RION / Norsonic

Sound and Vibration

RION/Norsonic S&V Measuring Instruments General Catalog

2024

About general requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)

RION Service Center CO., LTD. has earned certification under ISO/IEC 17025, an international standard on the ability of testing laboratories to generate accurate results. This makes us the first calibration service provider in Japan for manufacturers of sound level meters and sound calibrators to have earned this certification.* ISO/IEC 17025 is a standard for certification by an independent certifying agency on the ability of testing and calibration laboratories to generate accurate measurements and calibration results. It establishes requirements for testing laboratories engaged in activities such as product testing, analysis, and measurement as well as calibration laboratories engaged in the business of calibrating measurement instruments. A certified laboratory is internationally certified to possess management competence in product control and quality control as well as technical competence in generating reliable testing and calibration results.

* IEC 61672-3 (Electroacoustics - Sound level meters, Part 3: Periodic tests), the calibration method for sound level meters, and IEC 60942 (Electroacoustics - Sound calibrators, Annex B: Periodic tests), the calibration method for the sound calibrators used to calibrate such sound level meters

Designated models

Sound Level Meters	NL-43, NL-53, NL-63, NL-42A, NL-52A, NL-62A, NL-42, NL-52, NL-62, NL-27, NA-28
Pistonphone	NC-72A, NC-72B
Sound Calibrators	NC-74, NC-75

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 Accreditation Cooperation (APAC) 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

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-43, NL-53, NL-63, NL-42A, NL-52A, NL-62A, NL-42, NL-52, NL-62, NL-20, NL-21, NL-22, NL-31, NL-32, NL-26, NL-27, NL-28, NA-28, NA-42S
Measurement Microphones	UC-30, UC-31, UC-52, UC-53A, UC-57, UC-59
Pistonphone	NC-72, NC-72A, NC-72B
Sound Calibrators	NC-74, NC-75
Reference Piezoelectric Accelerometers	PV-03
Piezoelectric Accelerometers	PV-65, PV-85, PV-86, PV-90H
Field Vibration Calibrator (CALIBRATION EXCITER)	VE-10

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).

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

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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.

NL-43 NL-53 NL-63

class 1 / class 2 Sound Level Meters NL-43/53/63

Equipped with LAN terminals to enhance connectivity with other devices. The USB Type-C terminal allows power supply from mobile batteries compatible with USB Type-C connections. Buttons on the unit and the large, easily readable 3.5-inch color touch panel LCD ensures ease of use. These models offer functions for measuring A-weighted sound pressure levels, equivalent continuous A-weighted sound pressure levels, and minimum and maximum sound pressure levels, as well as percentile and sound exposure levels. Measurement data can be saved/written to internal memory or an SD card. The single range format eliminates the need to select and switch between ranges during measurements. The display interface offers multiple language options. In addition to the LAN and USB terminals, the unit is equipped with AC output, DC output, and RS-232C terminals. The water resistance performance of the main unit meets IP54 specifications (excluding the microphone) for use outdoors. The models can also run on AA alkaline batteries or Ni-MH batteries. The NL-63 can measure both ultra-low frequency (1 Hz–20 kHz) and audible frequency sound pressure levels.

Class 2 Sound Level Meter NL-28

Easy to use with one hand! The non-slip design makes it easy to grip.Allows L_p, L_{eq}, L_E, and Lmax measurement. Convenient for sound calibration before and after measurement. Insert the microphone into the acoustic calibrator and calibration is performed automatically.By connecting the USB Type-C connector and PC with a cable, data measured with the NL-28 can be acquired as a CSV file.

Noise Dosimeter NB-14

The NB-14 noise dosimeter, measures noise exposure for an individual working in a noisy workplace. Measuring and managing noise exposure for individual workers enable early detection and treatment of noise-induced hearing impairment, the adoption of personal hearing protection equipment such as earplugs and earmuffs, and the introduction of effective measures to reduce noise at the source.

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.

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)

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.

Portable Multi-function Measuring System RION OTE

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.

Viscometer 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.

Acoustics

Large colour touchscreen, intuitive menus – easy to use.

Single channel Sound Analyser
Nor145 CE

Dual channel Sound Analyser
Nor150 CE

The Nor145 and Nor150 sound analysers sets new standards in userfriendliness and sophistication not yet found in any other sound level meter on the market today. Featuring a large 4.3" true colour touchscreen sharing the same user philosophy as a smartphone.

