RION

Sound and Vibration

RION S&V Measuring Instruments General Catalog

2021 ~ 2022

About the JCSS Calibration Certificate

The Quality Assurance Section 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 Acoustics & Ultrasound, 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 acoustics & acceleration measuring instruments (sound level meters,measurement microphones, sound calibrators, accelerometer).
Calibration certificates with the ILAC MRA compliant JCSS symbol are recognized throughout the world.

JCSS Compliant Acoustic Measuring Instruments

■ Sound Level Meters ■ Measurement Microphones ■ Sound Calibrators ■ Reference Piezoelectric Accelerometers

JCSS 0197

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

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, NC-72B
Sound Calibrators	NC-74, NC-75
Reference Piezoelectric Accelerometers	PV-03
Piezoelectric Accelerometers	PV-85, PV-86, PV-90H

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: 2015).

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: 2015).

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.

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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.


NL-42


NL-52


NL-62

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. Low-power design enables 24 hour continuous operation.
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 137 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.

Aircraft Noise Monitoring System NA-39A

This system is designed for automated monitoring of aircraft noise.
It is capable of calculating evaluation values according to the "Environmental Standard Related to Aircraft Noise".
Improved aircraft identification supports long-term measurement and generates more accurate data. Compact and lightweight design facilitates installation. Power consumption reduced by about fifty percent.

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.

Pistonphone NC-72B

Suitable for IEC 60942: 2017 class LS/M and class 1/M, JIS C 1515: 2020 class LS/M and class 1/M.
Calibration sound source outputs 250 Hz tone at 114 dB SPL.

Multi-Channel Signal Analyzers SA-02M (4-channel expandable type) SA-02A4 (4-channel fixed type)


SA-02M SA-02A4

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.

Sound Calibrator NC-75

Conforming with IEC 60942: 2017 class 1 and JIS C 1515: 2020 class 1. Supports 1-inch, 1/2-inch, and 1/4-inch microphones. (1/4 inch with optional adapter)

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.

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.

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 voltage 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.

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.

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.

Viscotester VT-06 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 CE

Designated manufacturer of special measurement instrument
Designation number: 341301 (The Japan Measurement Act)
Type certification number (The Japan Measurement Act): TF161

CF-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

- 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: 2017 class 1, JIS C 1516 : 2014 class 1, JIS C 1513-1 : 2020 class 1, JIS C 1513 : 2002 class 1, JIS C 1514 : 2002 class 1, IEC 61672-1: 2013/2002 class 1, IEC 61260-1 : 2014 class 1, ANSI/ASA S1.4-2014/Part 1 class 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 or $L_{eq,\ 1sec}$ For sub channel in sound level meter mode, one of following items can be selected: L_{peak}, L_{tm5}
Linearity range (according to JIS, IEC)			25 dB to 140 dB
Measurement level range			A weighting: 25 dB to 140 dB, C weighting: 33 dB to 140 dB, Z weighting: 38 dB to 140 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 (15 hours operation with alkaline batteries) or external power supply (AC adapter, supplied)
Temperature/humidity range for operation			−10 ℃ to +50 ℃, 10 % to 90 %RH
Dimensions, Weight			331 (H) × 89 (W) × 51 (D) mm, approx. 730 g (including batteries)

Options

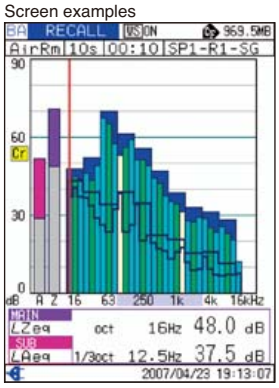
Remote Control Unit	NA-27RC1	Microphone Extension Cable*2	EC-04 (2 m and up)
Memory Card (256 MB CF card*1)	MC-25LC1	Pistonphone	NC-72B
Memory Card (2 GB CF card*1)	MC-20CF2	Sound Calibrator	NC-75

*1 Use RION supplied cards for assured operation *2 Max. extension cable length for the Japan Measurement Act compliance is 35 meters.

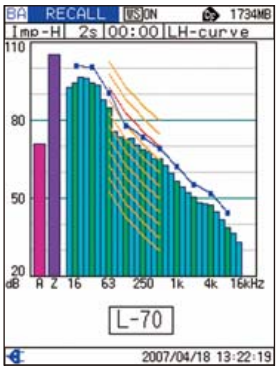
Building Acoustic Card
NX-28BA

- 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

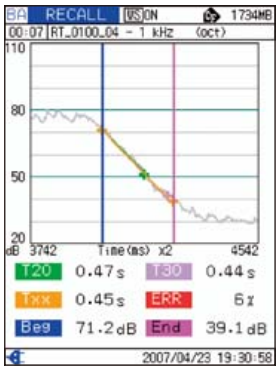
Screen examples



Overlay display of background noise measurement



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



Reverberation time decay curve

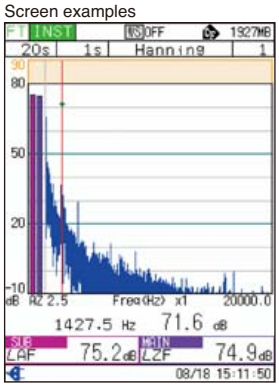
Specifications

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

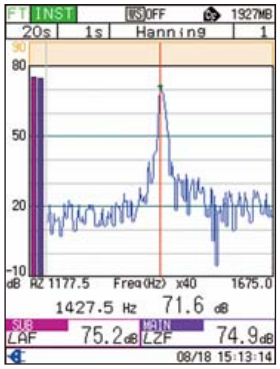
FFT Analysis Card
NX-28FT

- 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

*Depending on the sampling frequency, some software applications may not support direct import. For such software, a sampling frequency converter or other suitable tool should be used. For details, contact RION distributors.

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 43.

Waveform Analysis software
CAT-WAVE
For specifications, see page 43.

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）

WATER-RESISTANT

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

Sound Level Meter (class 1)
NL-52 CE

Type certification number (The Japan Measurement Act): TF163

Sound Level Meter (class 2)
NL-42 CE

Type certification number (The Japan Measurement Act): TS163

- 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 hours continuous measurement is possible
  (when using dry alkaline batteries).
- Supports long-term measurements (up to about 1 month) for environment monitoring etc. (external power supply)

Specifications		Sound Level Meter (class 1) NL-52	Sound Level Meter (class 2) NL-42
Applicable standards		IEC 61672-1: 2013/2002 class 1	IEC 61672-1: 2013/2002 class 2
		ANSI/ASA S1.4-2014/Part 1 class 1, JIS C 1509-1: 2017 class 1, JIS C 1516: 2014 class 1	ANSI/ASA S1.4-2014/Part 2 class 2, JIS C 1509-1: 2017 class 2, JIS C 1516: 2014 class 2
		CE marking, 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	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_{AIeq}*2, Maximum I-time-weighted equivalent continuous sound level: L_{AImax}*2, The power average of the maximum level of each 5 second interval: L_{Atm5}, 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_{Atm5} 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		10 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. 1000 sets, SD Card: depends on the capacity of the SD Card*1	
	Auto*2	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)*1	
Waveform recording*2*3		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*2	
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*2	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-98E)	
	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*4		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	AC adapter (100 V to 240 V)	NC-98E	Rain-protection windscreen	WS-16
Memory Card (2 GB SD card)	MC-20SD2	Microphone extension cables*5	EC-04 (2 m and up)	Pistonphone	NC-72B
Memory Card (32 GB SD card)	MC-32SP3	All-Weather windscreen	WS-15	Sound Calibrator	NC-75

＊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

NX-42EX
+
NX-42WR
NX-42RT
NX-42FT
NX-42RV

- 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

+

Additional function \ Program type	NX-42WR	NX-42RT	NX-42FT	NX-42RV
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

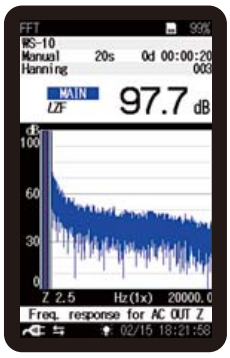
Maximum recording time (16 bit)

Sampling frequency \ Memory card	512 MB	2 GB	32 GB
48 kHz	1 h	4 h	64 h
24 kHz	2 h	8 h	128 h
12 kHz	4 h	16 h	256 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.

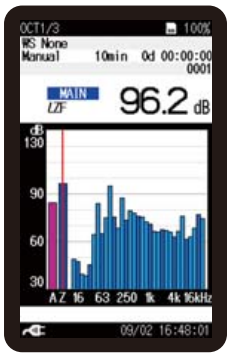


Analysis screen (x1)

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 32 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 Core™2 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 8.1 Pro 32 bit/64 bit, 10 Pro 32 bit/64 bit

● 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

For specifications, see page 43.

Waveform Analysis Software
CAT-WAVE

For specifications, see page 43.

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 15.

Sound Level Meter (class 1)
(With low-frequency sound measurement function)
NL-62 CE

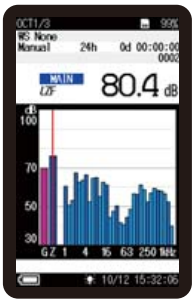
Type certification number (The Japan Measurement Act): TF164

- 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. (external power supply)

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 9.

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: 2013/2002 class 1, ISO 7196 : 1995
		ANSI/ASA S1.4-2014/Part 1 class 1, JIS C 1509-1: 2017 class 1, JIS C 1516 : 2014 class 1
		CE marking, 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_{AIeq}, 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_{AIeq}, 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 ＊1
	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) ＊1
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-98E)
	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)

＊ Max. extension cable length for the Japan Measurement Act compliance is 105 meters.

＊1 Use Rion fully guaranteed products. ＊2 NX-42WR required (sold separately). ＊3 Protection against harmful dust and water splashing from any direction.

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 CE

Type certification number (The Japan Measurement Act): TS162

- Compliant with Japan Measurement Act, JIS, and IEC requirements
- Wide 107 dB linearity range allows sound level measurements from 30 to 137 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: 2017 class 2, IEC 61672-1: 2013 class 2 CE mark, WEEE Directive
Measurement functions Processing functions (normal mode)	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)
Measurement level range (normal mode)	A-weighting: 30 dB to 137 dB, C-weighting: 36 dB to 137 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)

Options

Pistonphone	NC-72B
Sound Calibrator	NC-75

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 Time weighting characteristics	A, C, FLAT F (Fast), S (Slow), I (Impulse)
External filter input/output connector	BNC connector
Power	Four IEC R14 (size C) batteries, AC adapter (NC-98E, 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 CE TEDS compliant

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) Microphone bias voltage +30 V, +60 V, +200 V
	BNC connector	For CCLD compliant microphone or preamplifier (24 V 4 mA) For TEDS compliant microphone (24 V 4 mA)
Frequency weighting characteristics		A, C, Z (JIS C 1509-1 class 1, IEC 61672 class 1 electrical characteristics)
Measurement level range		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-99A, 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)
BNC-BNC Coaxial Cable	EC-90A (2 m and up)
AC Adapter	NC-99A

Interface Unit
UV-22

Battery Unit
BP-17

For specifications, see page 26. 27.

Sound Level Meter (Environmental Noise Monitor)

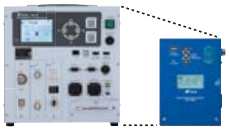
All required functions for aircraft noise measurement combined in a single system

Aircraft Noise Monitoring System CE

- This system is designed for automated monitoring of aircraft noise. It is capable of calculating evaluation values according to the "Environmental Standard Related to Aircraft Noise".
- The sound source identification provided as a standard feature is based on real time 1/3 octave band analysis.
- A GPS function is also standard, for obtaining location information and enabling automatic time calibration.
- LAN port and modem connector enable internet connection via an external router or an ordinary telephone line.

Power consumption **50%*less** Compact and lightweight

Volume reduced to one third



NA-37 NA-39A

*Compared to predecessor NA-37

Product Information

Environmental Noise Monitor NA-39A

- Compliant with IEC 61672-1: 2013 class 1 (JIS C 1509-1: 2017 class 1). Standard configuration includes one-third octave frequency analysis function.

Noise Arrival Direction Identification Unit AN-39D

- Elevation angle and bearing are measured using four microphones, to identify the arrival direction of aircraft noise and ground-level sound. From the sound source location and movement direction, aircraft noise can be identified with high accuracy.

SSR Receiver Unit AN-39R

- Receives SSR (Secondary Surveillance Radar) information used for air traffic control. Capable of capturing the squawk code (temporary 4-digit identification code), pressure altitude, and address (unique aircraft number). (Only for aircraft transmitting this information)

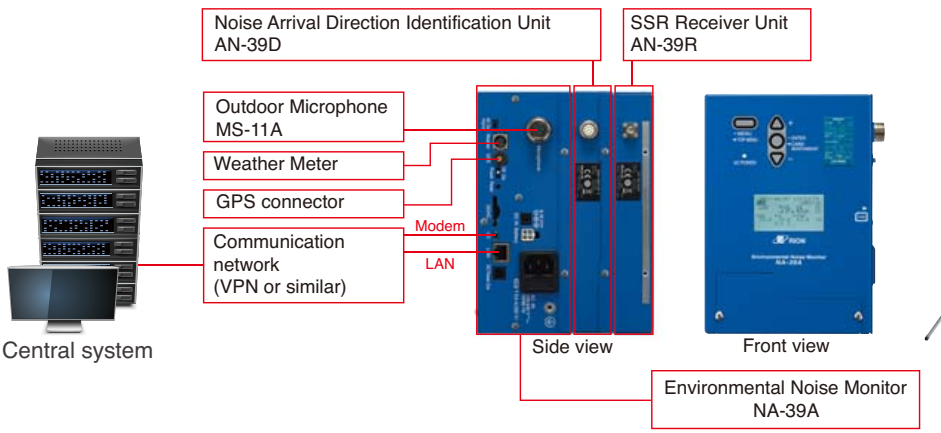
Outdoor Microphone MS-11A

- The Outdoor Microphone MS-11A therefore incorporates an anti-condensation heater that counteracts the main cause of sensitivity drift. An internal sound source for testing is also provided, enabling daily automatic sensitivity checking.

All-Weather Windscreen WS-13

- The all-weather windscreen is specially designed for the Outdoor Microphone MS-11A used with the Environmental Noise Monitor NA-39A. The combination of NA-39A and WS-13 ensures that the JIS C 1509-1: 2017 class 1 specifications are met with the windscreen in place. It also provides precipitation protection with an IPX3 rating.

Configuration Example for Aircraft Noise Monitoring System



Noise Monitoring System

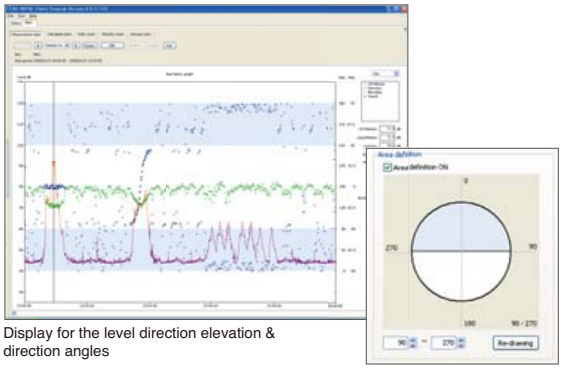
Environmental Sound Monitor
NA-37

Environmental Noise Processing Program
NX-37A

Designed for long-term noise monitoring application. Provides the functionality and durability requited for automated system, and ease of maintenance.

Environmental Noise Data Processing Software
AS-40PA1

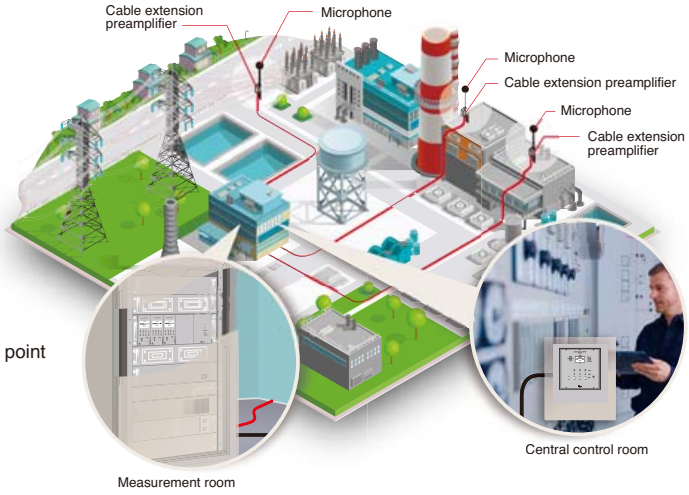
Collects data measured by NX-37A and allows saving, editing, and report creation.
＊Supported operating systems: Microsoft Windows 8.1 Pro 64 bit, 10 Pro 64 bit



Display for the level direction elevation & direction angles

Application example

Monitor noise levels in a plant or similar from a remote location
Set noise thresholds and limit values for triggering audible or visual alarms to alert operators of problems



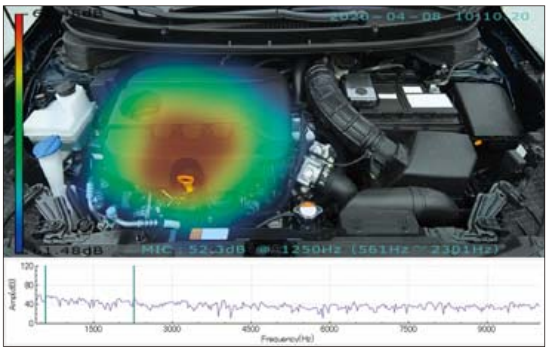
- Alarm level can be set to any value within the measurement range
- Alarm response delay time can be set (alarm is triggered after noise has continuously exceeded the threshold level for this interval)
- Relay contacts for operation of external equipment
- Integrated power amplifier allows monitoring of noise at measurement point
- Other customizing options

Sound Visualization

Easy × Light × Compact × Visualization

Acoustic Camera

This innovative portable system combines a 30-microphone array with a tablet computer to enable visualization of sound sources.
Possible applications include product development and on-site troubleshooting.
Problematic sound sources can be quickly located, and the efficiency of countermeasures can be checked visually.



Measurement screen examples (simulated)

Sound Level Meter (Measurement Microphone/Preamplifier)

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-34P	UC-35P CE	UC-30 CE	UC-31 CE	UC-33P	UC-52 CE	UC-59 CE	UC-57 CE	UC-29 CE	UC-54 CE
Suitable preamplifier	NH-06A	NH-34 supplied	NH-35 supplied	NH-04A/ 05A/12A	NH-04A/ 05A/12A	NH-04A/ 05A/12A	NH-17/ 17A/22A	NH-17/ 17A/22A	NH-17/ 17A/22A	NH-05A (using UA-12)	NH-17/ 17A/22A (using UA-12)
Nominal diameter	1 inch			1/2 inch						1/4 inch	
Frequency response	Sound field	Sound field	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	10 to 12 500	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 ∗2	20 to 100 000 ∗2
Bias voltage (V)	200	200	0	200	200	200	0	0	0	200	0
Sensitivity level (dB re 1 V/Pa) ∗1	−26.5	−21/−1	0	−25.5	−37	−38	−33	−27	−22	−47	−48
Capacitance (pF)	54	—	—	17	20	20	19	13	14	6	4
Maximum input sound pressure level (dB) (Linearity tolerance ± 0.3 dB)	152	—	96	144	160 ∗4	160	150	148	132 ∗4	164 ∗4	164
Inherent noise level (dB)	12	2	4	20	26	28	24	18	13	42	45
Temperature coefficient (dB/℃)	−0.005	—	—	−0.007	−0.007	−0.009	−0.008	within ±0.35 dB (at 1 kHz) ∗3	within ±0.45 dB (at 250 Hz) ∗3	−0.01	within ±0.7 dB (at 250 Hz) ∗3
Diaphragm	Titanium alloy									Titanium	
Dimensions (mm)	dia.23.8 x 21.0	dia.23.8 x 131	dia.23.8 x 132.7	dia.13.2 x 15.0	dia.13.2 x 13.2	dia.13.2 x 13.0	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 ℃ to +50 ℃ referenced to 23 ℃ ∗4 Distortion 3 %
∗5 Depend on connected instrument

Microphone With Preamplifier

- TEDS compliant

Model	UC-52T CE	UC-57T CE	UC-59T CE
Microphones	UC-52	UC-57	UC-59
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	ϕ13.2×98.5	ϕ13.2×99.4
Cable type	EC-90 series (BNC)	EC-90 series (BNC)	EC-90 series (BNC)

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.

