Sound Pressure Level)  
 No. 977 (Vibration Acceleration Level)



## Anechoic Room

This specially constructed room is insulated from all outside sound and vibrations. Internal surfaces are covered with 60 cm thick glass fiber blocks for sound absorption, with increasing density in deeper layers. This design ensures excellent absorption characteristics for incident sound from any angle.



## Architectural Acoustics Division Test Chamber Block

This building houses four chambers (two facing pairs) for testing sound insulation of building elements (walls) according to ISO 140-1 and 140-3, as well as two floor test chambers. The two pairs of wall test chambers use different methods for fastening the test object cassette. The two chambers which serve for floor impact sound testing have a floor base thickness of 200 mm and 150 mm respectively, to allow for testing with different structural parameters.



Interior of test chamber



Foundation Date: August 24, 1940

Chairman: Mitsuyasu Yamashita (Doctor of Engineering)

Location: 3-20-41 Higashi-Motomachi, Kokubunji, Tokyo,  
 185-0022 Japan Tel +81-42-321-2841

## ■ History

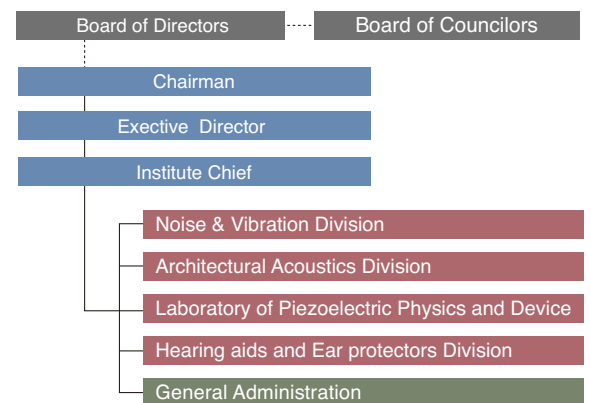
Based on a public grant by the industrialist Uneo Kobayasi, the concept for the Kobayasi Institute of Physical Research was worked out by Koji Sato, Takuzo Sakai, and others. In August 1940, permission to establish a non-profit foundation was granted by the Japanese Ministry of Education.

Originally, research was to cover the entire scope of physical science, but eventually the main focus came to be acoustics, which continues to this day.

In 1943, the development of a method to artificially grow Rochelle salt prompted the founding of Kobayashi-Riken Seisakusho Ltd., which is now Rion Corporation.

The institute became a general incorporated foundation in April 2013.

## Organization



## Scale Model Experiment Chamber

This chamber is used for scale model experiments aimed at clarifying noise propagation characteristics and collecting data for noise prediction. It is a large acoustic chamber insulated from outside sound with a large, flat floor space. Except for the floor, all internal surfaces are treated with sound absorbing materials to prevent reverberation.

# Company Outline



<http://www.rion.co.jp/>



RION was founded in 1944, with the aim of developing commercial products based on scientific work carried out at the Kobayasi Institute of Physical Research. Ever since its founding, RION CO., LTD. has upheld the belief that acoustics is a science of great importance to the well-being and welfare of society. RION has continued to introduce products based on this philosophy, aimed squarely at improving quality of life. A healthy and content society is the vision that guides our activities.

Rion's business activities are organized in two divisions: the medical equipment division and the environmental equipment division.

The former comprises hearing aids and other auditory equipment for hearing impaired persons. A central product category is medical devices in the field of otorhinolaryngology.

The environmental equipment division handles sound and vibration level meters, seismometers and other acoustic/vibration measurement devices, as well as particle counters primarily used for measurement of air-borne and liquid-borne particles.

RION covers a wide product spectrum while remaining firmly rooted in the science of acoustics. RION products are used by individuals as well as governmental institutions, schools and universities, medical facilities, the service sector, agriculture and fishery industries, and all branches of the manufacturing industry. RION products are not only used domestically but exported to more than 60 countries all over the world. Response has been overwhelmingly positive.

RION products are tailored to the requirements and expectations of its customers. This has helped the company maintain a leading position in the industry. RION wants to use its momentum and forward-looking stance to help create a society that is truly easy to live in. The ultimate aim is to provide a safe and gratifying environment for all members of society.

Foundation Date: June 21, 1944

Capital: JPYen 1.969 million

(as of March 31, 2014)

Sales: JPYen 18.510 million

(fiscal year ended March 2014, consolidated)

President & CEO: Kiyotsune Inoue

Certifications (in acoustic and vibration measurement field)

ISO 9001: 2000 Certification

ISO 14001: 1996 Certification

Designated manufacturer of special measurement

instrument (sound level meters, Vibration Level Meter)



## Logo and Corporate Philosophy

The logo symbolizes confidence in the company itself and the quality of its products. Resembling the ring of a planet, the stylized ring around the "R" expresses awareness of the universe to which our environment belongs and in which RION strives for the betterment and well-being of mankind.