Features
- Precision sound level meter and frequency analyser according to class 1
- Easy connectivity via built in WLAN and 3G/4G LTE modem (Nor145)
- Dual channel (Nor150 only)
- Large colour touch-screen (4.3")
- Real push keys for quick operation in challenging environments
- Intuitive user interface with graphical icons for selection of measurement mode and custom-made user setups
- Built-in webserver
- Voice, text notes and built-in GPS for documentation of the measurements
- Wide frequency range (0,4 Hz – 20 kHz in 1/3 octave band)
- Parallel 1/3 octaves and FFT analysis
- 120 dB measurement range
- Extensive trigger system for reports, audio recording and camera
- Seamless integration with Nor850 software
- Easy management of measurement files in NorConnect Nor1051
- Multi-language support
- Extensive on-board help system

Applications
- Sound Power measurements in accordance with -ISO 9614 -ANSI S12.12 -ECMA 160
- Noise Mapping
- Noise Source locations

Enviromental Analyser
Both units are ideal for all type of environmental noise measurements, attended or unattended, single or dual channel measurements. The Nor145 with its build in 4G/LTE modem features an easy connectivity to NorCloud and are for most environmental applications a prefeered choice due to its built-in modem.

Sound Intensity Analyser Nor150
The Nor150 fitted with sound intensity option and the sound intensity probe kit Nor1290 is a powerful tool for all kind of sound intensity measurements. It is designed for easy use in all type of measurement conditions. The remote-control handle using a Smartphone as a measurement control and displaying device forms a light weighted and easy to use system, allowing the user to perform all measurements with a single hand operation. The Smartphone communicates via Wi-Fi with the internal web server running in the Nor150. The system may also be used with the sound intensity probe directly attached to the Nor150.

Supported Standards
- ISO 16283-1, -2 and -3. ISO 140-4, -5 and -7, ISO 717-1 and -2, ISO 10052
- ASTM E336 and E413, ASTM E1007 and E989
- DIN 4109-4 and -11
- BS-ISO 140-4 and -7
- SS-EN-ISO 25267
- SIA 181

Building Acoustic Analyser
It can be used as a manually operated single or dual channel (Nor150) building acoustic analyser, or as a remotely controlled advanced building acoustic frontend for the Nor850 multichannel system. The Building Acoustics mode is designed to cover any in-situ sound insulation measurement tasks. You may choose to measure airborne, façade or impact sound insulation.

Noise at Work Analyser
The Nor145 is the right tool for the noise at work experts. It covers all the use in one unit. The wide frequency range covers additional applications such as infra sound and single axis vibration measurements.

NorVirtual/NorVirtual App

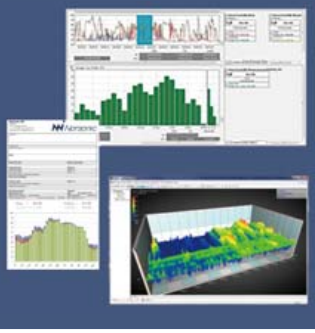
NorVirtual for Nor145/No150 supports all communication channels. Hence, you may connect to a Nor145/Nor150 via modem, Wlan, LAN etc and use the program as a simple remote control.
In combination with NorConnect you have a simple and intuitive solution for remote control and download measurements.
NorVirtual App can be downloaded from Apple Store or Google Play.

NorConnect Nor1051

NorConnect is a measurement suite and data management program for measurement files downloaded from Nor145 and Nor150.Dependent of your measurement, optimized graphical tools are offered for building acoustic, sound power and environmental/general measurements.

NorReview Nor1026

The NorReview is a flexible project oriented PC software package for presenting and post processing environmental noise data from our instruments.



NorCloud - Noise monitoring made easy!

NorCloud is designed to fit your need for noise monitoring. Even if you are a non expert, NorCloud offers you an easy setup of a project with alarms and triggers. Assigning your sound level meter or sound monitoring station has never been easier; connect the instrument to Internet, register the sensors id number in your NorCloud project, and you are up and running. Once registered the same sensor can easily be moved between your projects when needed. A powerful report generator integrated in NorCloud offers you to design your own report templates (or you can use one of our standard templates). You can set NorCloud to distribute via e-mail as many measurement reports that you need, as often as you want. Or just select a time window in the graph, and generate a NorCloud report based on the selected time span. Our Noise Monitoring Terminal Nor1531 is a weather proof cabinet supplied as a ready to go unit, including a IEC 61672 class 1 compliant instrument, our famous all weather outdoor microphone Nor1216, battery for shorter disruptions in power supply and a 4G modem.