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	NH-06A	NH-04A	NH-12A	NH-17	NH-17A	NH-22A CE	NH-05A
Suitable microphones	UC-27	UC-30/31/33P	UC-30/31/33P	UC-52/54 ∗1/ 57/59	UC-52/54 ∗1/ 57/59	UC-52/54 ∗1/57/59 (constant current drive) 2 mA to 4 mA	UC-29 ∗1 UC-30/31/33P
Nominal diameter	1 inch	1/2 inch,1/4 inch ∗1					1/2 inch, 1/4 inch
Input impedance (GΩ)	3	3	3	3	3	6	10
Input capacitance (pF)	0.3	0.25	0.25	0.8	0.8	0.7	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) ∗1
A-weighted inherent noise level (dB)	12 (UC-27)	20 (UC-30)	20 (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. 30	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

Optional accessories (For Sound Level Measurement)

114 dB/250 Hz calibration sound source

Pistonphone

NC-72B CE

- Suitable for high-precision calibration of 1, 1/2, and 1/4 inch microphones
- Powered by AA batteries (alkaline, manganese, NiMH) x 6, alkaline for 15 hours and NiMH for 13 hours continuous use at room temperature

Specifications

Applicable standards	IEC 60942:2017 class LS/M, class 1/M, ANSI/ASA S1.40-2006 (R2016) class LS/C, class 1/C, JIS C 1515:2020 class LS/M, class 1/M
Nominal sound pressure level	114 dB Specified sound pressure level tolerance ±0.1 % (101.325 kPa)
Nominal frequency	250 Hz Specified frequency tolerance ±0.1%
THD + noise rating of generated sound	2.0 % max. (22.4 Hz to 22.4 kHz)
Static pressure	65 kPa to 108 kPa
Ambient temperature/Relative humidity	−10 ℃ to +55 ℃, 10 % to 90 %RH (no condensation)
Dimensions, Weight	Approx. 62 (H) × 44 (W) × 170 (D) mm, approx. 750 g (including batteries)

Compensation for atmospheric pressure not required

Sound Calibrator

NC-75 CE

- Compact, lightweight, and easy to use unit that meets the performance requirements for calibrating high-precision sound level meters
- Operates on two IEC R6 (size AA) batteries (alkaline or nickel-hydride), enabling continuous operation for at least 50 hours at room temperature
- Supplied with JCSS Calibration Certificate

Specifications

Applicable standards	IEC 60942: 2017 class 1, JIS C 1515: 2020 class 1
Compatible microphones	1 inch, 1/2 inch, and 1/4 inch types
Nominal sound pressure level	94 dB
Nominal frequency	1 000 Hz
Dimensions, Weight	Approx. 42 (H) × 77 (W) × 70 (D) mm, approx. 200 g (including batteries)

Option

1/4-inch microphone adapter	NC-75-S11

Reduce adverse effects of wind noise

Windscreens

WS-15

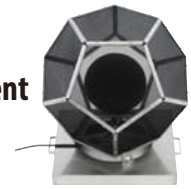
WS-16

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

Dual Windscreen to minimize influence of wind noise

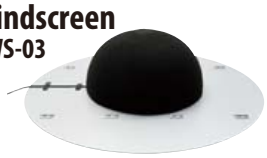
Noise Measurement for wind turbine

Dual Windscreen for Wind Turbine Noise Measurement
TWS-01



Acoustic Power Level measurement for wind turbine

Windscreen
KWS-03



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	405	1 220	695

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

SD cards

Type	Model	Supported models
512 MB SD card	MC-51SD1	For NL-42/52/62, VM-55/56
	MC-51SS1	For VA-12
2 GB SD card	MC-20SD2	For NL-42/52/62, DA-21, RIONOTE, VM-55/56
	MC-20SS2	For VA-12
32 GB SD card	MC-32SP3	For NL-42/52/62, DA-21, RIONOTE, VM-55/56

Reduction of wind noise for tunnel experiment

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

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) × 170 (W) × 50 (D) mm, approx. 1.1 kg

Sound Level Meter

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 49.

Application	Models	See page
General-purpose measurement	NL/NA series	6, 8 to 10
Sound level recording	NL/NA series + DA-21, LR series	6, 8 to 10, 42, 43
	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	32 to 37
	DA-21 + AS-70	42, 43
Real sound recording, Data processing	NL-42/52/62 (+ NX-42WR) + AS-60 (RT), RIONOTE	8 to 10, 40
Monitoring	NA-37 + WS-13	13
Aircraft noise	NA-39A	12
Low-frequency measurement	NL-62 + NX-62RT	10
Calibration	NC-72B/75	15

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, 10, 40
Performance testing	SA-02 + Various software	32 to 37
Calibration	NC-72B/75	15

3 Acoustic power level measurement

Application	Models	See page
Sound pressure level method	SA02 + AS-30PA5, AS-31PA5	32, 34
Acoustic intensity method	SA02 + AS-15PA5	32, 35
Calibration	NC-72B/75	15

4 Others

Application	Models	See page
Ultrasound, high sound pressure measurement	NA-42 + UC-29/54/31 + NH series	11, 14
Low sound pressure level measurement	NA-42 + UC-34 + NH-34	11, 14
	UN-14, SA-02, RIONOTE, DA-21 + UC-35 + NH-35	11, 14, 32, 40, 42
Coupler, diffuse sound field measurement	NA-42 + UC-33P + NH series	11, 14
Comparator	NL-42/52/62, NA-42	8, 10, 11
Acoustic analysis	NL-42/52 + NX-42FT	8, 9
	SA-02	32
	RIONOTE + Program	40
Quality management	NL/NA series	6, 8 to 10
	SA-02	32
Calibration	NC-72B/75	15
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.

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.

3 Measurement of extremely low-level sounds

UC-34P (with Preamplifier NH-34) /UC-35P (with Preamplifier NH-35)

The UC-34P and UC-35P are 1 inch microphones specially designed to make measurements in very quiet environments, with sound pressure levels as low as a few decibels.
The UC-34P requires a 200 V bias voltage supply.
The UC-35P is a CCLD type low-noise electret microphone which can be connected directly to an analyzer or other measuring device that provides a +24 V / 4 mA power voltage supply.

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.

5 Measurement extending to ultrasonic range

UC-31/UC-29/UC-54

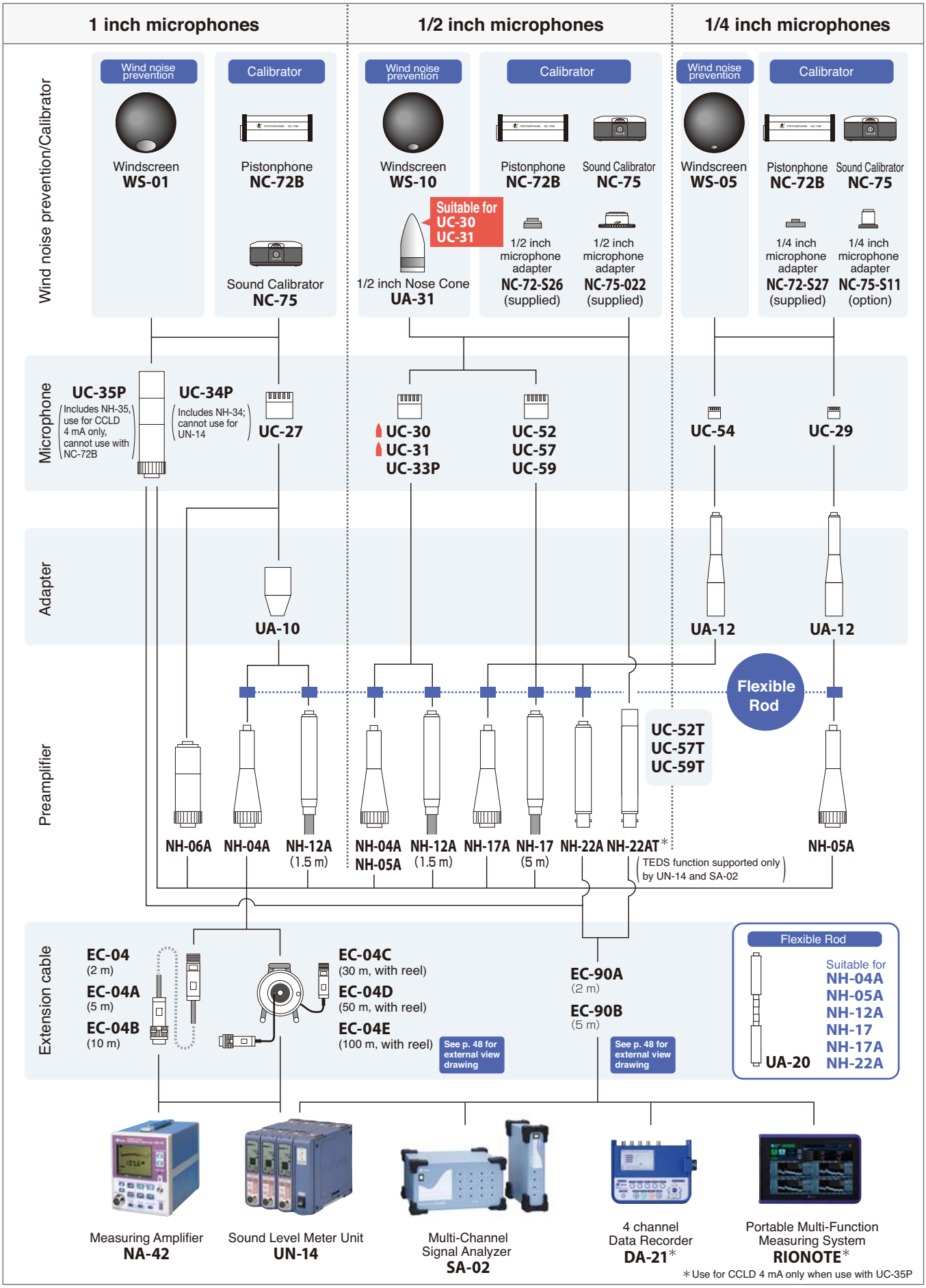
To make measurements of sounds including high-frequency components above 20 kHz, the same UC-31 (1/2 inch) and UC-29 (1/4 inch) microphones as for high-level measurements can be used.
Response of UC-31 extends to about 35 kHz, while UC-29/UC-54 goes up as high as 100 kHz.

6 Coupler and random sound field measurements

UC-33P

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.

Measurement Microphone Combination Examples



Sound Level Meter

SD-CARD CF-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

Sound Level Meter Connection Examples

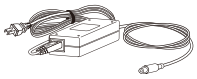
AC Adapter	Sound Level Meter	Connection Cable	Peripheral Equipment

Meter with integrated microphone

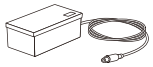
Sound Level Meter **NL-42** (SD-CARD)

Sound Level Meter **NL-52** (SD-CARD)

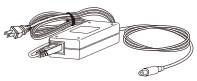
Sound Level Meter (With low-frequency sound measurement function) **NL-62** (SD-CARD)



AC Adapter **NC-98E**



Battery Pack **BP-21A**

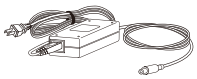


AC Adapter

Sound Level Meter **NA-28** (CF-CARD)

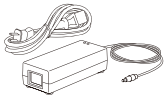
Meter with separate microphone option

＊For details, see "Condenser Microphone Combination Examples" on page 16.



AC Adapter **NC-98E**

Measuring Amplifier **NA-42**



AC Adapter **NC-99A**

Sound Level Meter Unit **UN-14**

Interface Unit **UV-22**

Battery Unit **BP-17**

Connection Cable

USB A-mini B Cable → **Computer**

RS-232C Serial I/O Cable **CC-42R** → **Computer**

BNC-mini plug Cable **CC-24** → **Peripheral device with BNC connector**

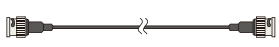
Comparator output Cable **CC-42C** → **External device**

USB A-mini B Cable → **Computer**

BNC-mini plug Cable **CC-24** → **Peripheral device with BNC connector**

Interface Cable **5WKR4030** → **Computer**

BNC-BNC Cable **NC-39A** → **Peripheral device with BNC connector**



BNC-BNC Coaxial Cable **EC-90A/90B** → **Peripheral device with BNC connector**

＊For information on comparator output connection, contact RION distributors.

USB A-mini B Cable → **Computer**

LAN Cable → **Computer**

Peripheral Equipment

Sound Calibrator

Pistonphone **NC-72B**

Sound Calibrator **NC-75**

Computer

Computer

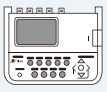
＊For information on software for various measurements, see the respective sound level meter page.

External device

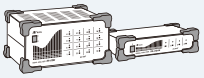
Rotating light, alarm etc.

Peripheral device with BNC connector

Level Recorder **LR-07**



Data Recorder **DA-21**

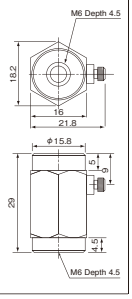
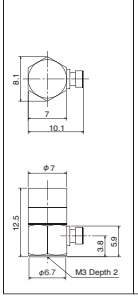
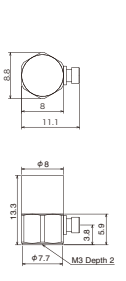
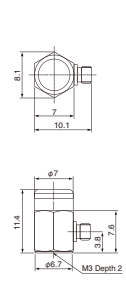
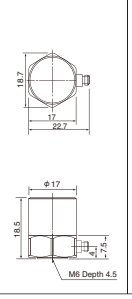
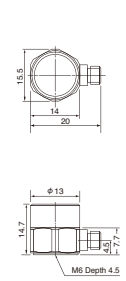
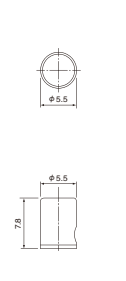
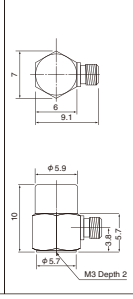
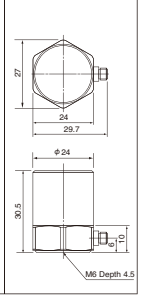


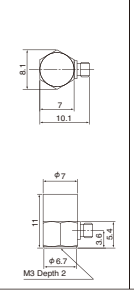
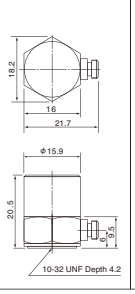
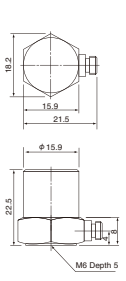
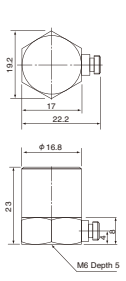
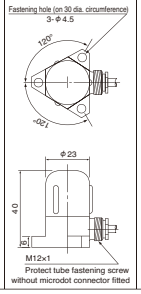
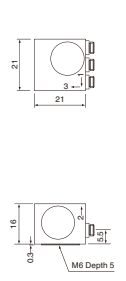
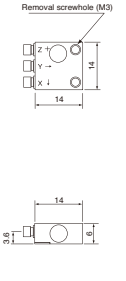
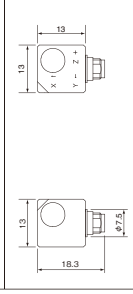
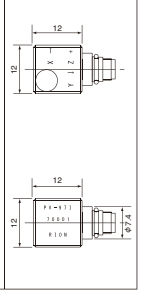
Multi-Channel Signal Analyzer **SA-02M/02A4**

Portable Multi-Function Measuring System **RIONOTE**

Vibration Meter (Piezoelectric Accelerometers/Servo Accelerometers/Other)

Piezoelectric Accelerometers

Type	Standard	With built-in amplifier			General-purpose		Compact / Lightweight		High-output
External view									
	PV-03	PV-91C	PV-91CH	PV-90T	PV-85/86	PV-94/95	PV-08A	PV-90B	PV-87
Principle	Compression	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Weight g	38	1.8	3	2	23	9	0.7	1.2	115
Charge sensitivity pC/(m/s²) ∗1	0.47	—	—	—	6.42	0.714	0.102	0.18	40
Voltage sensitivity mV/(m/s²) ∗1	—	1	11	0.5	—	—	—	—	—
Vibration frequency range (±1 dB) Hz ∗2	20 to 1 000 (±1 %) Secondary calibration range.	1 to 20 000 (±10 %) ∗5	1 to 15 000 (±10 %) ∗6	1 to 12 000 (±10 %)	1 to 7 000	1 to 10 000	1 to 25 000	1 to 25 000	1 to 3 000
Mounting resonance frequency kHz ∗2	30	55	50	50	24/21	36	52	70	9
Temperature range for use ℃	−50 to +200	−50 to +170	−50 to +170	−20 to +100 (TEDS: −20 to +85)	−50 to +160	−50 to +160	−50 to +160	−50 to +160	−50 to +160
Supplied cable	VP-51A (2 m)	VP-51LC (2 m)	VP-51LC (2 m)	VP-51LC (2 m)	VP-51A (2 m)	VP-51A (2 m)	VP-51J 38 cm ∗3	VP-51L (2 m)	VP-51A (2 m)
Dimensions mm									

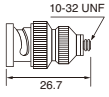
Type	High-temperature				Waterproof insulation	Triaxial type			
External view									
	PV-90H	PV-44A	PV-65	PV-63	PV-10B	PV-93	PV-97C	PV-97	PV-97I
Principle	Shear	Compression	Shear	Shear	Compression	Shear	Shear	Shear	Shear
Weight g	2	29	26	28	120	30	4.7	10	8
Charge sensitivity pC/(m/s²) ∗1	0.29	7.65	7.14	4.59	—	0.831	0.12	0.29	—
Voltage sensitivity mV/(m/s²) ∗1	—	—	—	—	5.1	—	—	—	1.1
Vibration frequency range (±1 dB) Hz ∗2	1 to 20 000	1 to 10 000	1 to 9 000	1 to 8 000	3 to 8 000	1 to 8 000 (2-axis) 1 to 4 000 (1·3)	1 to 15 000 (Z) 1 to 10 000 (X·Y)	1 to 10 000 (Z) 1 to 5 000 (X·Y) (±10 %)	1 to 7 000 (Z) ∗4 1 to 5 000 (X·Y) (±10 %)
Mounting resonance frequency kHz ∗2	60	28	25	26	24	—	—	—	—
Temperature range for use ℃	−50 to +250	−50 to +260	−50 to +260	−20 to +300	−20 to +100	−50 to +160	−50 to +160	−50 to +200	−20 to +125
Supplied cable	VP-51LB (2 m)	VP-51B (2 m)	VP-51B (2 m)	VP-51I (1 m)	Direct-mount cable 5 m (no connector)	VP-51C (2 m)	VP-51L×3 (2 m)	VP-51WL (2 m)	VP-51W (3 m)
Dimensions mm									

∗1 Representative value. Actual values are given on calibration sheet supplied with accelerometer. ∗2 Representative value when mounted on flat surface with standard mounting method.
∗3 To extend cable run, VP-52A and VP-51A are required. ∗4 Max. 100 ℃, 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 %)

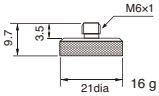
Note ● The piezoelectric element in a piezoelectric accelerometer may be damaged by excessive shock. Take care not to drop the accelerometer, and handle it with care when using the magnetic attachment.

Attachments

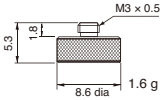
BNC Adapter
VP-52C



Magnet Attachment
VP-53S



Magnet Attachment
VP-53T



Vibration Meter

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/s²
Voltage sensitivity	0.5 V/(m/s²) ±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 ℃ to +60 ℃, max. 85 %RH
Dimensions, Weight	37 (H) x 37 (W) x 40 (D) mm, approx. 230 g (including cable)

Specifications LS-10C

Maximum measurable acceleration	±30 m/s²
Voltage sensitivity	0.3 V/(m/s²) ±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 ℃ to +60 ℃, max.85 %RH
Dimensions, Weight	37 (H) x 37 (W) x 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/s²)
	Using LS-10C	0.3 V/(m/s²)
Power		Six IEC R20 (size D) batteries, AC adapter (NC-99A, 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 CE

- 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/s²) (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/s²
Dimensions, Weight	Approx. 16 (hexagonal width across flats) x approx. 29 (H) mm, approx. 38 g

For calibration of accelerometers and vibration meters on-site

Calibration Exciter VE-10 CE

- 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/s² (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 Sensor 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) x 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/s²
Maximum measurable force		1 000 N
Dimensions, Weight		Approx. 16 (hexagonal width across flats) x approx. 32 (H) mm, approx. 37 g

For extension between accelerometer and vibration meter

Vibration Meter Preamplifier VP-26A

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

Specifications

Sensitivity	1 mV/pC
Frequency range	0.16 Hz to 30 kHz

Extension examples

Piezoelectric accelerometer → **VP-26A (6-pin)** → Extension cable **EC-02S series** → **Vibration Meter VM-83 / UV-15**

Support for CCLD (Constant Current Line Drive)

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

Charge Converter (Compact relay type) VP-42

- 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

Piezoelectric accelerometer → Connection cable **VP-51 series** → **VP-40** → **RIONOTE, SA-02,DA-21, VA-12,VM-82A**

Piezoelectric accelerometer → Connection cable **VP-51 series** → **VP-42** → Connection cable **VP-51A series** (Can be extended up to 100 m) → BNC adapter **VP-52C** → **RIONOTE, SA-02,DA-21, VA-12,VM-82A**

Vibration Meter (Tri-axial Groundborne Vibration Meter)

Simultaneous measurement of multiple parameters including PPV and VDV
Simultaneous calculation of the measurement quantities defined by DIN 45669-1, ISO 8041 and other international standards

WATER RESISTANT

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

Tri-axial Groundborne Vibration Meter
VM-56 CE

- Simultaneous measurement of multiple parameters including PPV and VDV.
- User definable PPV vs Frequency comparator output supports DIN 4150: Part 3 and other frequency-dependent PPV building damage criteria.
- Simultaneous tri-axial measurement. Compact and lightweight design.
- Flexible product configuration with waveform recording function and 1/3 octave band analysis function available as optional programs.
- Data stored as CSV files on an SD card.
- Suitable for use in a live-to-web system (please contact us for further details).