The coloring uses RION's traditional blue in two shades of intensity. Cyan signifies energy and vitality, and ultramarine represents intellect and style.

## RION Products

Quality

Ease of use

Reasonable cost

### SOUND AND VIBRATION MEASURING INSTRUMENTS



Sound Level Meter



Vibration Meter



Airborne Particle Counter



Liquid-borne Particle Counter

### HEARING INSTRUMENT

Rionet Hearing Instruments



BTE Type



Custom-made



Audiometer

### MEDICAL EQUIPMENT



# INDEX(Model)

<b>A</b>		<b>L</b>	
AN-37	13	LF-20	21, 32
AN-37R	13	LR-07	19, 33, 43
AS-14PA5	35	LS-10C	21, 32
AS-15PA5	37	LS-40C	21, 32
AS-16PA5	37		
AS-20PE5	35	<b>M</b>	
AS-30PA5	36	MC-12CF1	27
AS-31PA5	36	MC-20CF2	16
AS-40PA1	12	MC-20HS2	41
AS-50PA1	13	MC-20SD2	16
AS-60	9, 10	MC-20SS2	16
AS-60RT	9, 10	MC-25LC1	16
AS-60VM	22	MC-32SD3	16
AS-70	7, 9, 10, 42	MC-40HS2	41
AS-70Viewer	42	MC-51SD1	16
		MC-51SS1	16
<b>B</b>		ME' Scope VES	38
BP-17	11, 19, 29, 32, 33	MS-11	13
BP-21A	16, 19, 33	MY-11	46
<b>C</b>		<b>N</b>	
CAT-Report	39	NA-28	6, 19, 47
CAT-SA02-AR	38	NA-37	12
CAT-SA02-CMP03	39	NA-42	11, 18, 19, 47
CAT-SA02-CPWL	38	NA-83	13
CAT-SA02-HT	38	NC-39A	19, 33
CAT-SA02-Order	38	NC-72A	16, 18
CAT-SA02-SQ	38	NC-72-S06	18
CAT-SA02-TH	39	NC-72-S16	18
CAT-SA32	39	NC-74	16, 18
CAT-VA12-CMP01	27	NC-74-002	18
CAT-WAVE	7, 9, 42	NC-94B	18
CAT-UV22-MS	26	NC-97A	19, 29, 33
CC-24	19, 33	NC-98C	19, 33
CC-42C	19	NC-99	19, 29, 33
CC-42P	19	NH-04A	15, 18
CC-42R	19	NH-05A	15, 18
CC-87	33	NH-06A	15, 18
CC-87E	33	NH-12A	15, 18
CF-27	29	NH-17	15, 18
		NH-17A	15, 18
<b>D</b>		NH-22	15, 18
DA-21	18, 19, 32, 33, 41, 47	NH-22T	18
DA-40	18, 19, 32, 33, 41, 47	NL-27	11
DA-40Viewer	42	NL-42	8, 19, 47
DPU-414	19, 33, 43	NL-52	8, 19, 47
		NL-62	10, 19, 47
<b>E</b>		NX-28BA	7
EC-02S	32, 47	NX-28FT	7
EC-02SB	32, 47	NX-28WR	7
EC-02SD	32, 47	NX-37A	12
EC-03001	47	NX-37B	13
EC-02SE	32, 47	NX-37WR	13
EC-04	18, 47	NX-42EX	9
EC-04A	18, 47	NX-42FT	9, 10
EC-04B	18, 47	NX-42RT	9
EC-04C	18, 47	NX-42RV	9, 10
EC-04D	18, 47	NX-42WR	9, 10
EC-04E	18, 47	NX-50	30
EC-04S	18, 47	NX-62RT	10
EC-40A	32		
EC-40B	32	<b>P</b>	
EC-40C	32	PF-10	35
EC-40D	32	PF-31	21
EC-90A	18, 19, 33, 47	PF-60A	21
EC-90B	18, 19, 33, 47	PV-03	20, 21, 32
		PV-08A	20, 32
<b>F</b>		PV-10B	20, 30
FI-01	44	PV-10T	30
FI-02	44	PV-41	20, 32
		PV-44A	20, 32