When is NorCloud the preferred solution?

Whenever and wherever you need to monitor and collect noise data on a permanent or a longer time span as in:

- Construction noise monitoring
- Transport noise monitoring
- City noise monitoring
- Industrial estate noise monitoring
- Airport noise monitoring
- Harbour noise monitoring
- Race track and Shooting range monitoring
- Outdoor concerts and venues

NorCloud is seamless integrated with NorReview, when further analysis of measurement data is needed. Just select the periode window of interest, download the measurement and open it in NorReview. The NorReview PC software package is one of the most powerful tool available for post processing and presentation of environmental noise data. NorCloud is available in English, German, French and Spanish.

Why Norcloud?

Fast, easy to connect your sensor to NorCloud via 4G, Wi-Fi or LAN.

- No software installation required.
- All data automatically uploaded to NorCloud.
- Access all your data with any web browser on any device. The site is smart phone compatible.
- Project management with measurement, trigger and alert setups, in addition to user access control.
- Powerful report designer and generator integrated.
- View live data or download time specific measurements on the go.
- Seamless integrated with NorReview.
- Real time SMS and e-mail alerts sent directly from instrument.
- Protect your data. Redundant storage of data locally on the unit and in NorCloud.
- Norsonic reliability.

Acoustics

Exploring the possibility of Noise Measurement

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

WATER-RESISTANT

SD-CARD
Memory card compatible model

NL-53 NL-43 NL-63

Class 1 Sound Level Meter
NL-63 CE
(With low-frequency sound measurement function)

Class 1 Sound Level Meter
NL-53 CE

Class 2 Sound Level Meter
NL-43 CE

- Equipped with LAN terminals to enhance connectivity with other devices.
- Power can be supplied from portable charger via the USB Type-C connector.
- A single sound level meter can measure up to four measurement conditions simultaneously. Different frequency weighting and time weighting settings can be specified for each of four measurement conditions.
- The color touch panel LCD has been designed to offer high visibility both indoors and outdoors, and in the dark.

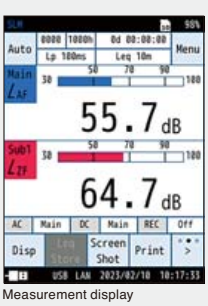
Specifications		Class 1 Sound Level Meter (With low-frequency sound measurement function) NL-63	Class 1 Sound Level Meter NL-53	Class 2 Sound Level Meter NL-43
Applicable standards		IEC 61672-1: 2013 class 1, ISO 7196: 1995, ANSI/ASA S1.4-2014/Part1 class 1, JIS C 1509-1:2017 class 1, JIS C 1516: 2020 class 1, ISO 7196: 1995	IEC 61672-1: 2013 class 1, ANSI/ASA S1.4-2014/Part1 class 1, JIS C 1509-1: 2017 class 1, JIS C 1516: 2020 class 1	IEC 61672-1: 2013 class 2, ANSI/ASA S1.4-2014/Part1 class 2, JIS C 1509-1: 2017 class 2, JIS C 1516: 2020 class 2
		CE marking ▪EMC Directive Directive 2014/30/EU EN 61326-1:2013 ▪RoHS Directive Directive 2011/65/EU EN IEC 63000:2018 ▪Low Voltage Directive Directive 2014/35/EU EN 61010-1:2010/A1:2019, UKCA Marking, China RoHS, KC mark, VCCI Class B		
Measurement function		Simultaneous measurement of up to four conditions (Main channel, Sub1 to Sub3 channels) with selected time weighting and frequency weighting		
	Instantaneous value	Time-weighted sound pressure level L_p		
	Calculated value	Equivalent continuous sound level: L_{eq}, I-time-weighted equivalent continuous sound level: L_{Ieq}*2, Moving L_{eq}: $L_{eq,\ mov}$*2, Sound exposure level: L_E, Maximum sound level: L_{max}, Minimum sound level: L_{min}, Percentile sound level: L_N, Peak sound level: L_{peak}, Takt-max sound level: L_{tm5}		
Measurement level 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-weighted peak sound level: 60 dB to 141 dB, Z-weighted peak sound level: 65 dB to 141 dB	A-weighting: 25 dB to 138 dB, C-weighting: 33 dB to 138 dB, Z-weighting: 38 dB to 138 dB, C-weighted peak sound level: 55 dB to 141 dB, Z-weighted peak sound level: 60 dB to 141 dB	
Measurement frequency range		1 Hz to 20 kHz	10 Hz to 20 kHz	20 Hz to 8 kHz
Frequency weighting		A, C, G, Z	A, C, Z	
Time weighting		F (Fast), S (Slow), I (Impulse), 10 s	F (Fast), S (Slow), I (Impulse)*2	
Power supply		4 × AA batteries, power supply to DC jack and USB port		
	Operating time (at 23°C, ECO setting)	Alkaline battery LR6: Approx. 12 hours, Ni-MH rechargeable battery HR6: Approx. 12 hours, Portable charger: Approx. 20 hours of power at 5000 mAh ＊When making Auto store mode and ECO settings, The operating time varies depending on the device settings and the battery manufacturer	Alkaline battery LR6: Approx. 16 hours, Ni-MH rechargeable battery HR6: Approx. 16 hours, Portable charger: Approx. 24 hours of power at 5000 mAh ＊When making Auto store mode and ECO settings, The operating time varies depending on the device settings and the battery manufacturer	
Languages		Japanese, English, German, Spanish, French, Chinese, Korean		