Specifications

Applicable standards		DIN 45669-1: 2010-09 (Frequency, Measurement range compliance), SBR Meten en beoordelen van trillingen, Deel A: Schade aan gebouwen 2010, Deel B: Hinder voor personen 2013, ISO 8041: 2005, ISO 8041-1: 2017, CE marking, WEEE directive
Measurement functions		Tri-axial simultaneous measurement
Measurement values		
	In accordance with DIN	Peak particle velocity |v|max (PPV) Dominant frequency fmg (D.F.) Weighted vibration maximum value KB_{Fmax} Maximum KB_F value over 30-second KB_{FT}
	In accordance with ISO	Corrected acceleration effective value Acc. Maximum transient vibration value MTVV Vibration dose value VDV Crest factor C.F.
	In accordance with SBR	Maximum weighted vibration value $v_{eff,max}$ Maximum veff over 30-second cycle $v_{eff,max,30}$
	Others	Displacement (0-p value) Disp. Combined PPV for 3 axes PVS
	Waveform recording (Option)	Time waveform of acceleration signal a(t)
	1/3 octave band analysis value (Option)	Time-weighted time average, maximum acceleration Band maximum OA for 3 axes combined *L*aw
Measurement frequency range		0.5 Hz to 315 Hz
Measurement range		Measurement frequency setting is 1 to 80 Hz, defining the following range
	Measurement range for VM-56	Vibration velocity: 0.03 to 100 mm/s Weighted vibration amount: 0.02 to 100 mm/s (Reference 16 Hz) Maximum absolute waveform value: 0.05 to 100 mm/s (Reference 16 Hz) Vibration acceleration: 0.0003 to 10 m/s² Displacement (0-p): 0.01 to 10 mm (0.5 to 4 Hz) Measurement range compliant with SBR-Deel B Vibration velocity: 0.02 to 100 mm/s (Frequency bandwidth 1 to 80 Hz)
Store modes		3 modes (Manual, Auto, Timer Auto), Data format: CSV
Power requirements		IEC R6 (size AA) battery x 8 or external power supply
	Battery life	24 hours or more, constant operation ＊Battery life will differ depending on settings.
	AC adapter	NC-98E
Dimensions and weight		Approx. 175 mm (H) x 175 mm (W) x 40 mm (D) mm, approx. 780 g (incl. batteries)
Accelerometer		Rated sensitivity: 60 mV/(m/s²)
Tri-axial		Frequency range: 0.5 Hz to 315 Hz
Accelerometer		Usage temperature range: -20 °C to +60 °C (no condensation)
PV-83D		Waterproofing: IPX7
(Cable: 1.5 m)		Dimensions and weight: Approx 67 mm (dia.) x 50.5 mm (D), approx. 450 g

Options

Waveform recording program	VX-56WR	AC adapter	NC-98E
1/3 octave band analysis program	VX-56RT	7P Extension Cable	EC-04 series
Waveform Analysis Software for Groundborne Vibration	AS-70GV	DIN plate	VP-54D
SD card (512 MB, 2 GB, 32 GB)		L-bracket	VP-54L

Waveform Recording Program VX-56WR

VX-56WR

Allows recording vibration waveforms on SD card as WAV files. The recording process is carried out simultaneously with the standard VM-56 functions.

2 kHz sampling with 24 bit or 16 bit can be selected

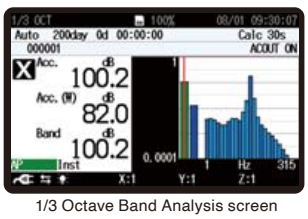
Max. recording time (at 16 bit)

Sampling frequency \ Memory card	512 MB	2 GB	32 GB
2 kHz	Approx. 6 hours	Approx. 27 hours	Approx. 470 hours

1/3 Octave Band Analysis Program VX-56RT

VX-56RT

Enables measurement and logging of 1/3 octave acceleration levels simultaneously with broadband parameters (e.g. PPV, dominant frequency, VDV, MTVV). Can be used concurrently with VX-56WR.



1/3 Octave Band Analysis screen

Waveform Analysis Software for Groundborne Vibration AS-70GV

Allows use of WAV files recorded with VM-56 + VX-56WR for graph display, level processing, frequency analysis (octave band analysis / FFT analysis), recalculation (PPV, KB, VDV), and file output.

Mounting options

DIN Plate
VP-54D

L-bracket
VP-54L

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

Simultaneous measurement in three axes of the instantaneous value for vibration level and vibration acceleration level, as well as the time percentile level, time averaged level, maximum and minimum values
Compliant with the Japan Measurement Act and JIS C 1510: 1995 and JIS C 1517: 2014

WATER-RESISTANT

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

Designated manufacturer of special measurement instrument
Designation number: 351301

Type certification number (The Japan Measurement Act): TW161

Vibration Level Meter
VM-55 CE

- Simultaneous measurement of vibration level (L_V),and vibration acceleration level (L_{Va})
- Support for high capacity SD cards up to 32 GB (Measurement data are output as CSV files, which can be handled by spreadsheet software such as Excel.)
- 27 hours of measurement operation with IEC R6 [size AA] batteries (alkaline or nickel-hydride rechargeable)
- Dust and water proofing IP54 rating (for main unit)

Specifications

Applicable standards	Weight and Measure Act (Vibration Level Meters) JIS C 1510:1995, JIS C 1517:2014
	CE marking, WEEE Directive, Chinese RoHS (export model for China only)
Measurement functions	3-axis simultaneous measurement supported
	Vibration level L_V and vibration acceleration level L_{Va}
	Maximum value hold for vibration level and vibration acceleration level
Processing measurement (processing values)	Time average level L_{eq} for vibration level and vibration acceleration level
	Time percentile level $L5$, $L10$, $L50$, $L90$, $L95$ for vibration level and vibration acceleration level
	Maximum value L_{max} for vibration level and vibration acceleration level
	Minimum value L_{min} for vibration level and vibration acceleration level
Measurement frequency range	
Vibration level	1 to 80 Hz
Vibration acceleration level	1 to 80 Hz
Measurement level range	
Vibration level, vertical direction	25 to 129 dB
Vibration level, horizontal direction	30 to 122 dB
Vibration acceleration level	30 to 129 dB
Store modes	3 modes: Manual, Auto*, Timer Auto*
Power supply	IEC R6 (size AA) battery x 8 or external power supply
AC adapter	(NC-98E option), Battery pack (BP-21A option)

* VX-55EX is required separately

Options

Memory Card (512 MB SD card)	MC-51SD1
Memory Card (2 GB SD card)	MC-20SD2
Memory Card (32 GB SD card)	MC-32SP3

Specifications Triaxial Accelerometer PV-83C (supplied)

Sensitivity	60 mV/(m/s²)
Waterproofing specifications	JIS C 0920, class 7 (sealed)
Temperature range for operation	−10 ℃ to +50 ℃
Dimensions, Weight	Approx. dia. 67 × 41 (H) mm, approx. 335 g

Adds a number of programs.

Extended Function Program
VX-55EX

The VX-55EX program is supplied on a 512 MB SD card. After installation, the card can be used as a 512 MB SD memory card.

- When the VX-55EX program has been installed*, the VX-55WR and VX-55RT can be added.
*Once installed, the VX-55EX cannot be uninstalled.

Functions: Auto store function (instantaneous value / processing values) / Marker function / Comparator function / Continuous data output function

Waveform Recording Program
VX-55WR

The VX-55WR program is supplied on a 2 GB SD card. After installation, the card can be used as a 2 GB SD memory card.

- Enables simultaneous vibration level processing and waveform recording. Recorded data can be analyzed on a computer, for example to perform frequency analysis.
(Non-compressed WAVE files)

1 kHz sampling. 24 bit or 16 bit selectable.

Max. recording time (at 16 bit)

Sampling frequency \ Memory card	512 MB	2GB	32GB
1 kHz	Approx. 13 hours	Approx. 55 hours	Approx. 950 hours

Vibration Calibrator for Vibration Level Meter Inspection and Calibration
Vibration Calibrator
VP-33A

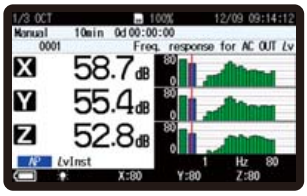
Specifications

Oscillator frequency	6.3 Hz ± 2 %
Acceleration	97 dB ± 0.5 dB (0 dB = 10-5 m/s² (rms))
	1 m/s² ± 0.06 m/s² (peak)
Acceleration waveform distortion	Max. 5 % (Frequency range: 1 Hz to 100 Hz)

1/3 Octave Real-time Analysis Program
VX-55RT

The VX-55RT program is supplied on a 512 MB SD card. After installation, the card can be used as a 512 MB SD memory card.

- Enables real time 1/3 octave band analysis.
Saved analysis results can be reloaded later for display.



1/3 octave band analysis screen

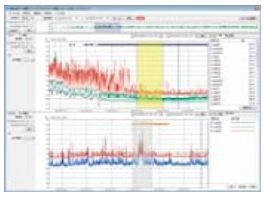
Adds support for handling data measured with VM-55 to AS-60

Data Management Software for Environmental Measurement (Includes the vibration level data management software)
AS-60VM

Supported models

- VM-55/53A* *Auto store data only

See p. 9 for AS-60 specifications



Adds support for handling data measured with VM-55 +VX-55VM + VX-55RT to AS-60

Data Management Software for Environmental Measurement (Includes the 1/3 octave data vibration level data management software)
AS-60VMRT

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

3-Axis Vibration Meter
VM-54 CE

- 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

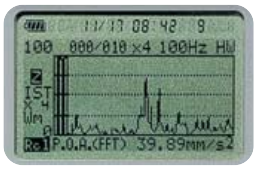
Inputs	3 channels (with 3-channel vibration input preamplifier)
Measurement frequency range	0.5 Hz to 5 000 Hz
Measurement mode (instantaneous 3-axis value)	Acceleration m/s²
Outputs	Separate AC outputs for 3-axis signals
Power	Four IEC R14 (size C) batteries, continuous operation 16 hours
Temperature/humidity range for operation	−10 ℃ to +50 ℃, max. 90 %RH
Dimensions, Weight	56 (H) × 200 (W) × 175 (D) mm, approx. 1 kg (including batteries)

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

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)

Specifications

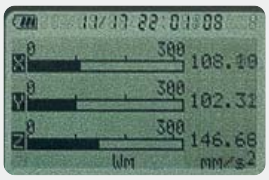
Display items	1. FFT processed spectrum display 2. Effective value (O.A.) calculated from time domain 3. O.A. value* calculated from frequency domain (FFT result) *Partial overall value for specified frequency range can also be calculated.
Display functions	Dependent on respective program card
Measurement 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, ISO 20283-5: 2016,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)

PV-83CW CE (supplied)



Graphic screen

Specifications

Applicable standards	ISO 6954: 2000, ISO 20283-5: 2016, 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

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)

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

Seat Accelerometer
PV-62 CE

Specifications

Number of components	3 axes
Charge sensitivity	3.5 pC/(m/s²) (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

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

Evaluate vibrations transmitted through hands and arms

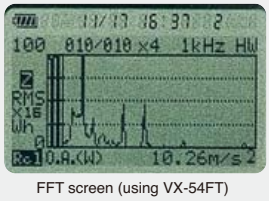
Hand-Arm Vibration Card
VX-54WH

- 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)

PV-97C CE

PV-97I

For specifications, see page 19.



FFT screen (using VX-54FT)

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

Vibration Meter (General-Purpose Vibration Meter/Vibration Analyzer)

Simply press against the measurement object

Pocketable Vibration Meter (RIOVIBRO)

VM-63C CE

- Ultra compact vibration meter with integrated accelerometer. Weighs only 200 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 to 199.9 m/s² EQ PEAK (RMS x √2)
	Velocity	0.1 to 199.9 mm/s RMS
	Displacement	0.001 to 1.999 mm EQ P-P (RMS x 2√2)
Display		3 1/2 digits, digital (LCD)
Power supply		IEC R6 (size AA) batteries (alkaline / manganese or nickel-hydride rechargeable batteries) x 2, About 50 h continuous use
Dimensions and weight		Approx. 178 (H) x 64 (W) x 27 (D) mm, approx. 200 g

Options

Attachment (L)	VP-53Y
Earphone	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 CE

- 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/s² to 200 m/s²	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	Four IEC R6 (size AA) batteries AC adapter (NC-98E, option)		
Dimensions, Weight	Approx. 171.5 (H) x 74 (W) x 25.5 (D) mm, Approx. 270 g (including batteries)		

Options

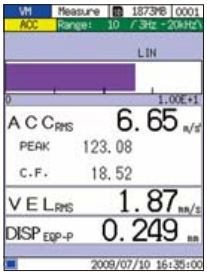
Charge converter	VP-40
Charge converter	VP-42
BNC-RCA output cable	CC-24

Portable vibration analyzer for equipment diagnosis and on-site measurements
Vibration Meter VA-12 with FFT analysis function

Vibration Analyzer
VA-12 CE

2011TPM優秀商品賞 開発賞
TPM Awards

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.



Vibration meter mode

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-57I (supplied)
Input range		
At sensitivity 1.00 to 9.99 mV/(m/s²), using PV-57I		
	ACC (Acceleration)	1, 3.16, 10, 31.6, 100, 316, 1 000 m/s² (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-57I, High-pass filter 3 Hz, Low-pass filter 20 kHz)		
	ACC (Acceleration)	0.02 to 141.4 m/s² (rms) Continuous measurement, 1 Hz to 5 kHz
	Instantaneous maximum acceleration	700 m/s²
	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/s² 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	Removable storage device class
Power		
DC12 V (11 to 15 V)		AC adapter NC-99A, eight IEC R6 (size AA) batteries
Battery life		Approx. 12 hours (23 ℃, normal operation, backlight off)
Dimensions, Weight		213 (H) x 105 (W) x 36 (D) mm (without protective cover), approx. 850 g (incl. batteries,with protective cover, PV-57I connected)

● Re-analysing is available on the computer.

Options

Wave Analysis Software	AS-70
Waveform Analysis Software	CAT-WAVE
Piezoelectric accelerometer	Various
BNC Adapter	VP-52C

Charge converter	VP-40
SD-CARD 512 MB*	MC-51SS1
SD-CARD 2 GB*	MC-20SS2

*Use only RION supplied cards for assured operation

Vibration Meter (Vibration Meter Unit/2-Channel Charge Amplifier/General-Purpose Vibration Meter)

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) Accelerometer with TEDS compliant integrated preamplifier (24 V 4 mA)
	7-pin preamp connector (Connector type PRC-03)	For piezoelectric accelerometer connected via preamplifier (VP-26A) (Maximum input voltage ±10 V)
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 (attenuation -18 dB/oct) (−10 % drop)	3, 5, 10, 15, 20, 30, 50, 100, 150, 200 Hz, Off (User filter supported with UV-22)
	LPF (attenuation -18 dB/oct) (−10 % drop)	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-99A, 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 CE

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_{eq} 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 ℃ to 50 ℃, max. 90 %RH
Power		9 V to 15 V DC, suitable AC adapter NC-99A, 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 CE

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
- 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-99A, 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

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

Battery Unit
BP-17 CE


Example for linkup with UV-15 units

- 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 ℃, with CHARGE setting, normal operation. Actual time will differ depending on ambient conditions and operation settings.

AC Adapter
NC-99A

- 100 V to 240 V AC, 12 V DC

Rack Mounting Base
CF-27 (JIS compliant)

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

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

General-Purpose Vibration Meter
VM-83 CE

- Measure and evaluate vibrations using a piezoelectric accelerometer or the Servo Accelerometer LS-10C (With optional servo accelerometer LS-10C, even very low frequency vibrations from 0.1 Hz upwards can be measured.)
- Display characteristics can be switched to rms, equivalent peak, and equivalent peak-to-peak, with maximum value hold and peak hold capability

Specifications

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

Options

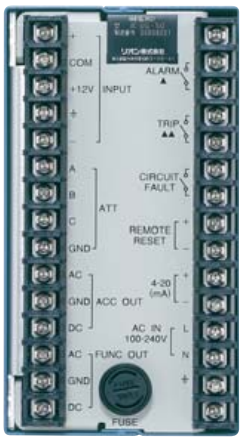
Vibration level meter/vibration accelerometer cable	EC-02S series (3 m and up)
Vibration Meter Preamplifier	VP-26A
Interface cable	5WKR4030

Vibration Meter (Vibration Monitor)

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

Vibration Monitor
UG-50

Front View



Rear View

- 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 preamplifier
	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/s²)	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: Acceleration / Velocity / Displacement; Dedicated acceleration range (Range depends on setting range of main circuit) 1 000 / 1 000 / 100 / 1 000 300 / 300 / 30 100 / 100 / 10 / 100 30 / 30 / 3 10 / 10 / 1 / 10 3 / 3 / 0.3 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 ℃ to 50 ℃, max. 90 %RH
Dimensions, Weight		Approx. 148 (H) x 80 (W) x 235 (D) mm, approx. 1.5 kg

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

For enhanced connection flexibility between piezoelectric accelerometer and vibration monitor

Preamplifier UG-20
Charge amplifier for cable runs up to 300 meters

Preamplifier UG-21
Junction box preamplifier for cable runs up to 400 meters

Junction Box
Please contact us.

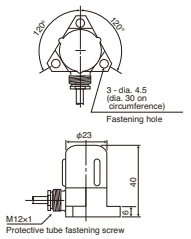
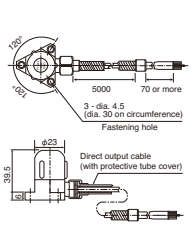
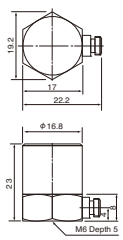
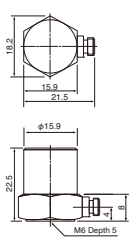
4-20 mA Isolation Unit
UG-33
4-20 mA current output
*Factory option

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 preamplifier **PV-10B**	 Waterproof, insulated accelerometer (For vibration measurements at nuclear power plants and similar; rated for gamma radiation resistance up to 1x10⁴ R) **PV-10T**	 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) **PV-63** CE	 For machine vibration measurements at high temperature **PV-65** CE
Charge sensitivity pC/(m/s²) ※1	—	9.18	4.59	7.14
Voltage sensitivity mV/(m/s²) ※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 ℃	−20 to +100	−50 to +150	−20 to +300	−50 to +260
Maximum measurable acceleration m/s²(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.

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 49.

Specific purpose				Model	See page
Vibration measurement	Point measurement	On-site measurement		VM-63C, VM-82A	24
		Test chamber measurement		VM-83 + PV series	19, 27
	Multi-point measurement	Vibration meter		UV-15 + PV series	19, 26
		Charge amplifier		UV-16 + PV series	19, 27
Vibration analysis		FFT analysis		VA-12	25
				SA-02	32
				RIONOTE + SX-A1VA, RIONOTE + SX-A1FT	40
		Octave analysis		SA-02, RIONOTE + SX-A1RT	32, 40
		Transfer function		RIONOTE + SX-A1FT	40
				SA-02	32
		Mode analysis		SA-02 + Mode analysis software + Impulse hammer	32, 36
		Tracking analysis		SA-02 + Tracking analysis software, RIONOTE + Tracking analysis software	32, 36, 40, 41
Equipment diagnosis	Vibration monitoring	Online		UG-50	28
		Trend management	Small-scale	VM-82A	24
	Vibration diagnosis	Simple diagnosis	Vibration magnitude measurement	VM-63C, VM-82A	24
		Precision diagnosis	Fault analysis	VA-12, RIONOTE + SX-A1VA	25, 40
			Visualization of vibrations	SA-02 + Mode analysis software	32, 36
Quality management	Product quality management			VM-83 + PV series	19, 27
				SA-02, RIONOTE + SX-A1CMP	32, 40, 41
	Low-Frequency Micro-vibrations			LS-40C, LS-10C	20
Damping material loss factor				SA-02 + AS-14PA5	32, 33
Vibration meter calibration				VE-10, PV-03	20

2 Vibrations affecting human body

Specific purpose		Model	See page
Vibration measurement	Road traffic vibrations, construction sites, environmental vibrations, measurements related to vibration restriction laws	VM-55	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	20, 32
	Hand-arm vibration	VM-54 + VX-54WH + PV-97Ⅰ/97C/93	19, 23
		SA-02 + PV-97Ⅰ + CAT-SA02-HT	19, 32, 37
Vibration level recording		VM-55 + LR-07	22, 43

Vibration Meter

Accelerometer Selection

Piezoelectric Accelerometer

Standard piezoelectric

Piezoelectric Accelerometer
PV-03

With integrated amplifier

Piezoelectric Accelerometer
PV-90T

Piezoelectric Accelerometer
PV-91C

Piezoelectric Accelerometer
PV-91CH

General-purpose

Piezoelectric Accelerometer
PV-85/86

Piezoelectric Accelerometer
PV-94/95

Compact/lightweight

Piezoelectric Accelerometer
PV-08A

Piezoelectric Accelerometer
PV-90B

High-output

Piezoelectric Accelerometer
PV-87

High-temperature

Piezoelectric Accelerometer
PV-90H

Piezoelectric Accelerometer
PV-44A

Piezoelectric Accelerometer
PV-65

Piezoelectric Accelerometer
PV-63

Triaxial type

Piezoelectric Accelerometer
PV-93

Piezoelectric Accelerometer
PV-97C

Piezoelectric Accelerometer
PV-97

Piezoelectric Accelerometer
PV-97I

Connection Cable

Standard Cable **VP-51A**

See p. 48 for external view drawings

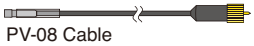
Ultra-compact Accelerometer Cable
VP-51LC ＊TEDS compliance only with UV-15

Ultra-compact Accelerometer Cable
VP-51LC

Ultra-compact Accelerometer Cable
VP-51LC

Standard Cable
VP-51A

Standard Cable
VP-51A



PV-08 Cable
VP-51J

Ultra-compact Accelerometer Cable
VP-51L

Standard Cable
VP-51A

Ultra-compact Accelerometer Cable
VP-51LB

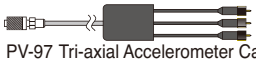
Heat-resistant Cable
VP-51B

Heat-resistant Cable
VP-51B

Heat-resistant Cable
VP-51I

Tri-axial Standard Cable
VP-51C

Ultra-compact Accelerometer Cable
VP-51L ×3



PV-97 Tri-axial Accelerometer Cable
VP-51WL

PV-97I Tri-axial Accelerometer Cable
VP-51W

Preamplifier
VP-26A

Extension Cable
EC-02S (3 m)
EC-02SB (10 m)
EC-02SD (50 m, with reel)
EC-02SE (100 m, with reel)

See p. 48 for external view drawings

※UV-16 does not allow extension with Preamplifier VP-26A

Charge Converter **VP-42**
Using **VP-51A** (Can be extended up to 100 m.)

BNC Adapter **VP-52C**

Charge Converter **VP-40**

BNC Adapter **VP-52C**

Charge Converter **VP-40**

Charge Converter **VP-42**
Using **VP-51A** (Can be extended up to 100 m.)