<b>P</b>		<b>V</b>	
PV-62	23	VA-11B	27
PV-63	20, 30, 32	VA-11C	27
PV-65	20, 30, 32	VA-11M	27
PV-83C	22	VA-12	26, 33
PV-83CW	23	VE-10	21
PV-85	20, 32	VM-53	22, 33, 47
PV-86	20, 32	VM-53A	22, 33, 47
PV-87	20, 32	VM-54	23
PV-90B	20, 32	VM-63A	24
PV-90H	20, 32	VM-82A	24, 33
PV-90T	20, 32	VM-83	25, 32, 33, 47
PV-91C	20, 32	VP-26A	21, 32
PV-91CH	20, 32	VP-26C	21
PV-93	20, 32	VP-40	21, 32
PV-94	20, 32	VP-42	21, 32
PV-95	20, 32	VP-51A	32, 47
PV-97C	20, 23, 32	VP-51B	32
PV-97I	20, 23, 32	VP-51C	32
		VP-51I	32
<b>R</b>		VP-51J	32
RIONOTE	18, 19, 32, 33, 40, 47	VP-51L	32
RKA Series	45	VP-51LB	32
RKB Series	45	VP-51LC	32
RKC Series	45	VP-51W	32
		VP-52C	20, 32
<b>S</b>		VP-53S	20
SA-02A4	18, 19, 32, 33, 34, 41, 47	VP-53T	20
SA-02M	18, 19, 32, 33, 34, 41, 47	VP-80	23
SA-A1B2	40	VT-06	43
SA-A1B4	40	VX-53RT	22
SA-A1WD	40	VX-54FT	23
SA-A1WL1	40	VX-54WB1	23
SF-06	44	VX-54WH	23
SI-31I	37	VX-54WS	23
SI-33I	37		
SS-05T	46	<b>W</b>	
ST-80	16	WS-01	16, 18
ST-80-100	16	WS-05	16, 18
ST-81	16	WS-10	16, 18
SX-A1FT	40	WS-13	13
SX-A1RT	40	WS-15	16
SX-A1WR	40	WS15006	16
		WS-16	16
<b>U</b>			
UA-10	18	<b>Y</b>	
UA-12	18	YI-01	44
UA-20	18		
UA-31	16, 18	<b>Others</b>	
UA-90	47	5SLIK	16
UC-27	15, 17, 18	5WCD2320	33
UC-29	15, 17, 18	5WKR4030	19, 33
UC-30	15, 18		
UC-31	15, 17, 18		
UC-32P	15, 17, 18		
UC-33P	15, 17, 18		
UC-34P	15, 17, 18		
UC-52	15, 17, 18		
UC-52T	15, 18		
UC-54	15, 17, 18		
UC-57	15, 17, 18		
UC-57T	15, 18		
UC-59	15, 17, 18		
UC-59T	15, 18		
UG-20	30		
UG-21	30		
UG-23	30		
UG-33	30		
UG-50	30		
UG-90	30		
UN-14	11, 18, 19, 47		
UV-15	28, 32, 33, 47		
UV-16	29, 33, 37, 47		
UV-22	11, 19, 28, 32, 33		