＊1 Use Rion fully guaranteed products.
＊2 NX-43EX required for NL-43/NL-53 (sold separately)

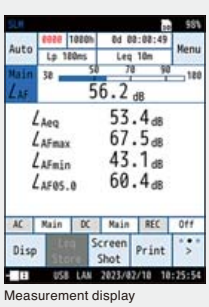
Precautions on portable charger usage
Avoid portable charger with functions that monitor device power consumption and are capable of interrupting the power supply. The power consumption of NL-43/53/63 is relatively low compared to smartphones; portable charger equipped with such features may erroneously terminate power supply to the unit.

Intuitive operation without the need to refer to manual

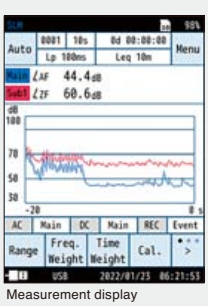
Color LCD with touch panel



Measurement display (instantaneous SPL, 2 channels)



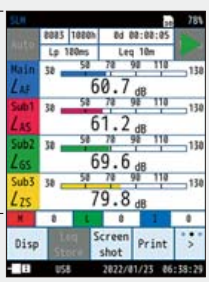
Measurement display (calculated values)


Measurement display (Time-Level Graph)

Convenient for noise and low frequency sound measurements

A-weighted, G-weighted*, and Z-weighted (LPF 100 Hz*) sounds can be saved in a single measurement run. E.g.) Set with L_{AF}, L_{GS}, L_{ZS} (L_{PF}100 Hz)

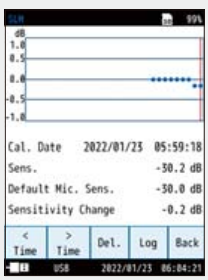
＊Only with NL-63



New Feature

A single meter can measure with up to 4 different settings simultaneously and reduces measurement time

You can set 4 different frequency and time weighting and save instantaneous and calculated values.



New Feature

View and manage a unit's calibration history and save to SD card

Recording changes in microphone sensitivity leads to reliable data management.

Web browser ＊NX-43EX required for NL-43/NL-53

By connecting to a network, remote connection via web browser of PC or smartphone is established.

- View and acquire measurement date
- Remote operation of the sound level meter
  (measurement settings, start and stop of measurement, time adjustment, etc.)
- Real-time audio playback
  (with optional NX-43WR, Supported by only Google Chrome)
- File download (Downloads are limited to one file at a time.)
- Marker function (up to four colors)

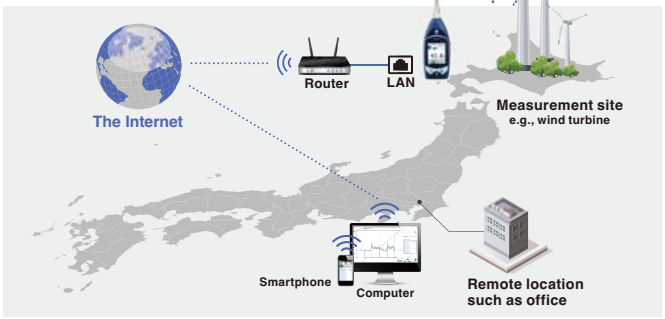
Marker function

Sections of characteristic sounds can be color-marked for later examination.