BNC Adapter **VP-52C**

BNC Adapter **VP-52C**

Vibration Meter

VM-83
UV-15
UV-16

SA-02
DA-21
RIONOTE

General-Purpose Vibration Meter
VM-83

Vibration Meter Unit
UV-15
Interface Unit
UV-22

2-Channel Charge Amplifier
UV-16
Battery Unit
BP-17

Multi-channel Signal Analyzer
SA-02

4 channel Data Recorder
DA-21

Portable Multi-function Measuring System
RIONOTE

Servo type

Servo Accelerometer
LS-10C

Servo Accelerometer
LS-40C

Integrated (1 m)

Integrated (1 m)

Extension Cable
EC-40A (5 m)
EC-40B (10 m)
EC-40C (30 m, with reel)
EC-40D (50 m, with reel)

VM-83
LF-20

LF-20

General-Purpose Vibration Meter
VM-83

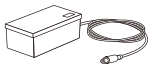
Servo Accelerometer Power Supply
LF-20

Vibration Meter Connection Examples

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

AC Adapter	Vibration Meter	Connection Cable	Peripheral Equipment

AC Adapter **NC-98E**



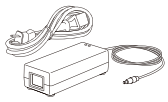
Battery Pack **BP-21A**

Vibration Level Meter **VM-55** SD-CARD

USB A-mini B Cable → **Computer**

RS232C serial I/O cable **CC-42R** → **Computer**

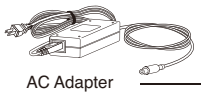
BNC-mini plug Cable **CC-24** → **Peripheral device with BNC connector**



AC Adapter **NC-99A**

Vibration Analyzer **VA-12** SD-CARD

USB A-mini B Cable → **Computer**

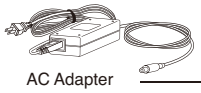


AC Adapter **NC-98E**

General-Purpose Vibration Meter **VM-82A**

USB A-mini B Cable → **Computer**

BNC-mini plug Cable **CC-24** → **Peripheral device with BNC connector**



AC Adapter **NC-98E**

Accelerometer sold separately
＊For details, see "Accelerometer Selection" on page 30.

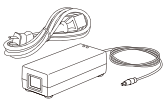
General-Purpose Vibration Meter **VM-83**

Interface Cable **5WKR4030** → **Computer**

BNC-BNC Cable **NC-39A** → **Peripheral device with BNC connector**

BNC-BNC Coaxial Cable **EC-90A/90B** → **Peripheral device with BNC connector**

＊For information on comparator output connection, contact RION distributors.



AC Adapter **NC-99A**

Vibration Meter Unit **UV-15**
Interface Unit **UV-22**

USB A-mini B Cable → **Computer**

LAN Cable → **Computer**

BNC-BNC Cable **NC-39A** → **Peripheral device with BNC connector**

BNC-BNC Coaxial Cable **EC-90A/90B** → **Peripheral device with BNC connector**

Battery Unit **BP-17**

2-Channel Charge Amplifier **UV-16**
Battery Unit **BP-17**

BNC-BNC Cable **NC-39A** → **Peripheral device with BNC connector**

BNC-BNC Coaxial Cable **EC-90A/90B** → **Peripheral device with BNC connector**

Computer

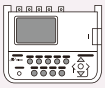
Computer
＊For supported software, see page of respective vibration meter.

External device

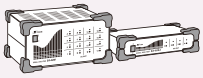
Rotating light, alarm etc.

Peripheral device with BNC connector

Level Recorder **LR-07**



Data Recorder **DA-21**



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

Portable Multi-function Measuring System **RIONOTE**

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 TEDS compliant
- Wide range of analysis software available
- Customizing of analysis software also possible
- Easy operation

Features 4 fixed channels

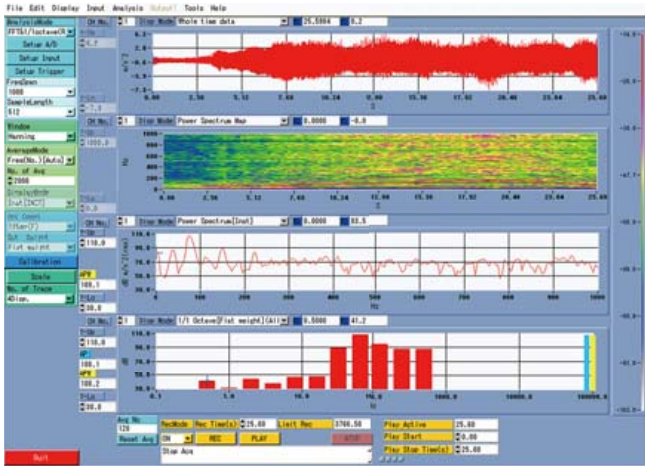
4-Channel Signal Analyzer
SA-02A4

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

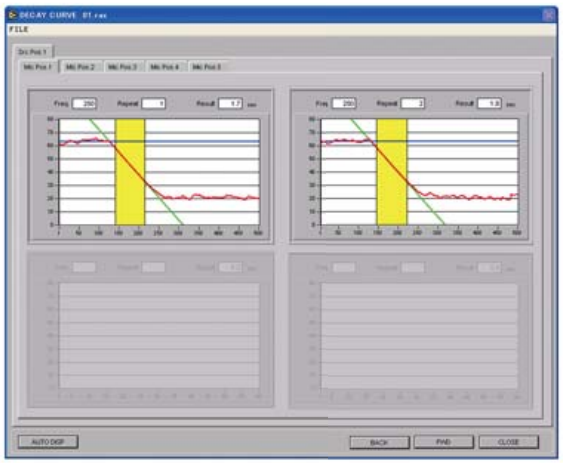
Standard compliance	1/1, 1/3, 1/12 octave band filters: IEC 61260-1: 2014 class 1 (JIS C 1513-1: 2020 (Filter) JIS C 1514: 2002 class 1), WEEE Directive, RoHS Directive, Chinese RoHS Directive				
Frequency range	DC to 40 kHz				
FFT analyzer section	Analysis frequencies	100 Hz / 200 Hz / 500 Hz / 1 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)			

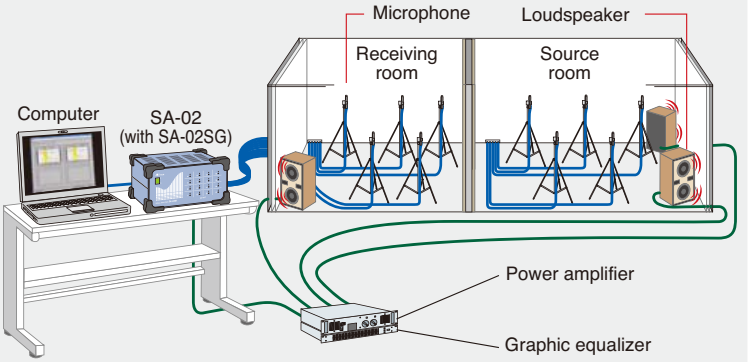
Options

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

Dedicated Analysis Software

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





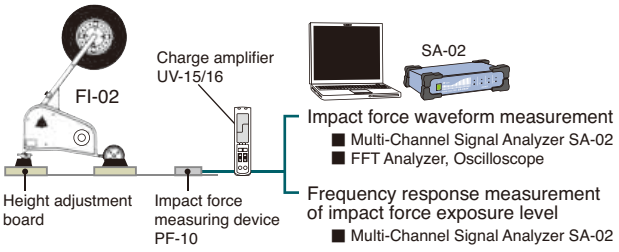
- Designed for sound insulation measurement of buildings and building materials based on ISO specifications. Measurement and evaluation for the categories of reverberation time, floor impact sound and attenuation, airborne sound, and sound absorption in a reverberation room are possible.
- Applicable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

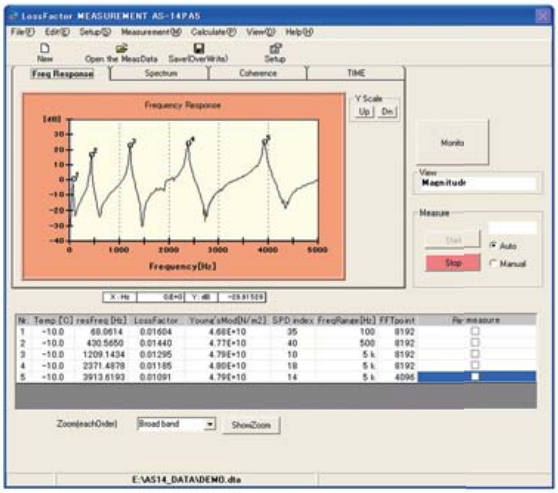
Impact Force Measuring Device
PF-10

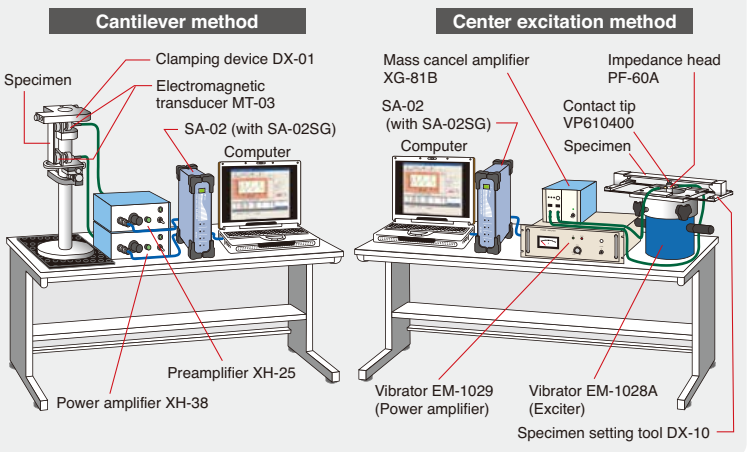
Impact force measurement using an impact ball

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



Loss Factor Measurement Software
AS-14PA5





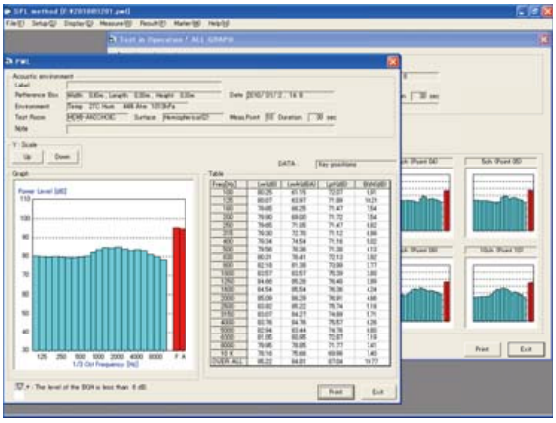
- Using the center excitation method or cantilever method, the frequency response of a strip specimen is measured, and the resonance characteristics are used to determine the loss factor and Young's modulus (or shear coefficient) of the specimen according to the half-power bandwidth method.
- Automatic measurement including temperature control of a thermostatic chamber is supported.
- Applicable standards
  ISO 10112 / ISO 16940 / ASTM E756-05

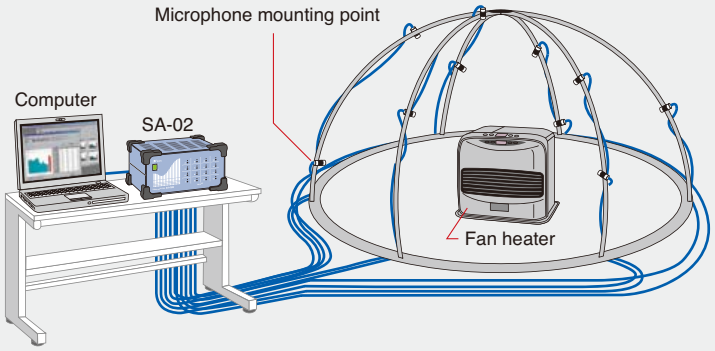
* When performing vibration attenuation testing for non-constraint compound damping, "Monogram display of damping material characteristics" is supported with optional software.

Frequency Analyzer (Software/Intensity Probe)

Dedicated Analysis Software

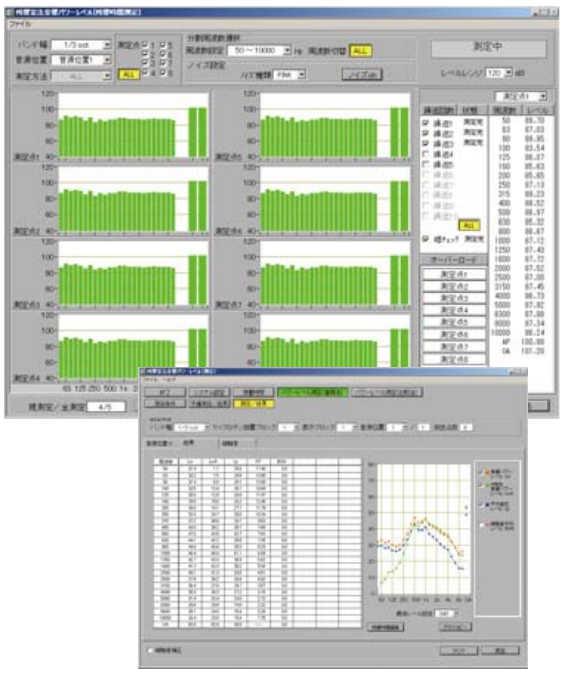
Sound Power Level Measurement Software for Hemi-anechoic Room
AS-30PA5

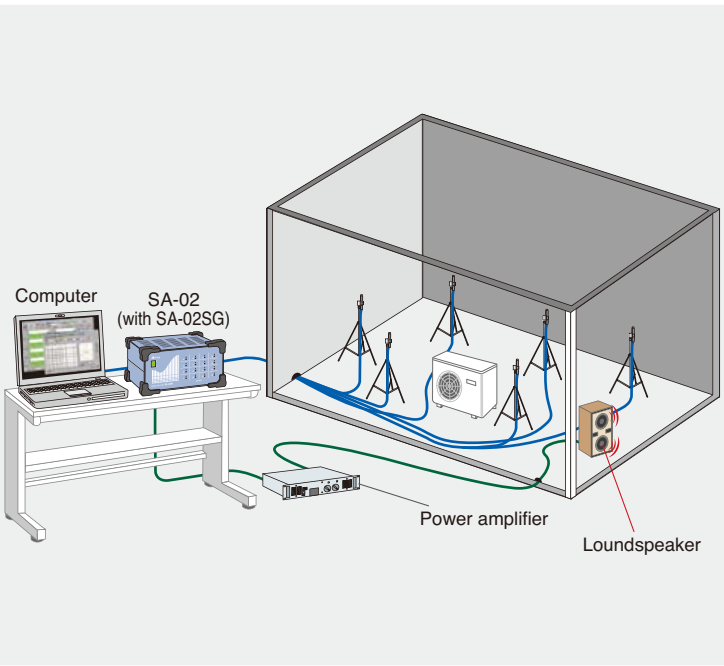




- Allows 1/3 octave band sound power level measurements, according to specifications for sound power level measurements in hemi-anechoic chambers.
- Sound pressure level values are measured in a hemi-anechoic chamber using measurement points arranged on a virtual measurement surface (hemispheric, cuboid). 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

Sound Power Level Measurement Software for Reverberation Room
AS-31PA5

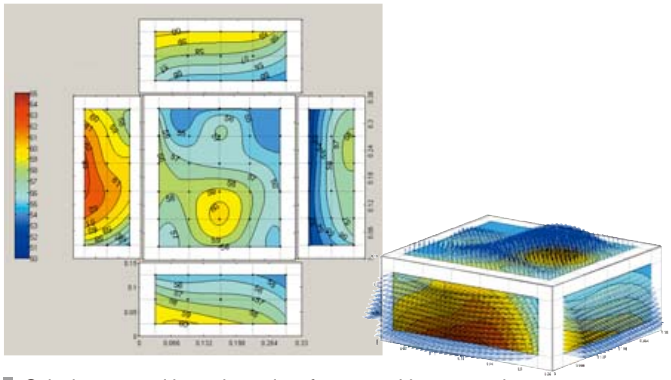


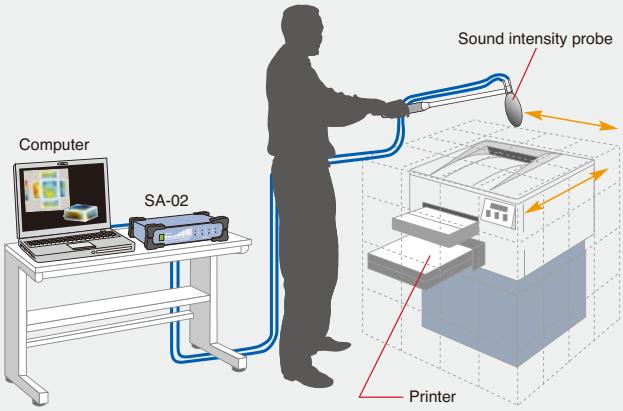


- Supports direct and comparative measurement. Also allows reverberation time measurement.
- Supports multi-channel measurement and microphone rotator use.
- Simultaneous power level measurement for up to 32 channels possible (up to 8 channels for reverberation time measurement).
- Applicable standards ISO 3741: 1999 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

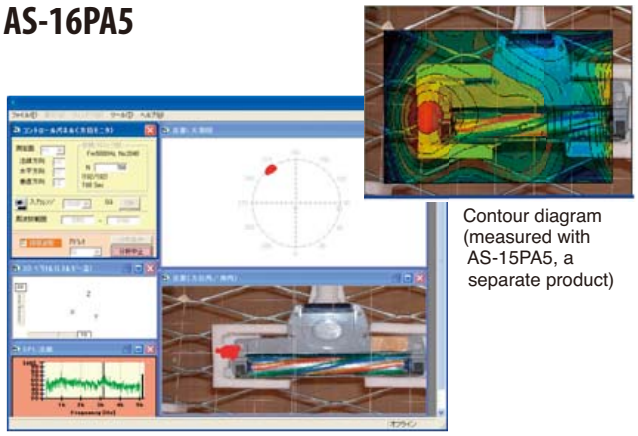
Sound Intensity Measurement Software
AS-15PA5



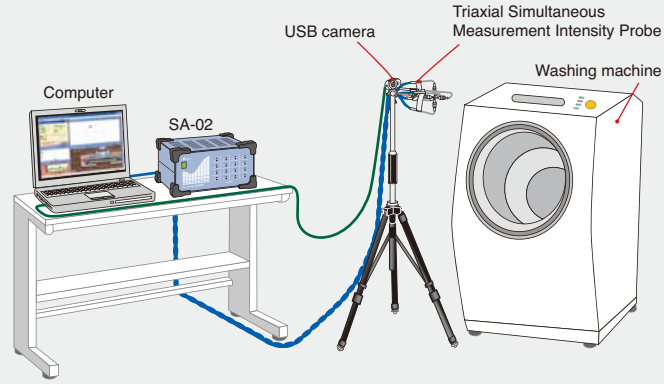


- Calculates sound intensity and performs graphics processing.
- Displays frequency spectrum, band level, and intensity spectrum information as spectrum line diagram, contour diagram, or mesh diagram, and shows sound power levels.

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

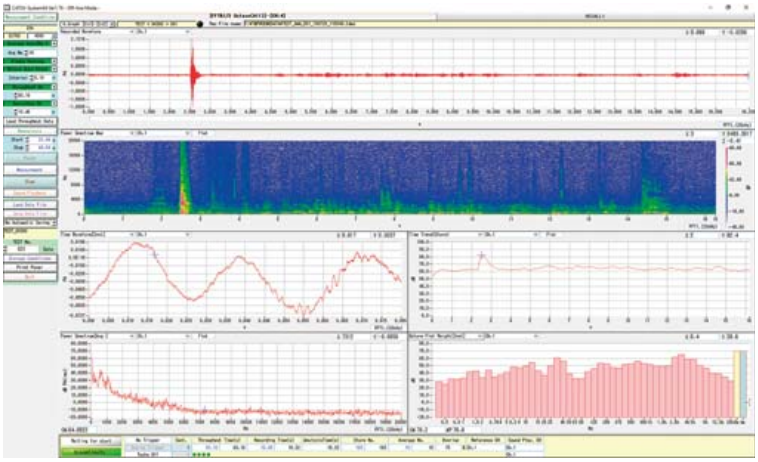
- Allows simultaneous measurement of sound intensity in all directions of a three-dimensional orthogonal coordinate system
- Dedicated microphones capable of capturing an intensity vector as a three-dimensional spatial vector
- Three sets of 1/2 inch electret microphone pairs UC-53I with matching phase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

Specifications

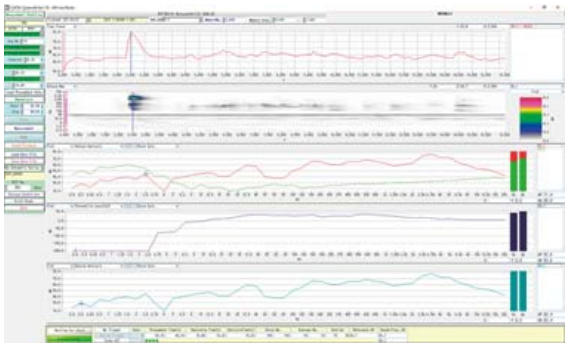
Construction principle		Face to face, with integrated preamplifier
Shape	Effective acoustic distance	31 mm: 100 Hz to 2 kHz 50 mm: 50 Hz to 1.2 kHz

Frequency Analyzer (Software/System)

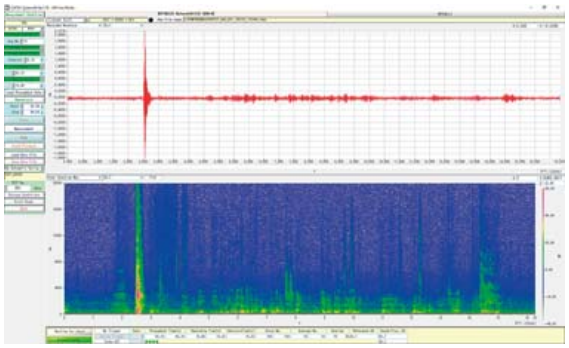
Dedicated Analysis Software



Basic screen



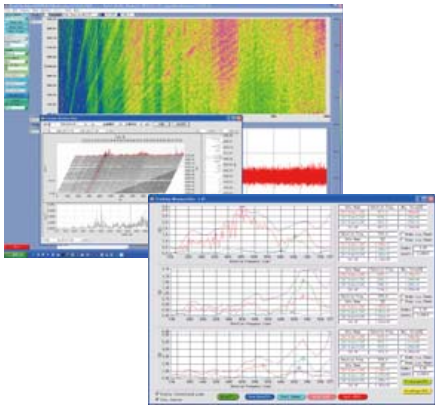
Recall screen



Spectrum map screen

Sound and Vibration Measurement System
CAT-SA02-Pro

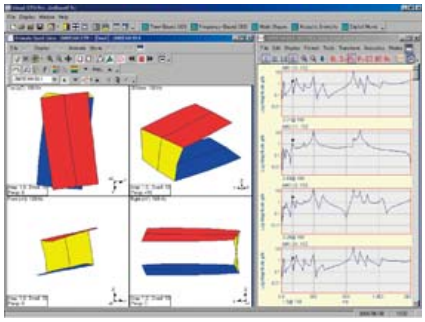
- Supports simultaneous FFT analysis, octave band analysis, and recall processing while recording time waveform data
- Allows combined viewing of downsampled FFT analysis results
- Supports simultaneous analysis for two sets of frequencies and number of sampling points
- Supports long-term time wave recording
- Comments and event notes can be attached to analysis results
- Combination with a USB camera or high-speed camera allows measurement while simultaneously recording video (option)
- Supports order ratio tracking analysis and sound quality evaluation (option)



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.)