# INDEX(Name)

<b>Alphanumeric</b>			
1/1 and 1/3 Octave Real-Time			
Analysis Card (VX-53RT)	22		
1/2 inch microphone adapter	18		
1/2 inch Nose Cone	16, 18		
1/4 inch microphone adapter	18		
2-Channel Charge Amplifier	29, 32, 33, 47		
3-Axis Vibration Meter	23		
3-ch preamplifier	23		
4 channel Data Recorder	18, 19, 32, 41, 47		
4-20 mA Isolation Unit	30		
4-Channel Signal Analyzer	34, 47		
7P microphone extension cable	47		
8 channel Data Recorder	18, 19, 32, 41, 47		
<b>A</b>			
AC adapter	19, 29, 33		
Accelerometer Cable	47		
Acoustical Volume Meter	46		
Airborne Noise/Floor Impact Noise			
Insulation Measurement Software	35		
Aircraft/Environmental noise online			
monitoring system	14		
Aircraft Noise Data Processing			
Application Software	13		
Aircraft Noise Processing Program	13		
All-weather Windscreen	13		
Anechoic Acoustic Power Level Measurement			
Software	36		
Anechoic Box (Compact Type)	45		
Anechoic Room	45		
Array Type Visualization Software	38		
Automotive Vibration Analyzer	27		
<b>B</b>			
Battery Pack	16, 19, 33		
Battery Unit	11, 19, 29, 32, 33		
BNC Adapter	20, 32		
BNC-BNC Cable	19, 33, 47		
BNC-BNC Coaxial Cable	19, 33, 47		
BNC-mini plug Cable	19, 33		
Building Acoustic Card	7		
<b>C</b>			
Calibration Exciter	21		
CF Card	16, 41		
Charge Converter	21, 32		
Comparator Output Cable	19		
Condenser Microphone	15, 17, 18		
Construction Machinery Acoustic			
Power Level Measurement System	38		
<b>D</b>			
Data Collector	27		
Data Management Software For Environmental			
Measurement	9, 10, 22		
Data Recorder	19, 33		
<b>E</b>			
Environmental Sound Monitor	12		
Environmental Noise Processing Program	12		
Environmental Noise Data Processing			
Software	12		
Extended Function Program	9		
Extension Cable	18, 32		
<b>F</b>			
FFT Analysis Card (NX-28FT)	7		
FFT Analysis Card (VX-54FT)	23		
FFT Analysis Program	9, 10		
Field Balancer	27		
Flexible Rod	18		
Force Pickup	21		
<b>G</b>			
General-Purpose Vibration			
Meter	24, 25, 32, 33, 47		
<b>H</b>			
Hand-Arm Vibration Card	23		
Hand-arm Vibration Measurement Software	38		
Heat-resistant Cable	32		
Heavy Floor Impact Source	44		
Hemi-Anechoic Acoustic Power			
Level Measurement Software	36		
<b>I</b>			
Impact Ball	44		
Impact Force Measurement System	35		
Impedance Head	21		
Interface cable	19, 33		
Interface unit	11, 19, 28, 32, 33		
<b>J</b>			
Junction Box	30		
<b>L</b>			
Level Recorder	19, 33, 43		
Loss Factor Measurement Software	35		
<b>M</b>			
Magnet Attachment	20		
Mamemaster	27		
Marine Vibration Card	23		
Measuring Amplifier	11, 18, 19, 47		
Memory Card	16, 41		
Microphone Holder	47		
Microphone With Preamplifier	15		
Mobile measurement Point			
monitoring system	14		
Mode Analysis Software	38		
Multi-Channel Signal			
Analzer	18, 19, 32, 33, 34, 41, 47		
<b>N</b>			
Noise Discrimination Unit	13		
<b>O</b>			
Octave, 1/3 Octave Real-time			
Analysis Program	9, 10		
Outdoor microphone	13		
<b>P</b>			
Piezoelectric Accelerometer	19, 20, 30, 32, 47		
Pistonphone	16, 18		
Pocketable Vibration Meter	24		
Portable Multi-function Measuring			
System	18, 19, 32, 33, 40, 47		
Preamplifier	15, 18, 30, 32		
Printer	19, 33, 43		
Printer Cable	19, 33		
PV-08 Cable	32		
PV-971 Tri-axial Accelerometer Cable	32		
<b>R</b>			
Rack Mounting Base	29		
Rack Mount Panel	30		
Random Noise Generator	44		
Real Sound recording Program	13		
Reference Piezoelectric Accelerometer	21		
Remote Noise Monitoring System	46		
Report Creation Support Tool	39		
Reverberation time Measurement			
Program	9, 10		
RIONOTE 2 channel Amplifier	40		
RIONOTE 4 channel Amplifier	40		
RIONOTE Maine control unit	40		
RIONOTE Software for FFT	40		
RIONOTE Software for 1/1 and 1/3 Octaves	40		
RIONOTE Software for Waveform Recording	40		
RIONOTE Wireless Dock	40		
RIONOTE Wireless Sensor Amplifier	40		
RS-232C Serial I/O Cable	19		
<b>S</b>			
SD Card	16		
Seat Accelerometer	23		
Servo Accelerometer	21, 32		
Servo Accelerometer Power Supply	21, 32		
Sound Calibrator	16, 18		
Sound Intensity Measurement			
Software	37		
Sound Intensity Probe	37		
Sound Level Meter (Class 1)	8, 10, 13, 19		
Sound Level Meter (Class 2)	8, 11, 19		
Sound Level Meter Cable	47		
Sound Level Meter Unit	11, 18, 19, 47		
Sound-Proof Chamber	45		
Sound Quality Evaluation Software	38		
Sound Source Location Software	37		
Sound/Vibration Evaluation System	39		
Standard Cable	32, 47		
Surface Intensity Evaluation			
Software	39		
<b>T</b>			
Tapping Machine Light Floor Impact Sound			
Generator	44		
Throughput Disk	39		
Tracking Analysis Software	38		
Triaxial Accelerometer	47		
Triaxial Simultaneous Measurement			
Intensity Probe	37		
Tri-axial Standard Cable	32		
Tripod	16		
<b>U</b>			
Ultra-compact Accelerometer Cable	32		
User Filter	30		
UV-22 Sound and Vibration Monitoring System	28		
<b>V</b>			
VA-12 Comparator System	27		
Vibration Analyzer	26, 33		
Vibration Level Meter	22, 33		
Vibration Level Meter / Vibration Meter			
Accelerometer Cable	47		
Vibration Level Meter / Vibration Meter Cable	47		
Vibration Level Meter Cable	47		
Vibration Meter Preamplifier	21		
Vibration Meter Unit	28, 32, 33, 47		
Vibration Monitor	30		
Viewer Software	42		
Viscotester	43		
<b>W</b>			
Waveform Analysis Software	7, 9, 42		
Waveform Data Manipulation Software	39		
Waveform Recording Card	7		
Waveform Recording Program	9, 10		
Whole Body Vibration Card	23		
Windscreen	16, 18		

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