Measurement screen (Time-Level graph display, calculated value display)

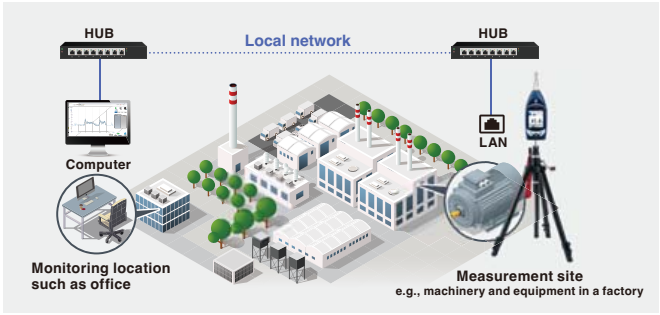
Case 1 Environmental noise monitoring of remote locations

The operational status of the sound level meter can be checked remotely from a web browser, reducing the number of site visits. You can also use the meter with a mobile router for wireless communications.



Case 2 Noise monitoring of equipment and machinery at factories and site boundary lines

Connecting the LAN terminal on the sound level meter and computer with a LAN cable allows noise monitoring from the web browser.



＊A NX-43WR is required to listen to the sound during noise measurement on your browser.

Adds a number of programs.

Extended Function Program NX-43EX

- Installation of NX-43EX＊ enables addition of NX-43WR / NX-43RT / NX-43FT

＊The NX-43EX program cannot be uninstalled.
＊The NX-43EX is pre-installed to NL-63

- Auto store function (instantaneous value, processed value)
- Instantaneous value's interval (L_p store interval) is Off, 10 ms, 25 ms, 100 ms, 200 ms, 1 s
- Comparator function
- Continuous data output function
- Trigger function
- LAN function
- Four types of marker functions

Waveform Recording Program NX-43WR

- 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)

＊For NL-63 only

- Sampling at 48 kHz, 24 kHz, 12 kHz, 1200Hz*, 240Hz*
- Selection of 24 bit or 16 bit

Maximum recording time (Assumes certain settings for auto store mode, 16 bit, and L_p store cycle of 100 ms:) ＊For NL-63 only

Sampling frequency \ Memory card	512 MB	2 GB	32 GB
48 kHz	1 h	4 h	74 h
24 kHz	2 h	9 h	146 h
12 kHz	4 h	18 h	278 h
1200 Hz＊	24 h	100 h	1520 h
240 Hz＊	41 h	165 h	2520 h

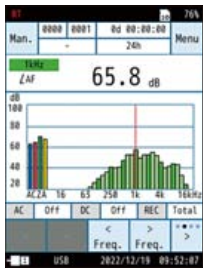
Recording in 24 bit creates files 1.5 times larger than 16-bit recordings. Accordingly, the maximum recording time is reduced to 2/3.

Octave, 1/3 Octave Real-time Analysis Program NX-43RT NX-63RT

(Compatible with NL-63)

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

Examples of the display screen

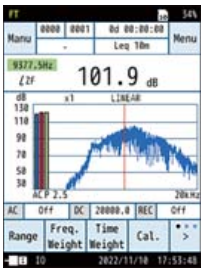


1/3 octave band analysis display

FFT Analysis Program NX-43FT

- FFT analysis can be performed.

Examples of the display screen



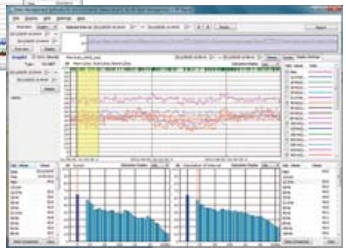
Analysis display (x1)

Complete software for environmental measurements

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

- Enables measurement data graph display, arithmetic processing, sound exclusion, report creation, file output, and real-sound file playback. AS-60RT adds support for handling octave band analysis data to AS-60.
  - If AS-60/60RT/60VM is used on the NL-42A/52A/42/52, the NX-42EX is also needed.
  - If AS-60/60RT/60VM is used on the NL-43/53, the NX-43EX is also needed.