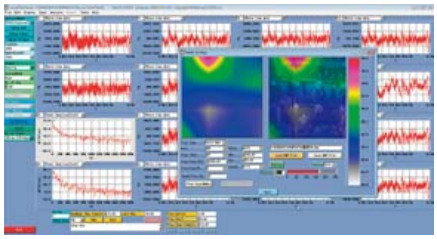
- Allows direct linking of SA-02 and mode analysis software
- Measurement points and direction for each channel can be displayed on screen using arrows, making it easy to check the next measurement point.
- Analysis using animated display can be generated in a few steps.

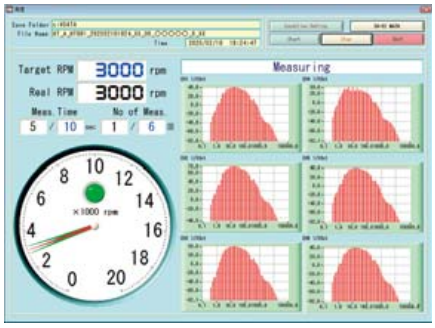
Sound Quality Evaluation Software
CAT-SA02-SQ

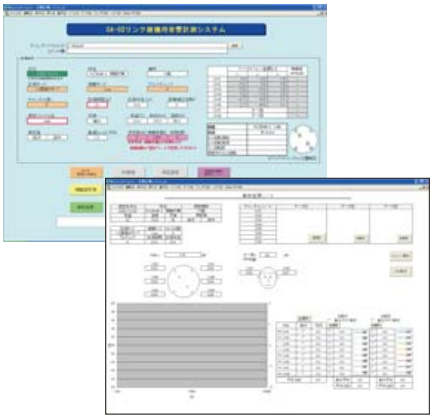
(This software is a product of Catec Inc.)

- 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.

Dedicated Analysis Software







Array Type Visualization Software
CAT-SA02-AR
(This software is a product of Catec Inc.)

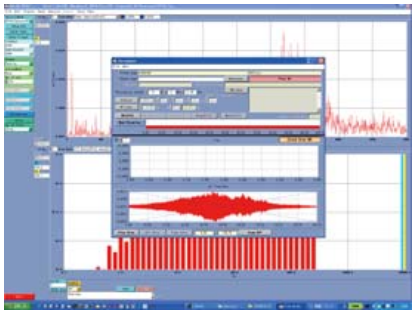
- Sound pressure level fluctuations and changes are made visible using a 32-microphone array.
- Visualization can be performed separately by frequency or overall. Microphone frequency analysis results can be displayed for each mode.
- Power spectrum and 3-D spectrum map can be observed for each array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

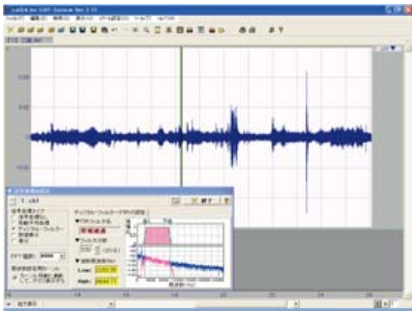
Hand-arm Vibration Measurement Software
CAT-SA02-HT
(This software is a product of Catec Inc.)

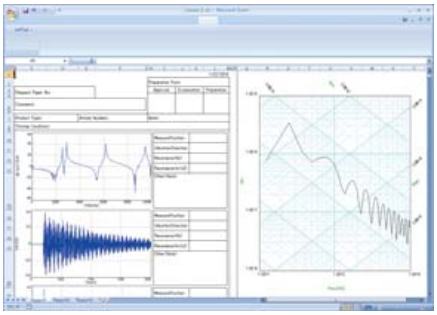
- Frequency-weighted acceleration rms values are measured for the X, Y, Z axes simultaneously. From these values (a_{hwx}, a_{hwy}, a_{hwz}), the software determines the triaxial combined value a_{hv}.
- Applicable standards
  ISO 8041 / ISO 5349-2

Sound Power Level Measurement Software for Construction Machinery
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







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

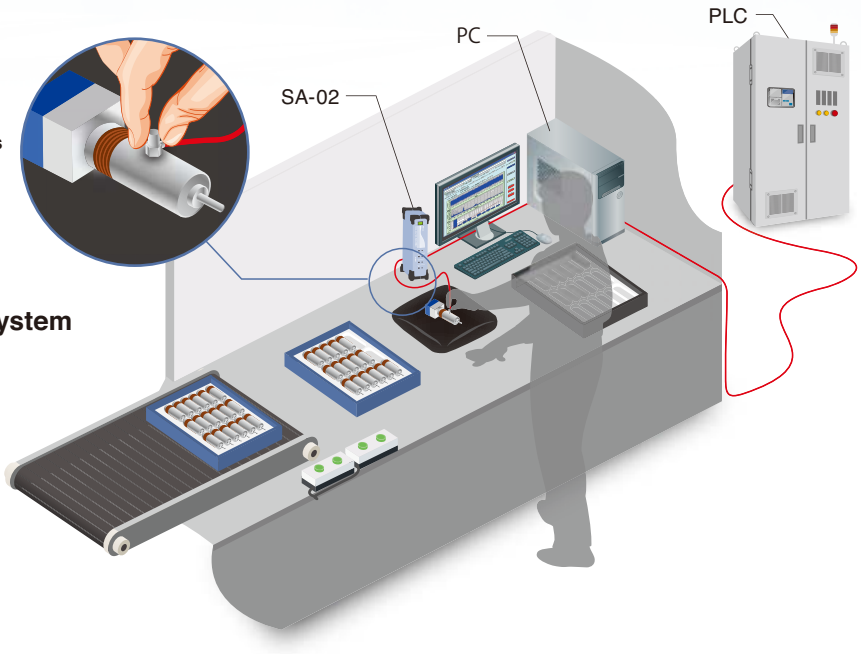
Frequency Analyzer (Sound and vibration evaluation system)

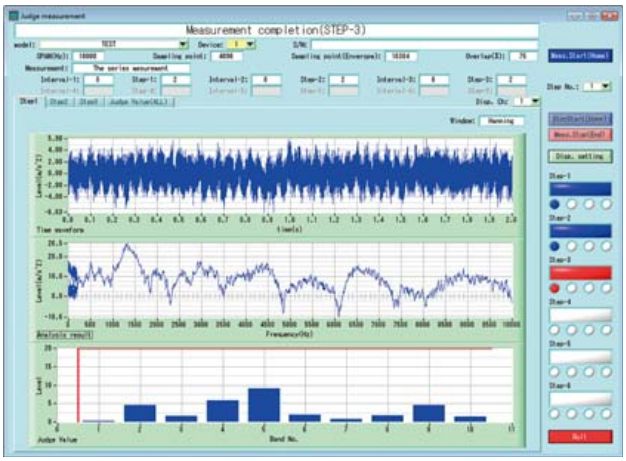
Dedicated Analysis Software

Unusual noise and abnormal vibrations generated on a production or inspection line can be detected from the FFT analysis results of the Multi-Channel Signal Analyzer SA-02 to implement pass / fail evaluation.

Sound and Vibration Evaluation System

- **Self-learning type evaluation system**
  Utilizes Mahalanobis distance (MTA method)
- **Threshold evaluation system**
  Pass / fail evaluation using a threshold area enclosed by upper and lower frequency level limits
- **Comparative evaluation using reference level**
  Calculates and compares the reference level from the average value and standard deviation
- **Real-time sound quality evaluation system for noise detection**
  Uses sound quality evaluation parameters such as transient loudness and sharpness
- **Bearing vibration evaluation system**
  Automatically determines bearing fault locations from bearing parameters and rotation speed





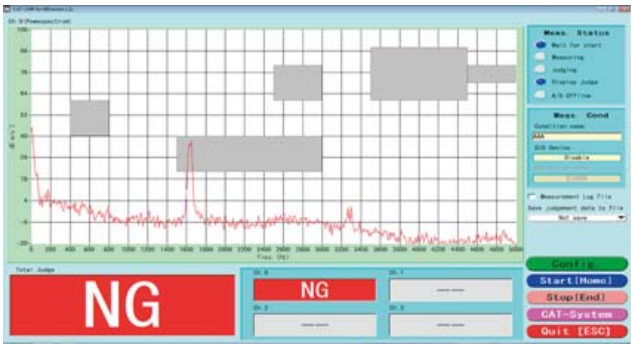
Self-learning Evaluation System
CAT-CMP-MTA

(This software is a product of Catec Inc.)

Using the Mahalanobis distance (MTA method) for statistical analysis, the system can be trained to recognize OK (Pass) products and mark products not in the OK group as NG (Fail). The evaluation threshold is set by the distance from each frequency range set.

- Simultaneous evaluation in multiple channels supported
- Evaluation thresholds can be set separately for each testing stage
- Evaluation thresholds can be set separately for each machine
- By defining a frequency range, evaluation thresholds can be set for each frequency range
- Automatic measurement using DIO communication or PLC communication supported

Application examples:
transmission, combustion engine



Threshold Evaluation System
CAT-SA02-CMP01

(This software is a product of Catec Inc.)

A square threshold area is formed by specifying the upper and lower frequency and upper and lower level where abnormality occurs. The program then determines whether the respective measured peak level falls within this area.

- Up to five evaluation threshold area can be set
- AND/OR linking of threshold area is possible
- Settings can also be made for all-pass level
- Peak level or partial overall level can be selected

Application examples:
electric motor, combustion engine, compressor

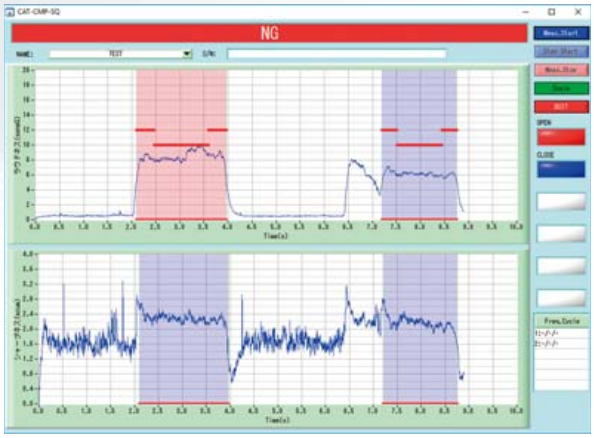
Reference Level Comparison Method Evaluation System
CAT-CMP-REF

(This software is a product of Catec Inc.)

OK (Pass) products are measured several times, and the average value and standard deviation are calculated from the data for each frequency. The calculation results are used to set multiple frequency ranges. If level standard deviation is within range (such as 3σ etc.), the product is marked as OK, otherwise as NG (Fail). In the above sample screen, yellow is the OK range and red indicates the measured data.

- Simultaneous evaluation in multiple channels supported
- Evaluation thresholds can be set separately for each testing stage
- Evaluation thresholds can be set separately for each machine
- By defining a frequency range, evaluation thresholds can be set for each frequency range
- Automatic measurement using DIO communication or PLC communication supported

Application examples:
transmission, combustion engine



Real-time Sound Quality Evaluation System for Noise Detection
CAT-CMP-SQ

(This software is a product of Catec Inc.)

Applying an analytic method that closely simulates human hearing (transient loudness [DIN 45631 standard], sharpness is used to determine abnormal noise from a product. This allows identification also of sounds that could not be evaluated by sound pressure level measurements alone.

- Simultaneous evaluation in 4 channels supported
- Evaluation can be performed by transient loudness (according to DIN 45631 standard) and transient sharpness
- Evaluation thresholds can be set separately for each testing stage
- Evaluation thresholds can be set separately for each machine
- Automatic measurement using DIO communication or PLC communication supported

Application examples:
electric motor, automotive parts

Bearing Vibration Evaluation System
CAT-CMP-BR

(This software is a product of Catec Inc.)

Allows automatic evaluation of bearing faults based on bearing parameters and rotation speed, by setting a frequency for bearing damage. When an abnormality is detected, the location can also be identified (inner ring, outer ring, rolling element, cage).

- Evaluation by input of bearing parameters and rotation speed
- Evaluation by envelope function supported
- Indication of fault location (inner ring, outer ring, rolling element, cage) supported
- Evaluation thresholds can be set separately for each machine
- Automatic measurement using DIO communication or PLC communication supported

Application examples:
bearing

FFT & Order Tracking Evaluation System
CAT-CMP-ORD

(This software is a product of Catec Inc.)

Performs FFT analysis of a measurement object in steady rotation, and allows threshold evaluation of frequency on the horizontal axis and level on the vertical axis. For a measurement object with fluctuating rotation, order tracking evaluation is performed by measuring rotation speed and calculating the order values.
For each specified order, threshold evaluation of frequency on the horizontal axis and level on the vertical axis is possible.
Evaluation threshold values can be set separately for each type of measurement object.

Application examples:
transmission, combustion engine, electric motor, compressor, and other rotating machinery

Frequency Analyzer Portable Multi-function Measuring System

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

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

Portable Multi-function Measuring System
RIONOTE CE

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 amplifier)

Number of channels	4(2), BNC connectors, CCLD, AC/DC
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, fs = 51.2 kHz, 400 line FFT noise level)
A/D converter	24 bit, delta-sigma type, simultaneous sampling
Tacho pulse input, General purpose input	
Number of channels	1, BNC connector
Tacho pulse	
Input voltage range	0 - 12 V, open collector supported, internal pull-up 3.3 V (pull-up resistance 1 kΩ)
H-L threshold level	2.5 V
Measurement rotation speed range	5 000 pulse/s
General purpose	
A/D converter	10 bit successive approximation type
Sampling frequency	Approx. 10 Hz

Display	10.1 inch TFT color LCD
Touch panel	Multi-touch (2 points), projected capacitive type
Input/output section	
USB	USB A x 1, mini B x 1
Earphone jack	Yes, Stereo mini jack, ϕ3.5
SD card slot	Yes (SDHC support, max. 32 GB)
SD card	SDHC support, max. 32 GB
Power supply	Li-Ion battery, AC adapter
Dimensions, Weight	188 (H) x 275 (W) x 30 (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.

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)

RIONOTE also enables the use of a wireless dock 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

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

Analysis 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 61260-1:2014 class1, ANSI/ASA S1.11-2004/Part1 class1
Band filter center frequencies and number of bands	
Octave bands	0.5 to 16 000 Hz, 16 bands Max. 4 channels
1/3 octave bands	0.4 to 20 000 Hz, 48 bands Max. 3 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 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. The waveform can be analyzed on SX-A1FT. Recorded WAVE files can be analyzed with the Waveform Processing Software AS-70

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 (20 kHz, 10 kHz, 5 kHz only)
Recorded data	WAVE format

● Analysing is available also on the computer.

Vibration Analysis Program
SX-A1VA

This program adds vibration measurement functions.

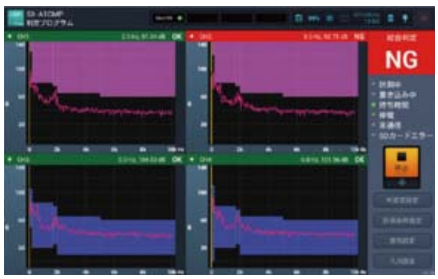
- All essential vibration measurement functions are provided, enabling equipment diagnosis and trend management for industrial machinery.
- The program also supports detailed diagnosis including FFT analysis and envelope processing.

Vibration frequency range (using PV-57I)		
	Acceleration	0.02 to 141.4 m/s² (rms)
	Velocity	0.2 to 141.4 mm/s (rms, at 159.15 Hz)
	Displacement	0.02 to 40.0 mm (EQ peak-peak, at 15.915 Hz)
FFT analysis mode		Power spectrum Time waveform of 1 frame
	Frequency range	100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz
	Number of analysis lines	200, 400, 800, 1 600, 3200

Judgment Program
(Pass/Fail Evaluation)
SX-A1CMP

This program is suitable for pass/fail evaluation of noise, vibrations and other phenomena in production or inspection lines.

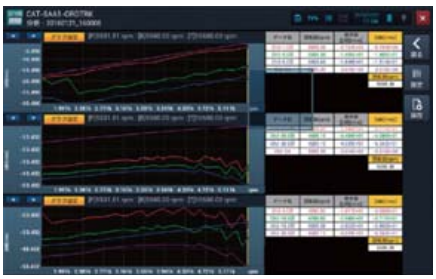
- It allows the definition of evaluation windows for FFT analysis results to determine pass/fail.



Order Tracking Program
CAT-SAA1-ORDTRK
(This software is a product of Catec Inc.)

Noise or vibration evaluation to assess causes of resonance phenomena related to revolution speed changes

- Automatic analysis based on recorded revolution data and noise/vibration waveform data



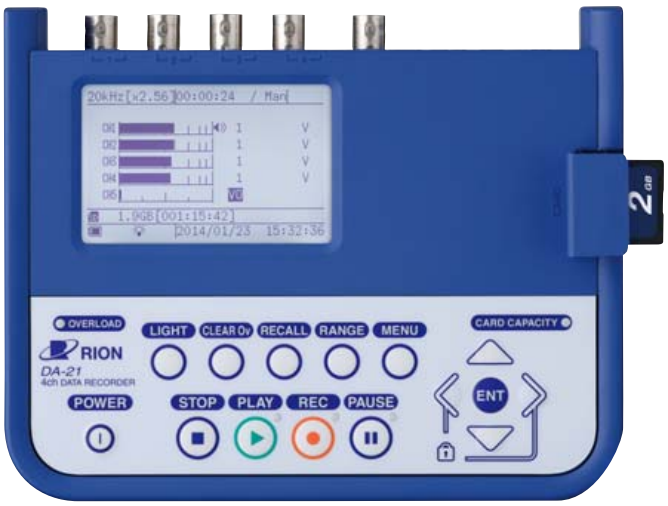
Recorder (Data Recorder/Software)

Capable of recording acoustic / vibration waveforms and various voltage signals in the field
Recorded data are saved in WAVE format on SD cards and can be imported into a computer for waveform analysis and other processing tasks

4 channel Data Recorder
DA-21 CE

SD-CARD **Memory card compatible model**
For details, see "Memory Card" on page 15.

- 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

Input section	Signal input	4 channels (BNC), 1 channel (BNC rotation speed)
	CCLD (Constant Current Line Drive)	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
Output section	Playback output connectors	4 channels, ϕ2.5 monaural jacks
Recording section	Media	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	Four IEC R6 (size AA) batteries, AC adapter (NC-98E, option), Cigarette plug adapter CC-82 (option)
Dimensions, Weight		Approx. 140 (H) x 175 (W) x 45 (D) mm, approx. 450 g (not including batteries), approx. 770 g (including batteries)

● Re-analysing is available on the computer.

Options

Memory card (2 GB SD card*)	MC-20SD2
Memory card (32 GB SD card*)	MC-32SP3
Inter-unit sync cable	CC-43
Battery Pack	BP-21A
AC adapter	NC-98E
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 32 GB SD card (approximate)
Sampling frequency: frequency range x 2.56 (2.4 also supported)

		Frequency range (Hz)					
		100	500	1 000	5 000	10 000	20 000
Number of channels	1	1 7066 h 40 m	3413 h 20 m	1706 h 40 m	341 h 20 m	170 h 40 m	85 h 20 m
	2	8 533 h 20 m	1 706 h 40 m	853 h 20 m	170 h 40 m	85 h 20 m	42 h 40 m
	3	5 688 h 32 m	1137 h 36 m	568 h 48 m	113 h 36 m	56 h 48 m	28 h 24 m
	4	4 266 h 40 m	853 h 20 m	426 h 40 m	85 h 20 m	42 h 40 m	21 h 20 m

● Maximum recording times with 2 GB SD card (approximate)
Sampling frequency: frequency range x 2.56 (2.4 also supported)

		Frequency range (Hz)					
		100	500	1 000	5 000	10 000	20 000
Number of channels	1	1066 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. 1000 hours *Use RION supplied cards for assured operation

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

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

Provides various display and analysis functions for WAVE file

Viewer Software
AS-70 Viewer (supplied with DA-21)

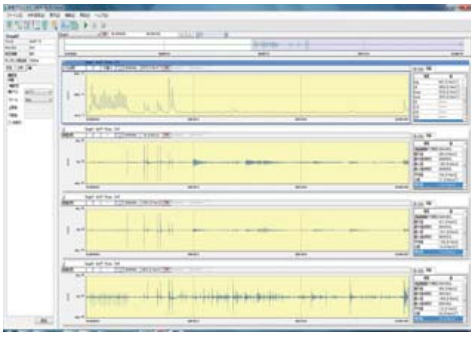
Supported models : RIONOTE, NX-42WR, NX-28WR, SA-78WR DA-21/20/40, VA-12, VX-55WR, SX-A1VA

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

Specifications

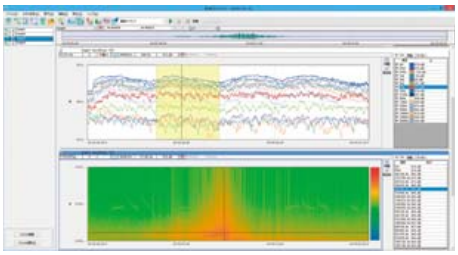
Waveform	Display functions	Amplitude waveform, level waveform
	Weighting functions	10 ms, F (Fast), 630 ms, S (Slow), 10 s

*Supported operating system: Microsoft Windows, 8.1 Pro 64 bit, 10 Pro 64 bit

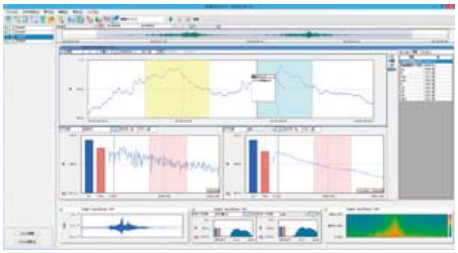

4-channel display screen

Recorder (Level Recorder/Printer)

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, VX-55WR, SX-A1VA

- 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

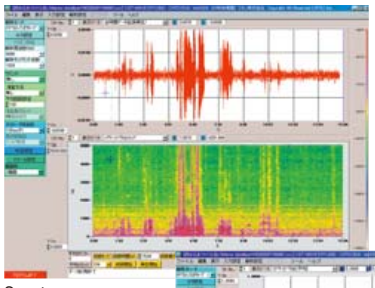
Waveform analysis	Processing	Maximum value, minimum value, average value, effective value, distribution, differentiation and integration, HPF, LPF
Frequency weighting characteristics		Z, A, C, G, C to A, vertical vibration characteristics, horizontal vibration characteristics
FFT analysis	Number of analysis points	32 to 65 536
	Data view	Power spectrum, power spectrum density, spectrogram
Time weighting characteristics		10 ms, F (Fast), 630 ms, S (Slow), 10 s
Octave band analysis	Applicable standards	IEC 61260-1: 2014, JIS C 1513-1: 2020 class1 (Filter), JIS C 1514: 2002 class1
	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

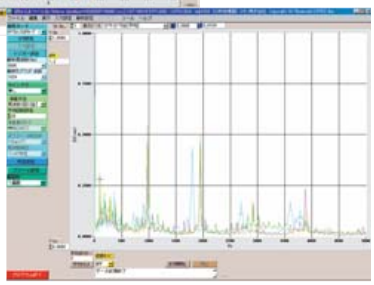
CPU	Intel Core i5 2 GHz or faster
RAM	2 GB or more, 4 GB recommended
HDD	20 GB or more (free space), 100 GB or more recommended
DISPLAY	XGA (1024 x 768 pixels) resolution or higher
OS	Microsoft Windows, 8.1 Pro 64 bit, 10 Pro 64 bit

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
FFT analysis	Sampling points	64 to 32 768 points
	Display function	Power spectrum, Cross spectrum, Transfer function, Coherence, Power spectrum map,Octave map, Differential and calculus for spectrum area
Octave band analysis	Applicable standard	IEC 61260-1: 2014, JIS C 1513-1: 2020 class1 (Filter), JIS C 1514: 2002 class1
	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)

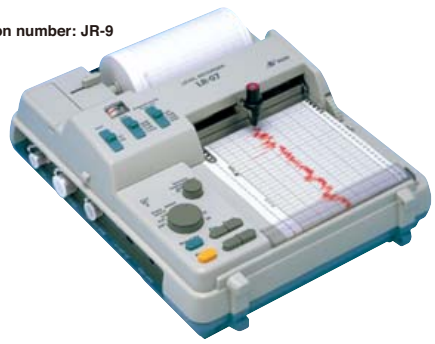
Operating environment requirements

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 × 1024) or more
OS	Microsoft Windows, 8.1 Pro 64 bit, 10 Pro 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-99A, 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 6)

Related Products (Acoustic Measurement Related Products)

Check the performance characteristics of floor surface materials

Tapping Machine Light Floor Impact Sound Generator

FI-01A CE

- 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

ISO 10140-5,ISO 16283-2, JIS A 1418-1 Standard Light Impact Sound Source

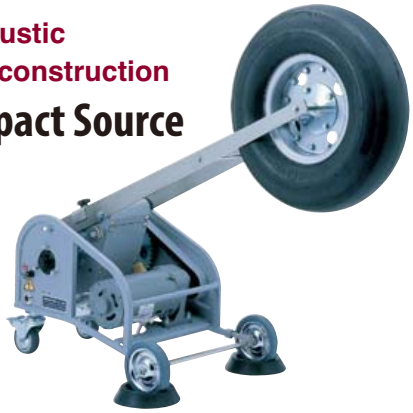
Specifications

Applicable standards	ISO 10140-5, ISO 16283-2, JIS A 1418-1
Hammers Number and Spacing	5 hammers are arrayed at 100 mm intervals in a straight line
Interface	RS-232C
Power requirements	AC power supply 100 V to 240 V Built-in rechargeable lithium ion battery (Under continuous operation Approx. 45 minutes)
Dimensions, Weight	230 (H) × 265 (W) × 557 (D) mm, approx. 10 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: 2019 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

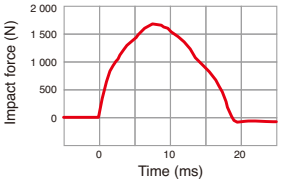
YI-01

- YI-01 conforms the rubber ball impact source defined by JIS A 1418-2:2019 and ISO 10140-3:2010.
- 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 can be created.

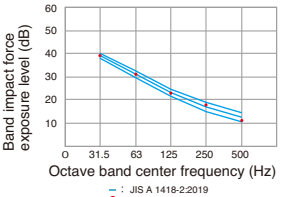
Specifications

Major rubber compound	Silicone rubber
Shape	Hollow sphere with 32 mm thick wall and 178 mm external diameter
Equivalent mass	2.5 kg ±0.1 kg
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) ×198 (W) ×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)

- 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
11L	947 (H) × 904 (W) × 722 (D) mm	500 (H) × 600 (W) × 400 (D) mm	125 kg
22L	1187 (H) × 1104 (W) × 922 (D) mm	700 (H) × 800 (W) × 600 (D) mm	150 kg
33L	1387 (H) × 1304 (W) × 1122 (D) mm	900 (H) × 1000 (W) × 800 (D) mm	200 kg

Anechoic Room

- Can be assembled on site in existing buildings, which helps to keep costs low
- Wall reflections are damped for enhanced measurement accuracy
- 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
11L	2 900 (H) × 2 400 (W) × 2 000 (D) mm	2 100 (H) × 1 800 (W) × 1 400 (D) mm	3 400 kg
22L	2 900 (H) × 3 400 (W) × 2 800 (D) mm	2 100 (H) × 2 800 (W) × 2 200 (D) mm	5 200 kg
33L	2 900 (H) × 4 200 (W) × 3 800 (D) mm	2 100 (H) × 3 600 (W) × 3 200 (D) mm	7 200 kg

Sound Proof Chamber

- 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
71	2 415 (H) × 2 080 (W) × 2 080 (D) mm	1 925 (H) × 1 830 (W) × 1 830 (D) mm	1 340 kg
81	2 415 (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.

Related Products (Acoustic Measurement Related Products)

Vertical Incidence sound absorption coefficient measuring device using two-microphone method

Vertical Incidence Acoustic Measurement System
Impedance Tube

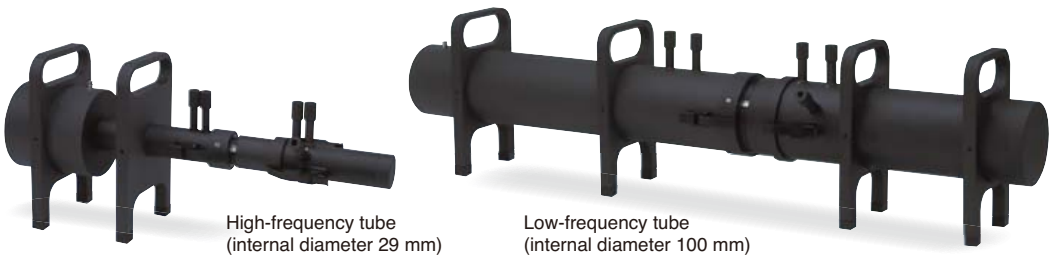
- Within an Impedance tube, the reflected sound or transmitted sound from sound hitting the sound absorbing material or sound insulation material surface vertically is captured to measure the sound absorption coefficient, acoustic impedance, and related values, as well as the sound reduction index of a material.
- The results can serve for evaluation and for determining the physical properties of sound absorbing material, sound insulation material and similar materials used for example to achieve weight reduction in automobiles or high-rise buildings.

Specifications

Model		Model 9301	Model 9302	Model 9303
Applicable standards		JIS A 1405-2, ISO 10534-2		JIS A 1405-2, ISO 10534-2, ISO 13472-2
Measurement range	Low-frequency tube	100 Hz to 1 600 Hz	125 Hz to 1 600 Hz	125 Hz to 1 600 Hz
	High-frequency tube	500 Hz to 6 300 Hz	500 Hz to 6 300 Hz	—
Configuration	Low-frequency tube	Main section, Link section, Calibration section, Measurement section, Sound absorption coefficient measurement section, Diameter 100 mm	Main section, Calibration section, Measurement section, Diameter 100 mm	Main section, Calibration section, Measurement section, Road mounting metal bracket, Reference metal bracket Diameter 100 mm
	High-frequency tube	Main section, Link section, Calibration section, Measurement section, Sound absorption coefficient measurement section, Diameter 29 mm	Main section, Link section, Measurement section, Diameter 29 mm	—
	1/4-inch microphones	4	2	2
	Amplifier	1 set	1 set	1 set
	Computer (Option)	1	1	1

Model 9301 Vertical Incidence Sound Absorption Coefficient/Sound Reduction Index Measurement System

Measures the sound absorption coefficient and acoustic impedance related items of sound absorbing material and the vertical incidence sound reduction index of sound insulation material.

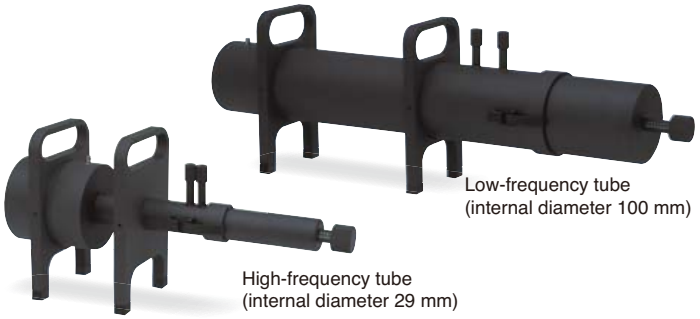


High-frequency tube (internal diameter 29 mm)

Low-frequency tube (internal diameter 100 mm)

Model 9302 Vertical Incidence Sound Absorption Coefficient Measurement System

Measures the sound absorption coefficient and acoustic impedance related items of sound absorbing material.



Low-frequency tube (internal diameter 100 mm)

High-frequency tube (internal diameter 29 mm)

Model 9303 Road Surface Sound Absorption Coefficient Measurement System

Designed for on-site measurements of the sound absorption coefficient of road surfaces, used in running vehicle noise tests.
Enables similar measurements as the Model 9302.

Low-frequency tube (internal diameter 100 mm)

Related Products (Other)

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-hydride rechargeable batteries, AC adapter VA-05JA
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

Note ● The Viscotester cannot measure accurately with anything other than supplied cups or the JIS 300 mL beaker.

*1 JIS R 3503 : 1994, φ78×103 (H)

Options

Stand	VA-04
AC adapter	VA-05JA

Perform precise measurements of volume of engine combustion chambers in seconds with no fluid needed

RION Acoustical Volumeter

(For combustion chamber volume measurement)

CE

- The volume of a combustion chamber, regardless of its size and shape, can be measured by simply placing the sensor of the RION Acoustical Volumeter on the combustion chamber cavity of the cylinder head.
- For assembled engines, a special adapter can be used to connect the sensor of the volumemeter to the spark plug hole.
- The Acoustical Volumeter can measure the precise volume of a combustion chamber in about two seconds. This instrument is perfect for the process of engine manufacturing or maintenance.

RION Acoustical Volumeter

(For volume of solid object)

CE

- Even the volume of objects with complex shape, such as a golf ball, can be measured accurately in about two seconds.

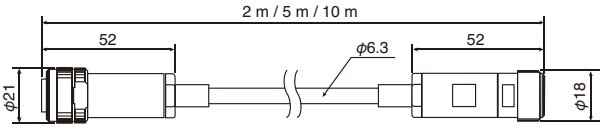
[Theory]
Unlike the conventional method using Archimedes Principle (where the target object is immersed in a fluid (water or oil) and the displaced liquid's volume is measured), the volume meter system, using acoustics, allows volume and density measurement of the target object in a dry state.

External view drawings of measurement microphone and accelerometer cables

Units: mm

Sound Level Meter Cables

EC-04/04A/04B



Type	Model	Length
7P Microphone Extension Cable	**EC-04**	2 m
	EC-04A	5 m
	EC-04B	10 m
	EC-04C	30 m (with reel)
	EC-04D	50 m (with reel)
	EC-04E	100 m (with reel)

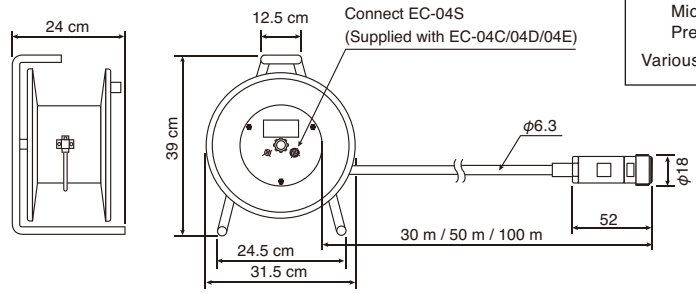
● **EC03001**

Sensor	Main Unit
Microphone Preamplifier Various See p. 17	Mearuring Amplifier **NA-42** Sound Level Meter Unit **UN-14**

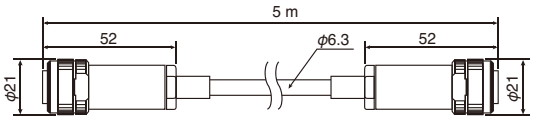
Can also be used as extension cable for these sound level meters

NA-28, NA-42, NL-62/52/42

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

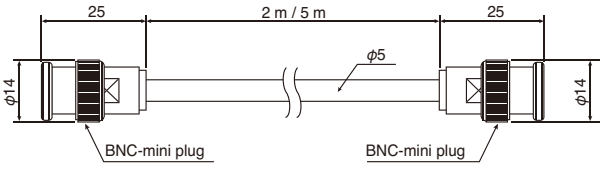


EC-04S (for connection of sound level meter to reel)



BNC-BNC Cable

EC-90A/90B

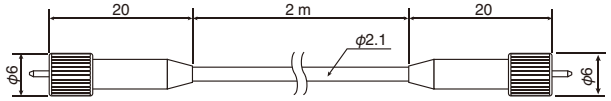


Type	Model	Length
BNC-BNC Coaxial Cable	**EC-90A**	2 m
	EC-90B	5 m

Sensor	Main Unit
Microphone Preamplifier Various See p. 17	Sound Level Meter Unit **UN-14** Multi-Channel Signal Analyzer **SA-02** Data Recorder **DA-21** Portable Multi-function Measuring System **RIONOTE**

Accelerometer Cables

VP-51A

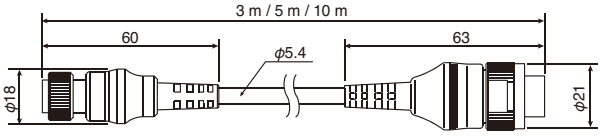


Type	Model	Length
Standard Cable	**VP-51A**	2 m～

Sensor	Main Unit
Piezoelectric Accelerometers Various See p.32	General-Purpose Vibration Meter **VM-83** Vibration Meter Unit **UV-15** 2-Channel Charge Amplifier **UV-16**

Vibration Level Meter Cables

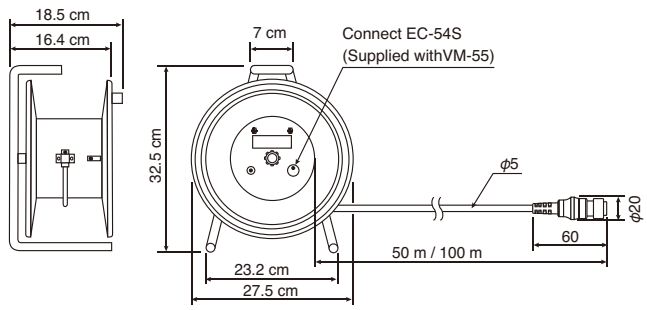
EC-54S/54SA/54SB



Type	Model	Length
Extension Cable	**EC-54S**	3 m
	EC-54SA	5 m
	EC-54SB	10 m
Vibration Level Meter/ Vibration Meter Cables	**EC-02SD**	50 m (with reel)
	EC-02SE	100 m (with reel)

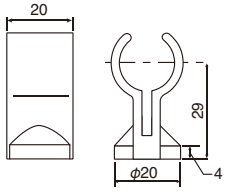
Sensor	Main Unit
Triaxial Accelerometer (Supplied with main unit) See p.22	Vibration Level Meter **VM-55**

EC-02SD/02SE (with reel)



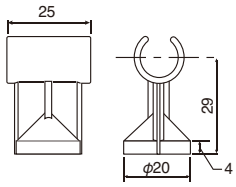
Microphone Holders

● **EC03001**



For EC-04 series

● **UA-90**



For EC-90 series

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.)?**

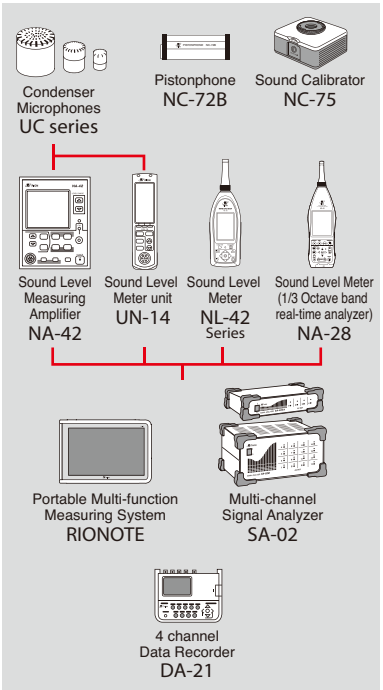
Depending on these factors, the measurement method, type of measuring instrument, and choice of peripheral equipment will differ.
Selecting the right combination of products is essential for achieving accurate and reliable results.
The following pages are intended to help with the selection of equipment,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

INDEX

1 Acoustic Measurement

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※ octave band real-time analysis＊ and FFT analysis＊ capability.

※ SA-02 only
＊ RIONOTE is optional



2 Calibration of Sound Level Meters and Vibration Meters

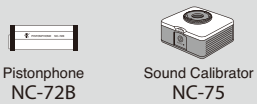
● Calibration of sound level meters and similar devices

For overall checking of sound level meters and acoustic measurement systems, RION offers the Sound Calibrator NC-75 (1 kHz, sound pressure level 94 dB), as well as the Pistonphone NC-72B (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^2, velocity 10 mm/s, displacement 10 μm) .

Calibration of sound level meters and similar devices



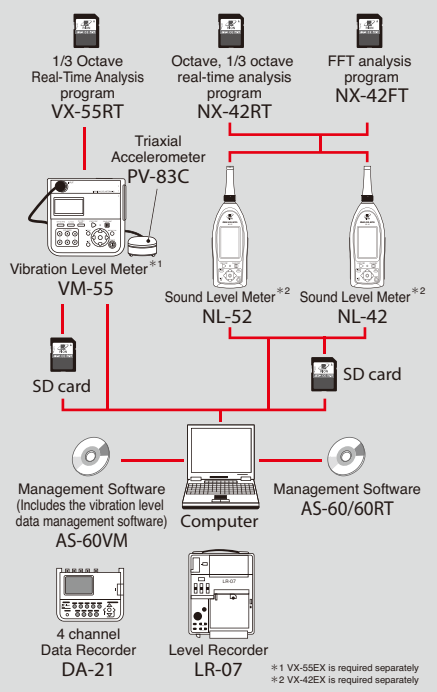
Calibration of vibration meters and similar devices

Measuring Instrument Combinations

3

Sound Level Meters and Vibration Level Meters in the Field

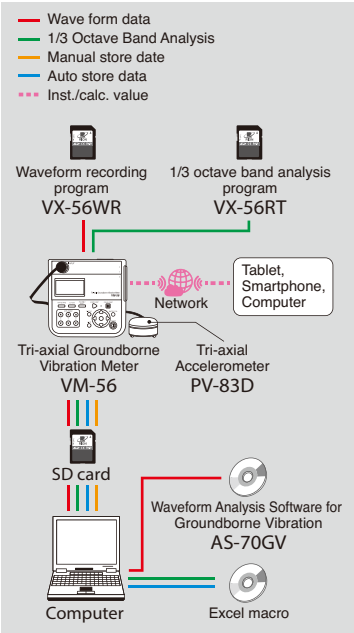
The basic model lineup for JIS and IEC standard compliant sound level meters is the NL series. For on-site measurements of vibration levels, the Japan Measurement Law and JIS compliant Vibration Level Meters VM-55 are suitable.
The NL-42 series (SD cards) and the VM-55 series (SD cards) use memory cards 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-55 allows use of the 1/3 Octave Real-Time Analysis program VX-55RT 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 4 channel data recorder DA-21, allowing for later analysis with waveform processing software.