Data management screen (AS-60)



Data management screen (AS-60RT)

Supported models

AS-60

- NL-43/53/63＊
- NL-42A/52A/62A＊
- NL-42/52/62＊
- NL-21/22/31/32＊
- DA-40 Viewer

AS-60RT

- NX-43RT/63RT＊
- NX-42RT/62RT＊
- NA-28＊
- SX-A1RT＊

＊Only auto store data are supported.

Acoustics

High-quality and cost-effective.Essential functions.
Complies with IEC standards.

Class 2 Sound Level Meter
NL-28 CE

- Confoms to IEC 61672-1:2013 class 2, JIS C 1509-1:2017 class 2, JIS C 1516:2020 class 2
- Pause measurement function to remove unwanted noises for measurement evaluation.
- Continuous operation time is over 9 hours with two AA batteries
  (Compatible with alkaline batteries, Ni-MH rechargeable batteries)

At the selected time weighting, the following calculation values can be measured simultaneously.

Measurement function	A-weighting	C-weighting
Time-weighted sound level L_p	●	●
Equivalent continuous sound level L_{eq}	●	●
Maximum time-weighted sound level L_{max}	●	●
Sound exposure level L_E	●	●
Peak sound level L_{peak}	—	●

Useful for:
Occupational safety and health, construction, traffic, karaoke/bars, factories, schools, hospitals, car inspections, HVAC, etc.

Easy-to-read OLED display

Specifications

Applicable standards		IEC 61672-1:2013 class 2 JIS C 1509-1:2017 class 2 JIS C 1516:2020 class 2
		CE Marking • EMC Directive Directive 2014/30/EU EN 61326-1:2013 • RoHS Directive Directive 2011/65/EU EN IEC 63000:2018 UKCA Marking, China RoHS, KC Mark
Measurement function		At the selected time weighting, the following calculation values can all be measured simultaneously at the frequency weighting A and C. (For L_{peak}, only the C-weighting can be measured.)
	Instantaneous value	Time-weighted sound level L_p
	Calculated values	Equivalent continuous sound level L_{eq} Sound exposure level L_E Maximum time-weighted sound level L_{max} Peak sound level L_{peak}
Measurement level range		A-weighting: 30 dB to 137 dB, C-weighting: 36 dB to 137 dB, C-weighted peak sound level: 65 dB to 140 dB
Measurement frequency range		20 Hz to 8 kHz
Power supply		AA battery × 2
	Operating time (23 °C at measurement)	Alkaline battery: Approx. 9 hours, Ni-MH rechargeable battery: Approx. 9 hours
Dimensions, weight		Approx. 200 mm (H) x 50 mm (W) x 34 mm (D), Approx. 160 g (including batteries)
Optional accessories		Sound calibrator NC-75, Pistonphone NC-72B, Tripod for sound level meter ST-80

Equipped with USB Type-C connector

By connecting the USB Type-C connector and PC with a cable, data measured with the NL-28 can be acquired as a CSV file.

Automatic calibration function

- Convenient for sound calibration before and after measurement. Insert the microphone into the acoustic calibrator and calibration is performed automatically.
- Calibration history data can be stored.

Sound Calibrator
NC-75

Workplace Noise Measurements for Industrial Safety and Health

Noise Dosimeter
NB-14 CE

- The NB-14 noise dosimeter, measures noise exposure for an individual working in a noisy workplace. It enables early detection and treatment of noise-induced hearing impairmnent, and the adoption of noise protection and effective measures to reduce noise at the source.
- Easy operation — The only operations are power ON/OFF and measurement START/STOP butons
- Compact and lightweight — Workers feel no burden about 72 g
- Automatic calibration — Convenient for acoustic calibration before and after measurement

Easy operation

Procedure of noise exposure measurement

Automatic sound calibration (before measurement) → Attachment → Measurement → Automatic sound calibration (after measurement) → Uploading data to software (AS-05 Viewer)

Reviewing results with a mobile app

The app will be available on Google Play store.

Measurement result report is generated

Specifications

Applicable standards	IEC 61252:1993+AMD1:2000+AMD2:2017, IEC 61672-1:2013 class 2, JIS C 1509-1:2017 class 2, VCCI Class B Enables measurements in compliance with ISO 9612.
	CE Marking •EMC Directive 2014/30/EU •RoHS Directive 2011/65/EU UKCA Marking, China RoHS
Measurement function (Measures each calculated value at the same time)	Equivalent continuous A-weighted sound level L_{Aeq}, Equivalent continuous C-weighted sound level L_{Ceq}, C-weighted peak sound level L_{Cpeak}, Percentage of the legal limit of a physical quantity of exposure DOSE
Measurement level range	Equivalent continuous A-weighted sound level 58 dB to 143 dB Equivalent continuous C-weighted sound level 58 dB to 143 dB C-weighted peak sound level 75 dB to 146 dB
Measurement frequency range	20 Hz to 8 kHz
Power	Built-in lithium-ion rechargeable battery (secondary battery), Continuous operating time: 12 hours or more from a fully charged state (within the operating temperature range)
Dimensions, weight	85 mm (H) × 43 mm (W) × 22 mm (D) / Approx. 72 g (excluding Crocodile clip holder)

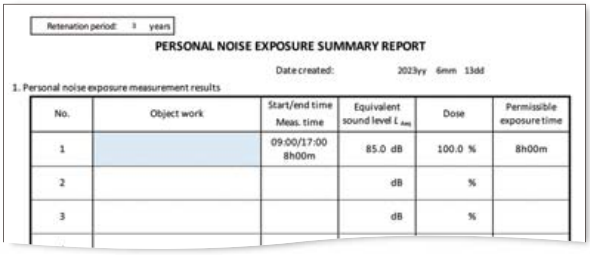
Options

Sound calibrator
NC-75

Noise Dosimeter Data Management Software
AS-05 Viewer

- The AS-05 Viewer Noise Dosimeter Data Management Software reads data measured by the NB-14 Noise Dosimeter into a computer for viewing measurement data and outputting reports.

Measurement results report



Retenation period: » years

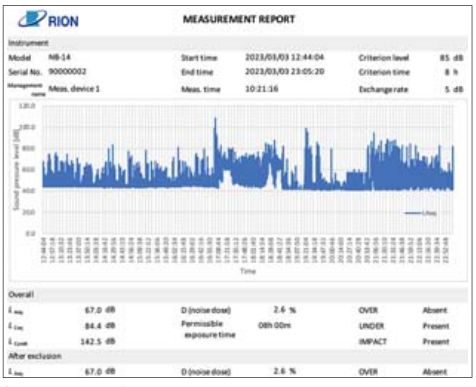
PERSONAL NOISE EXPOSURE SUMMARY REPORT

Date created: 2023yy 6mm 13dd

1. Personal noise exposure measurement results

No.	Object work	Start/end time Meas. time	Equivalent sound level L_{Aeq}	Dose	Permissible exposure time
1		09:00/17:00 8h00m	85.0 dB	100.0 %	8h00m
2			dB	%	
3			dB	%	