4

Measurement of groundborne vibrations

The Tri-axial Groundborne Vibration Meter VM-56 can be used for measuring groundborne vibrations, for example in accordance with the stipulations for "Building damage" and "Human annoyance in buildings" of DIN 4150-2/-3 and ISO 8041, or for mining vibration measurements etc.
By using the Waveform Recording Program VX-56WR or the Waveform Analysis Software for Groundborne Vibration AS-70GV, detailed frequency analysis is also possible.
Because the sensor and the unit are waterproof (sensor IPX7, main unit IP54), long-term measurements present no problem. Similar to the data of short-term measurements, data are saved on the SD card in CSV format, which enables editing on a computer without the need for proprietary software. To facilitate report creation, an Excel macro is supplied free of charge.
Utilizing online connection via a communications circuit, long-term monitoring from a remote site is possible.
The communication function also makes it easy to configure a live-to-web system, and the high quality for which RION products are famous contributes significantly to data security in a long-term setup. High reliability minimizes the risk of missing data.



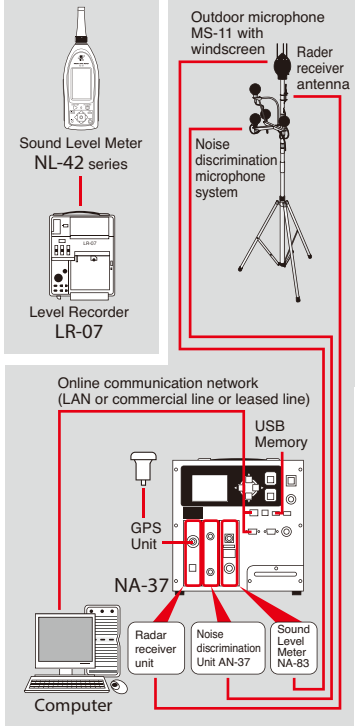
5

Sound Level Monitoring

Plant Noise Monitoring System
Noise level monitoring is widely used as part of noise control measures to improve the living environment in the vicinity of factories. For short-term measurement, a system that combines the Sound Level Meter NL-42 series with the Level Recorder LR-07 and an all-weather windscreen can be used (Figure 1).
For installations where permanent monitoring of plant noise is required, the Environmental sound Monitor NA-37 in combination with the Environmental Noise Processing Program NA-37 is suitable. This system can utilize a company LAN or a modem and public phone line connection to transfer data and realize online monitoring of noise.
Adding the AN-37 unit with sound direction identification capability makes it possible to determine where noise is coming from, which is useful for devising countermeasures.
Measurement data acquired with the NA-37 system can be imported into the Environmental Data Processing Software AS-40PA1 for producing reports (Figure 2).

Figure 1

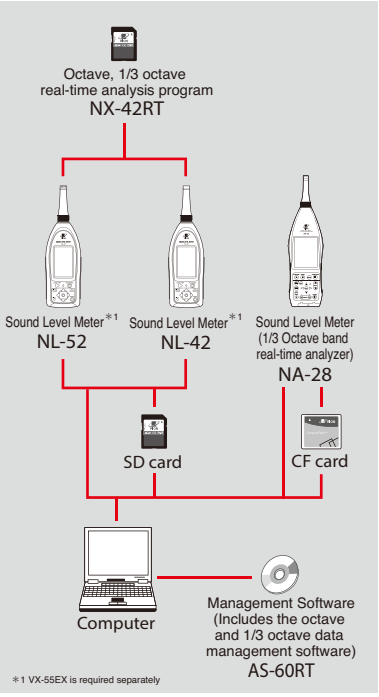
Figure 2



6

Noise Measurement at Working Places

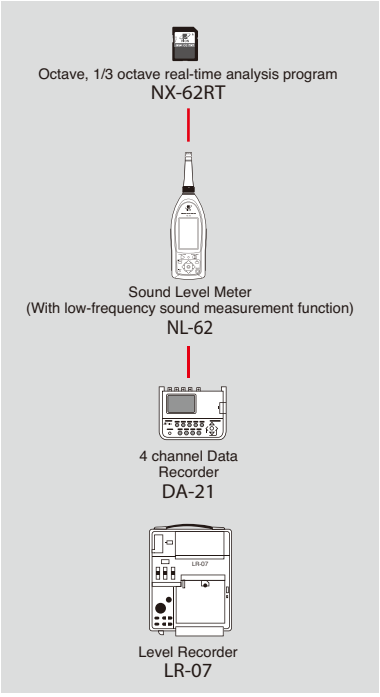
The measurement of sound exposure levels is an important prerequisite for protecting personnel working in an environment with high sound level from hearing damage. Regulations to control generation of noise at work places have come into force in many countries.
For instance, The Noise Prevention Guideline 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.



7

Low-Frequency Sound Measurement

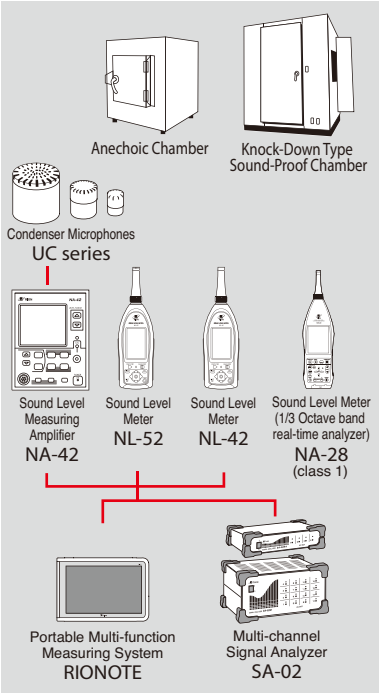
So-called infrasound in the range below the human hearing threshold, from 1 Hz to about 20 Hz, can have a physiological impact on humans if sound pressure levels are very high. It can also cause other unwanted effects such as window rattling and develop into an environmental problem.
To measure sound 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 4 channel Data Recorder DA-21 the level changes and sound pressure signal condition can be recorded.



8

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-CMP01 series, or the Portable Multi-function Measuring System RIONOTE and dedicated evaluation software (under development) are suitable.



Measuring Instrument Combinations

9

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.

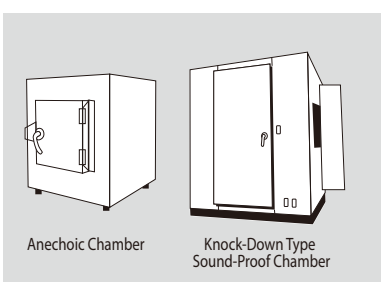
- Low-noise environment
  Using a sound-proof chamber or box, when the sound level emitted by equipment is low, ambient noise can influence a measurement. To prevent this, place the measurement target in a sound-proof chamber or box. In some cases, using an anechoic chamber or box where the influence 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.

- Hemi-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.



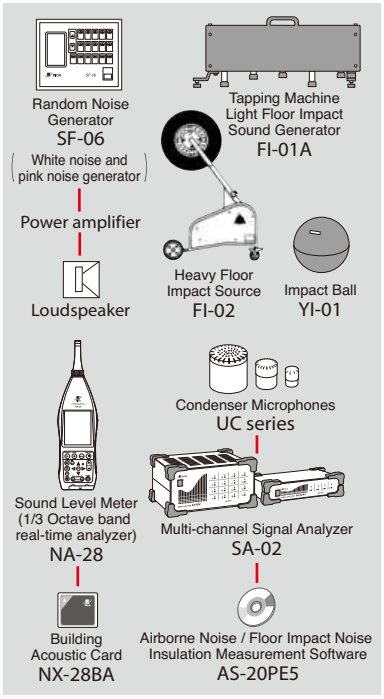
10

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

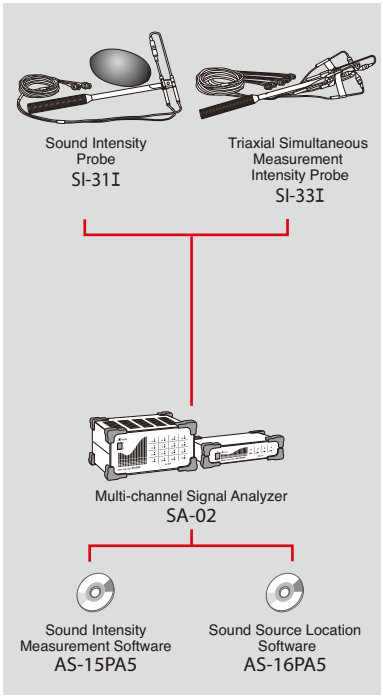
To create the white / pink noise required for these measurements, the Random Noise Generator SF-06 is used. Suitable impact sound sources are the Tapping Machine FI-01A, the Bang Machine FI-02, and the Impact Ball YI-01.
For evaluation complying with the standard stipulations, frequency analysis must 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.



11

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.



12

Sound Power Level

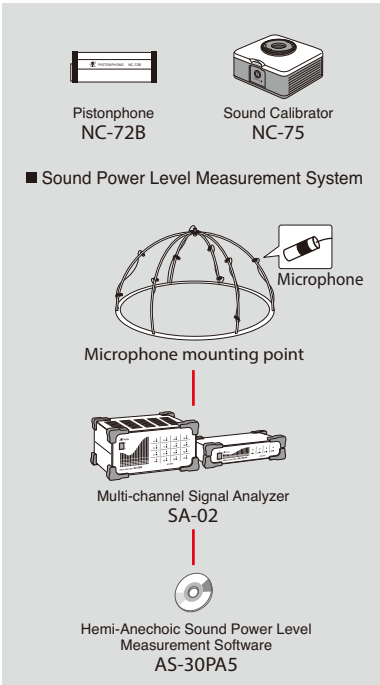
Even if emitting noise of the same energy level, the actual ambient noise level in the vicinity of mechanical or electrical machinery, office equipment etc. will differ, depending on various conditions. When predicting expected noise levels associated with installation or removal of a given piece of 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

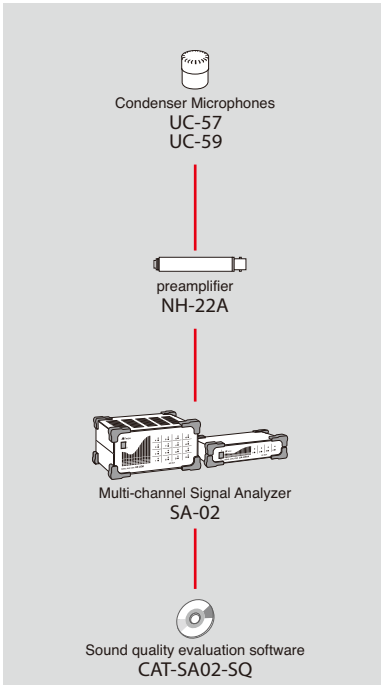


13

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.



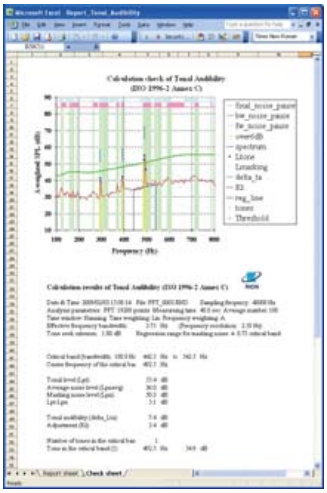
14

Pure tone evaluation

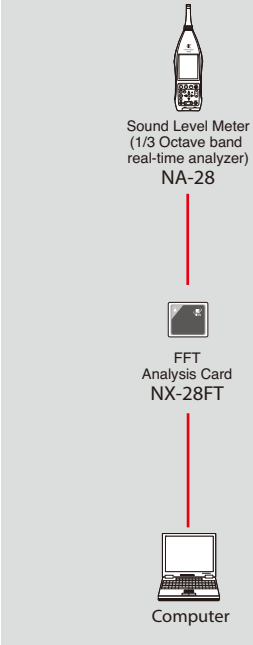
The Tonal Audibility Calculation Program (Excel macro) can be used for pure tone evaluation.
ISO 1996-2:2007- Annex C

- 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



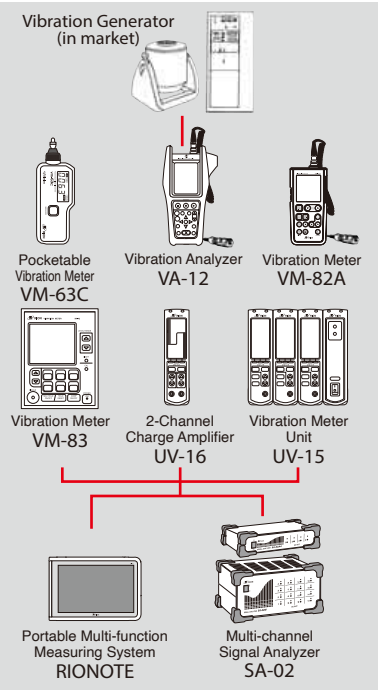
Measuring Instrument Combinations

15

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-63C, 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.

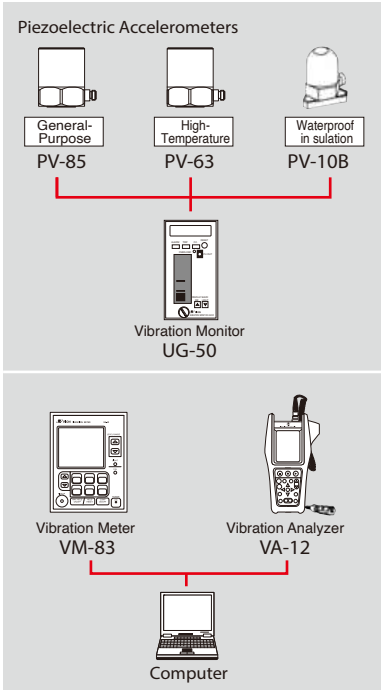
※ SA-02 only
＊ RIONOTE is optional



16

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 and the Vibration Meter VM-83 can be connected to a computer for configuring a constant monitoring system.



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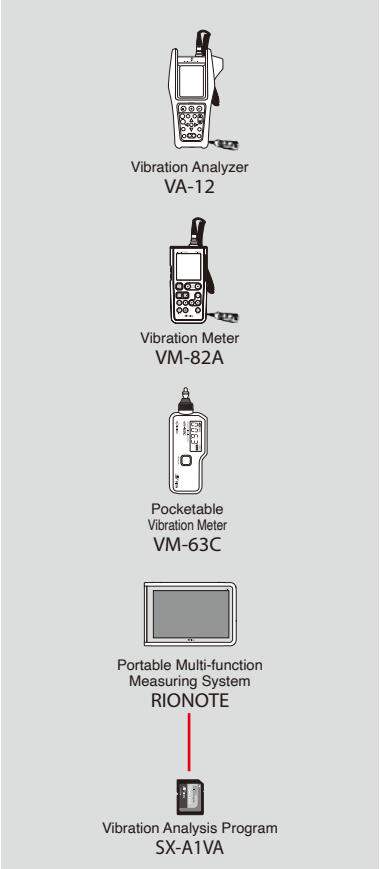
Industrial Machinery Equipment Diagnosis

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 MeterVM-63C. These allow checking multiple pieces of machinery within a short time, using simple procedures.
For detailed equipment diagnosis, the Vibration Analyzer VA-12 with integrated FFT analysis function or the RIONOTE Multifunction Measurement System together with the Vibration Analysis Program SX-A1VA are well suited.



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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).

Figure 1

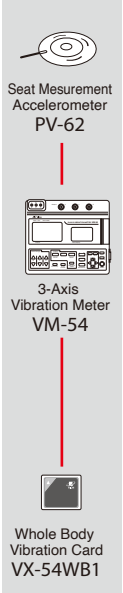


Figure 2

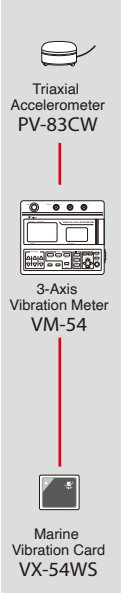
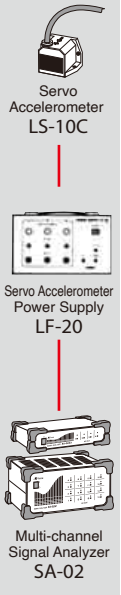


Figure 3



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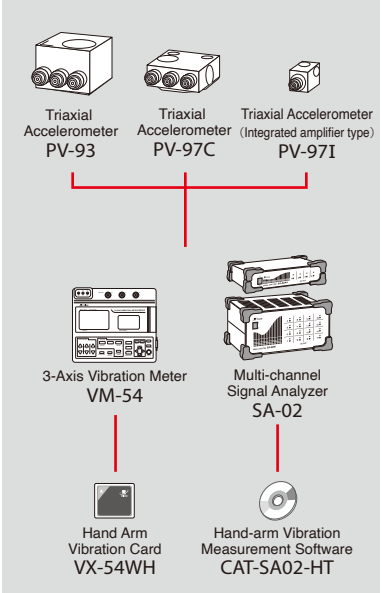
Hand-arm Vibration Measurement

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.



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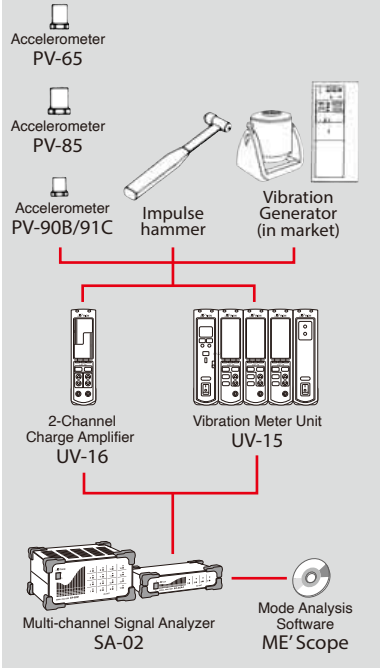
Mode Analysis

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.



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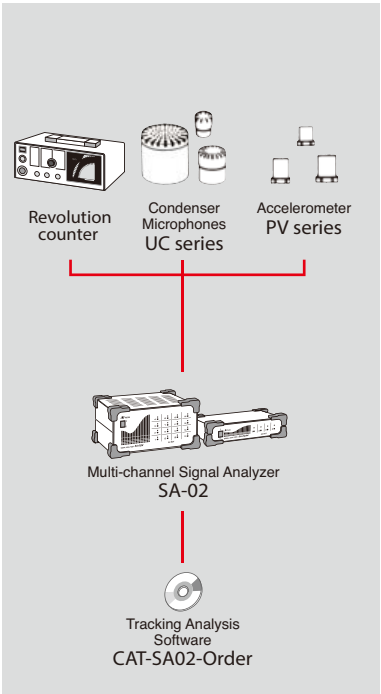
Tracking Analysis System

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.



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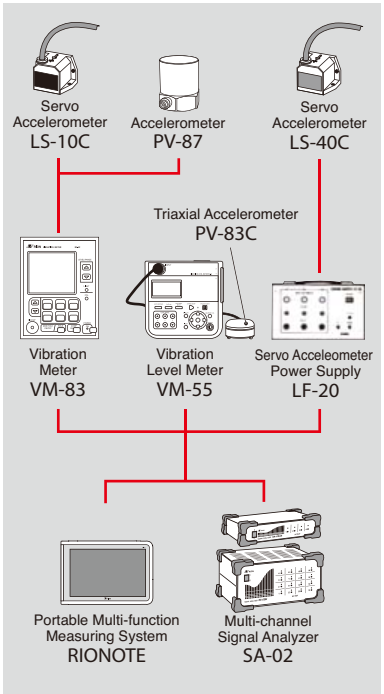
Measurement of Low-Frequency Microvibrations

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-55 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.)



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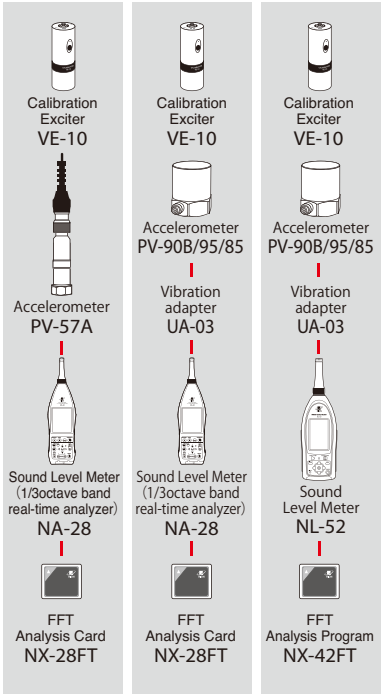
Vibration measurement with sound level meter

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



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 20μPa to 200 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 (20μPa) 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.

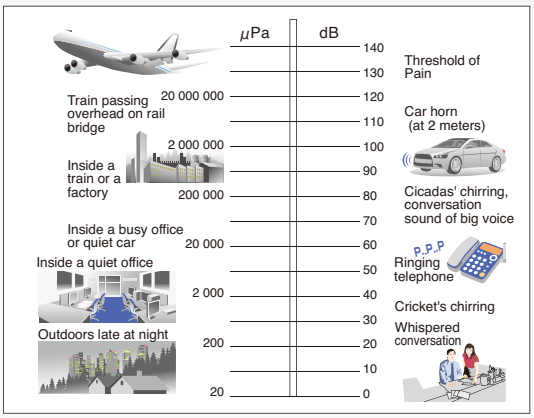


Fig. 1 Sound pressure and sound pressure level

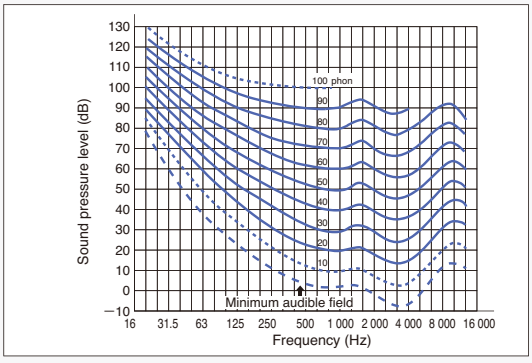


Fig. 2 Equal loudness curves of sound

Sound Level and Sound Level Meter

A reverse curve corresponding to the equal loudness curve at 40 phon (ISO 226 : 1987) is applied to the sound pressure.
The resulting level is called sound level and is expressed in dB.
However, the equal loudness curve in ISO 226:2003 is close to 60 phon.

What is equivalent continuous sound level L_{eq}?

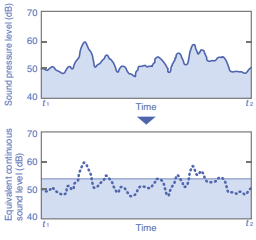
Equivalent continuous sound level L_{eq} is used for environmental noise evaluation.

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 a 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 $t1$ to $t2$. 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.



Sound pressure level and equivalent continuous sound level

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. Perfomance 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.

①Frequency 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).

②Time 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.

③Type 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.

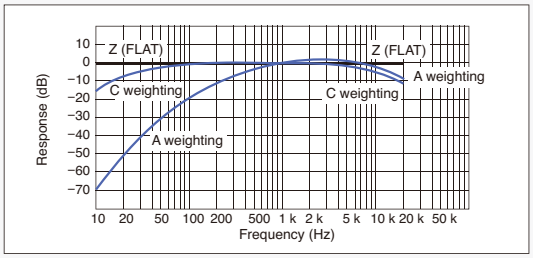


Fig. 3 Frequency weightings of sound level meters

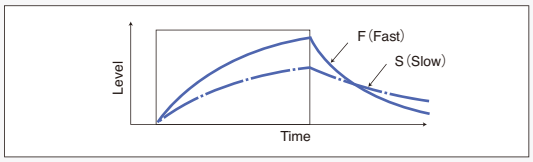


Fig. 4 Time weightings of sound level meters

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:

①Sound 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.

②High-Precision Measuring Amplifier
A wide range of frequency and level range settings make this product suitable for many different measurements.

③Sound 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.

④Environmentel 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.

⑤Sound 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.

⑥Sound Level Display
Designed for mounting in outdoor urban locations, this type of device can display the ambient sound level at a specific point.

Outline

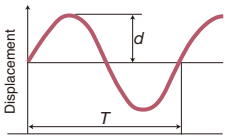
VIBRATION AND VIBRATION METERS

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.



Displacement amplitude: $d=v/2\pi f=a/(2\pi f)^2$
Velocity amplitude: $v=d\cdot 2\pi f=a/2\pi f$
Acceleration amplitude: $a=d(2\pi f)^2=v\cdot 2\pi f$
＊ f = 1/T (Hz), where T is period (s)

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

Displacement	mm、μm(1 μm=10^{-3} mm)
Velocity	mm/s
Acceleration	m/s²、cm/s²　Gal(1 Gal=1 cm/s²)
Vibration acceleration	dB(re・10^{-5} m/s²)：JIS

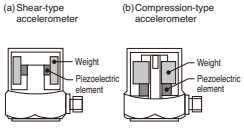
Vibration Meters for Mechanical Vibrations

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 to 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 pressure is applied. The amount of the charge is proportional to the external force. This phenomenon is called the piezoelectric effect, and the vibration acceleration sensor called a piezoelectric accelerometer makes use of it.
Piezoelectric accelerometers can be made compact and lightweight, allowing them to cover a wide vibration frequency range.
Accuracy and reliability are also very good, and handling is simple.
Thanks to these characteristics, piezoelectric accelerometers are widely used for many general applications, and also serve as reference accelerometers. There are two types of piezoelectric accelerometers, namely shear-type and compression-type, which differ in the way the piezoelectric element is used.

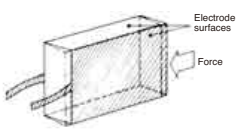
Fig. 1 Piezoelectric accelerometer types



Shear-type 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. Pyronoise (pyroelectric output) caused by temperature changes is low, which is advantageous for measuring low-level vibrations and vibrations in the low frequency range.
This type is useful for monitoring vibrations in machinery and buildings, and for seismometer applications.

Fig. 2 Principle of shear-type accelerometer



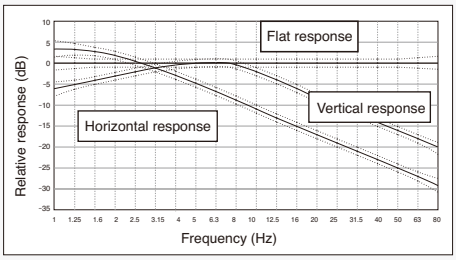
Compression-type accelerometer

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

● When using a piezoelectric accelerometer with a TEDS compliant measuring device, sensitivity setting must be performed.
● In case of a TEDS compliant piezoelectric accelerometer, sensitivity setting is not required.

Measurement of Vibration Pollution (Vibration Level Meter)

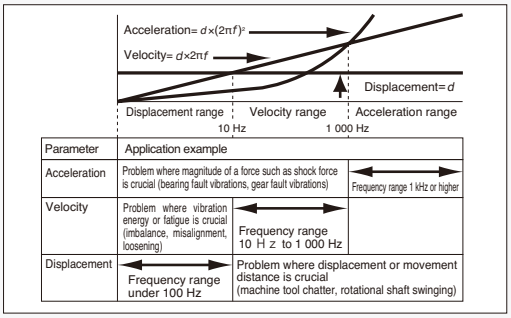
The evaluation of vibrations considered as environmental pollution uses the vibration level (dB), which is based on the pattern of human sensitivity to vibration. This is the same principle employed for the measurement and evaluation of sound pressure levels considered noise. Compensation according to 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

①Types 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).
②Equipment 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).
③Frequency 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.
④Diagnosis 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-63C, VA-12, SX-A1VA 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, SX-A1VA etc.



Vibration parameter

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
● Evaluation of sensory impact of sound and vibration ● Evaluation of countermeasures ● Materials development and evaluation	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-55RT (VM-55)
● Identify noise and vibration phenomena ● Noise and vibration countermeasures ● Materials development and evaluation	Constant width FFT (narrow-band analysis)	NX-28FT (NA-28) SX-A1FT (RIONOTE) SA-02 NX-42FT (NL-62/52/42) VA-12

①Frequency 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.

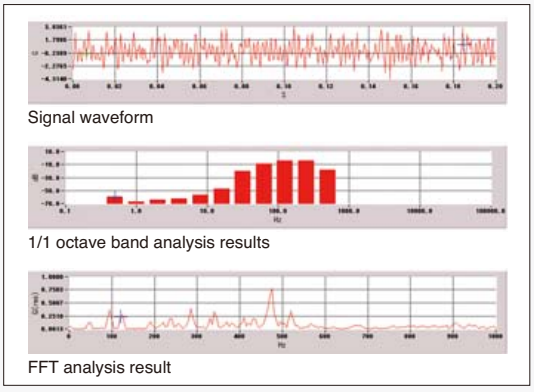


Fig.1 1/1 octave band analysis results, FFT analysis result

②Constant 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 ration filter and a linear scale for a fixed.

③Filter specifications

Filter characteristics for octave band and 1/N octave band filters (Frequency Analyzers) are specified in JIS C 1513-1. Internationally, the IEC 61260-1 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.

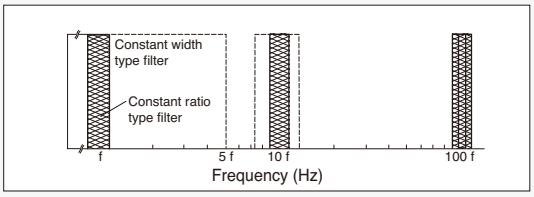


Fig. 2 Bandwidth representation for constant ratio and constant width filter on logarithmic scale

Different Ways of Using Frequency Analyzers

①Real-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.

②FFT 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

①FFT 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.

②Signal 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.

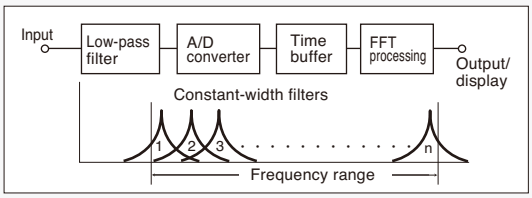
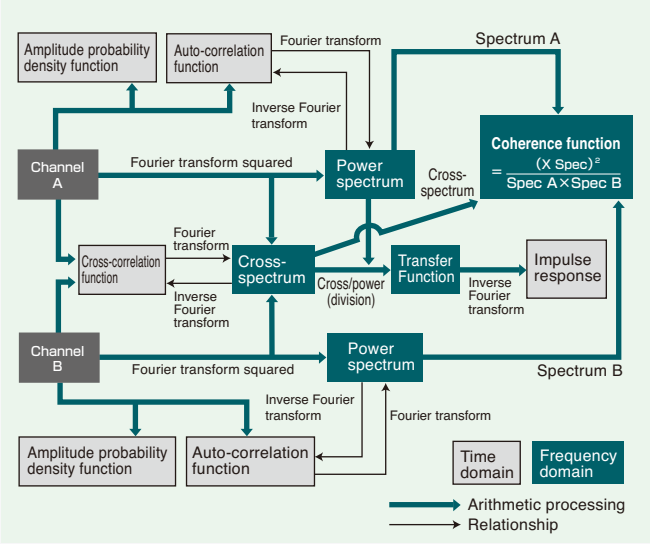


Fig. 3 FFT spectrum analyzer (spectrum analysis)

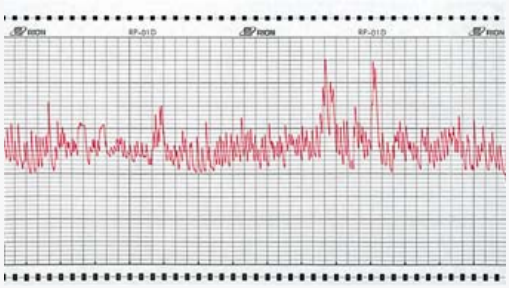
table 2 Relationship btween varioas FFT analyzer functions



RECORDING SOUND AND VIBRATION

Sound and Vibration Level Recording

①For 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.

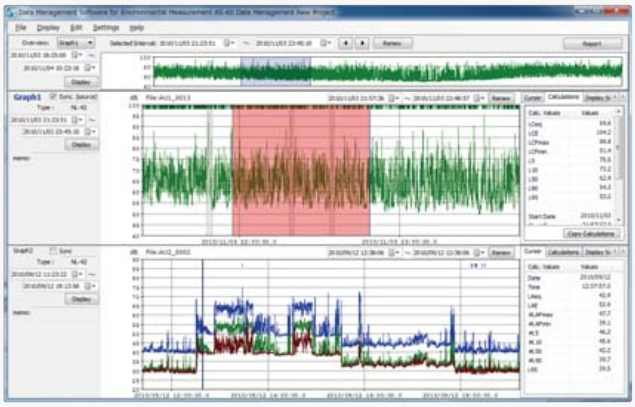


Sound level recording on Recording Paper RP-01D

②When a sound level meter or vibration level meter with integrated SD 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-55).

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

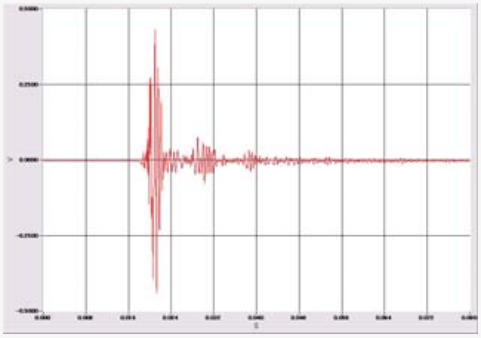
	Sound level meter	Vibration level meter (3-axis)
512 MB	5.5 days	2.5 days



Data management software for environmental measurement AS-60

Sound and Vibration Waveform Recording

①Sound 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)

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

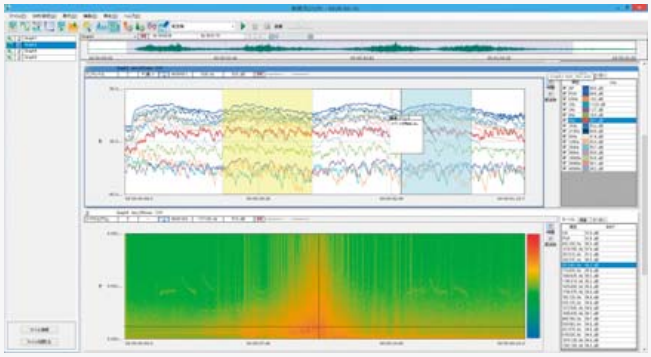
③Waveform data recorded on a memory card can be displayed and analyzed using dedicated application software (such as the Waveform Analysis Software AS-70). Recorded sound data (WAVE files) can be played back as real sound using Media Player or other suitable software.

■ DA-21

		Frequency range (Hz)					
		100	500	1 000	5 000	10 000	20 000
Number of channels	1	1066 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.

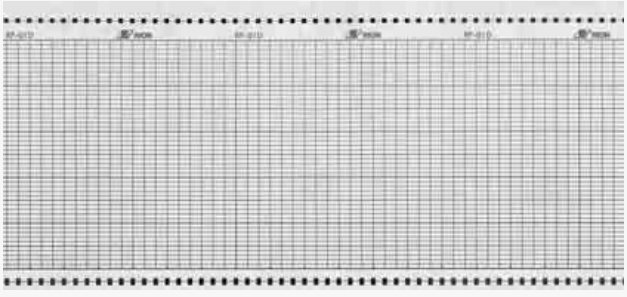
Waveform analysis screen example



Waveform analysis screen example

Sound Level/Vibration Level Measurement Paper

①Recording 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?

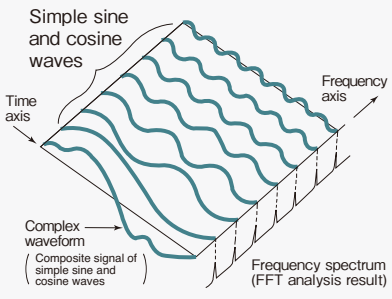
Sound and vibrations commonly have complex waveforms consisting of many different frequency components. The process of dividing such a complex waveform into discrete frequency components in order to examine the nature of the sound or vibration is called frequency analysis. Commonly used types of frequency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

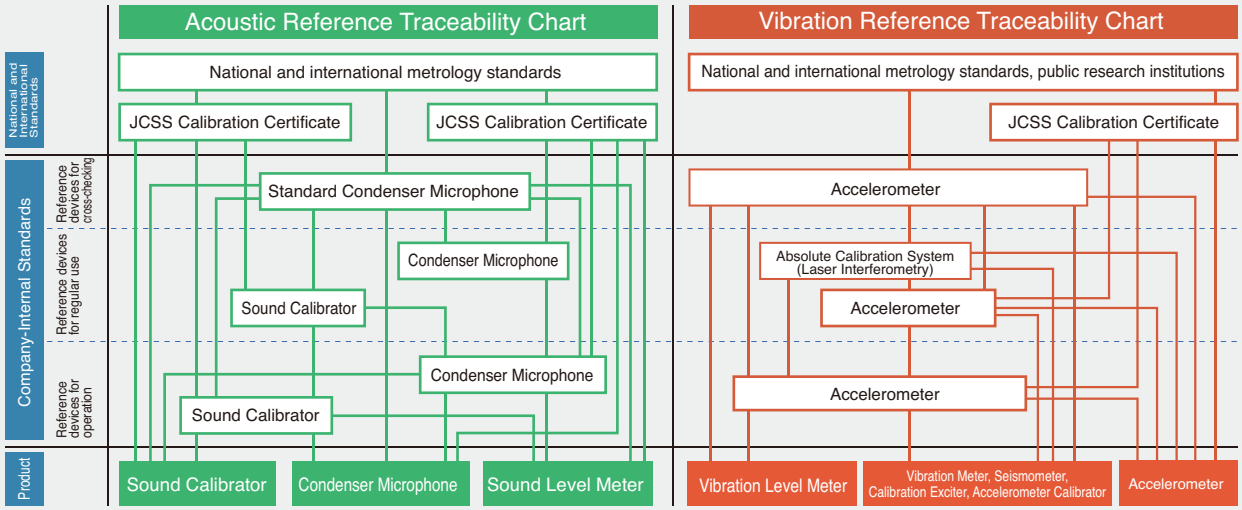
Environmental test chamber for products

Absolute calibration setup for vibration accelerometers

Absolute Calibration of Vibration Accelerometers

The accuracy of measurement values when measuring length or weight is an important consideration, and the same applies for acoustic and vibration measurements. As a manufacturer of equipment for measuring sound and vibration, RION has developed various systems for the calibration of our products. These systems are traceable according to domestic and international standards to assure high calibration accuracy. They are employed in the manufacturing process and for quality control of sound level meters and vibration level meters.

RION has gained accreditation by the JCSS (Japan Calibration Service System) in the category of acoustic measuring instruments and vibration acceleration measuring instruments. This amounts to public recognition of the validity of our calibration methods within the scope of accreditation, and of their traceability to national measurement standards.



Company Outline

RSC
RION Service Center CO., LTD.
https://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: 91
Registration and certifications:
Designated service provider for special measurement instrument
Service provider for medical equipment
ISO 9001 Certification (12 100 24501 TMS) Head Office, Tohoku Office
ISO 13485 Certification (Q1N 11 01 54475 141) Head Office, Tohoku Office
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 +81-42-632-1160 Fax +81-42-632-1140
Tohoku Office
25-13 Minami-Onoda, Taihaku-ku, Sendai, Miyagi Pref., Japan
Tel +81-42-632-1160 Fax +81-22-738-7502

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.

Inspection certificate

After performing servicing and calibration in house, we offer application services for official 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, and transmission loss. Other types of sound and vibration measurements can be arranged by consultation. Some of our products are also available on a rental basis.

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.

Company Outline

Kobayasi Institute of Physical Research

E-mail 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 certifi cation 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.

Interior of test chamber

Architectural Acoustics Division Test Chamber Block

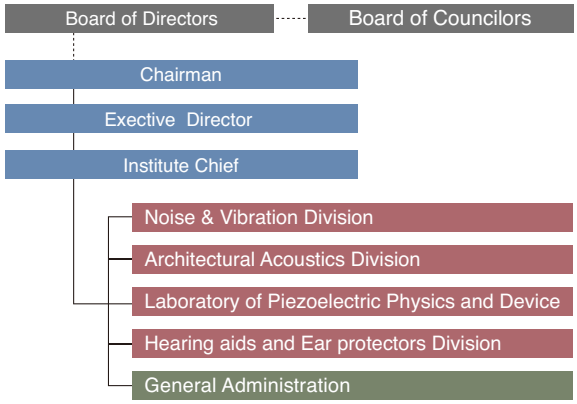
This building houses four chambers (two facing pairs) for testing sound insulation of building elements (walls) according to ISO 140-1 and 140-3, as well as two floor test chambers.The two pairs of wall test chambers use different methods for fastening the test object cassette.
The two chambers which 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.

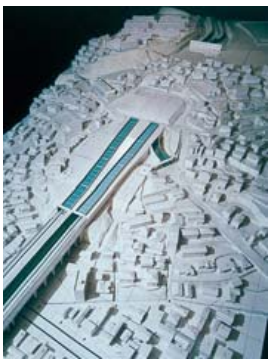
Foundation Date: August 24, 1940
Chairman: Kohei Yamamoto (Doctor of Engineering)
Location: 3-20-41 Higashi-Motomachi, Kokubunji, Tokyo, 185-0022 Japan Tel +81-42-321-2841

■ 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.

RION CO., LTD.

https://www.rion.co.jp/

Foundation Date: June 21, 1944
Capital: JPYen 2.014 million
(as of March 31, 2020)
Sales: JPYen 21.465 million
(fiscal year ended March 2020, consolidated)
President & CEO: Kenichi Shimizu
Certifications (in acoustic and vibration measurement field)
ISO 9001: 2015 Certification
ISO 14001: 2015 Certification
Designated manufacturer of special measurement instrument (Sound Level Meters, Vibration Level Meter)

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 has three business divisions: “the Medical Instrument Division”, “the Environmental Instrument Division”, and “the Particle Counter Division”.
The Medical Instrument Division develops, manufactures, and sells hearing instruments, assistive listening devices, and medical equipment, mainly used in the field of otolaryngology (ear, nose and throat).
“The Environmental Instrument Division” develops, manufactures, and sells sound and vibration measuring instruments, including sound level meters, vibration meters and seismometers.
“The Particle Counter Division” develops, manufactures, and sells particle counters to measure particles in the air and liquids.
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.

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

PARTICLE COUNTER

Airborne Particle Counter

Liquid-borne Particle Counter

HEARING INSTRUMENT

Rionet Hearing Instruments

BTE Type

Custom-made

MEDICAL EQUIPMENT

Audiometer

INDEX(Model)

INDEX(Name)

Sound and Vibration

https://rion-sv.com/

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

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

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

SIAA Anti Virus
Reduces the number of specific viruses on the product surface
Inorganic・printing・cover surface
JP0612707A0001Z

[Notes] ・Antiviral processing is not intended to treat or prevent illness ・Meets SIAA safety standards