DOWNLOAD Available for free download from the RION website



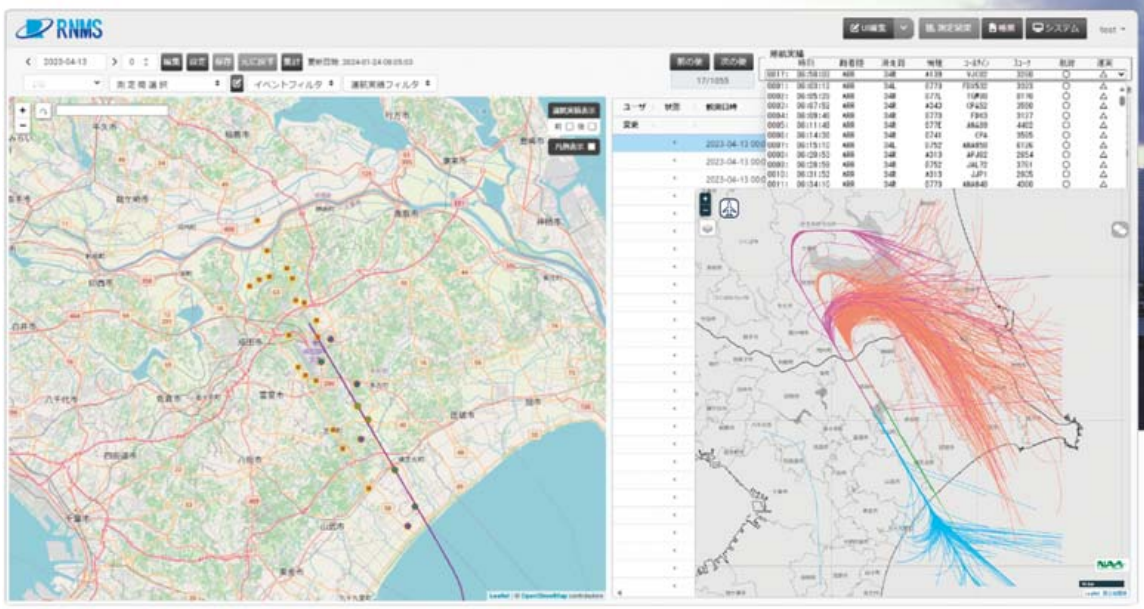
Graphical display of the data

Acoustics

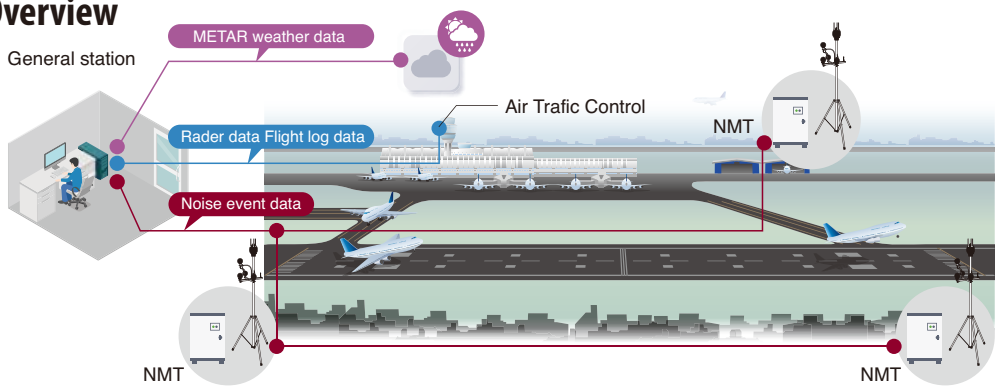
Comprehensive solution for aircraft noise management supporting noise and flight track data together.

R-EMS (RION-Environmental Managing System)

- Acquire aircraft noise report with detailed aircraft information.
- Observe flight tracking data using ADS-B and PSSR* even in situations where radar data from airport cannot be provided.
  *PSSR (Passive Secondary Surveyrance Rader) is RION's unique technology, which can observe flight-tracking information for all aircraft including one without ADS-B.
- Sound Arrival Direction information can identify the noise events even when there are large noise sources other than aircraft nearby, or when it is difficult to identify noise events by flight tracks.
- Special microphone with excellent weather resistance, allowing accurate measurements even in the rainy and humid climate.



Overview



- The NMTs, noise monitoring terminals are installed around an airport. The monitoring must be continued with stable operation for long time and will be unattended. The durable NMT have communication function for concentlizing all data onto data server. The data is controled on central station and will be used for several purpose.

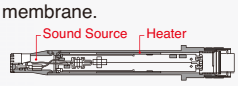
Noise Monitoring Terminal

Sound Level Meter NA-39A

- Designed for long-term monitoring.

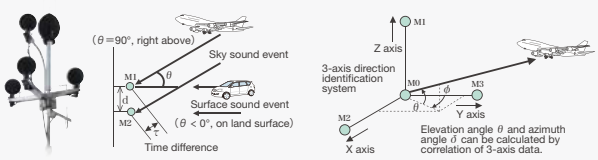
Outdoor Microphone MS-11A

- Built-in sound source for automatically checking the microphone sensitivity.
- Built-in Heater for preventing condensation on microphone membrane.



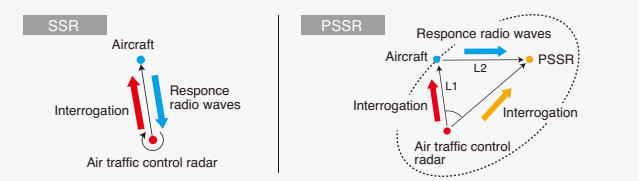
Sound Arrival Direction Sensor NA-39D

The sensor structured by 4 microphones detects vertical/horizontal sound arrival direction to identify whether the sound source is aircraft.

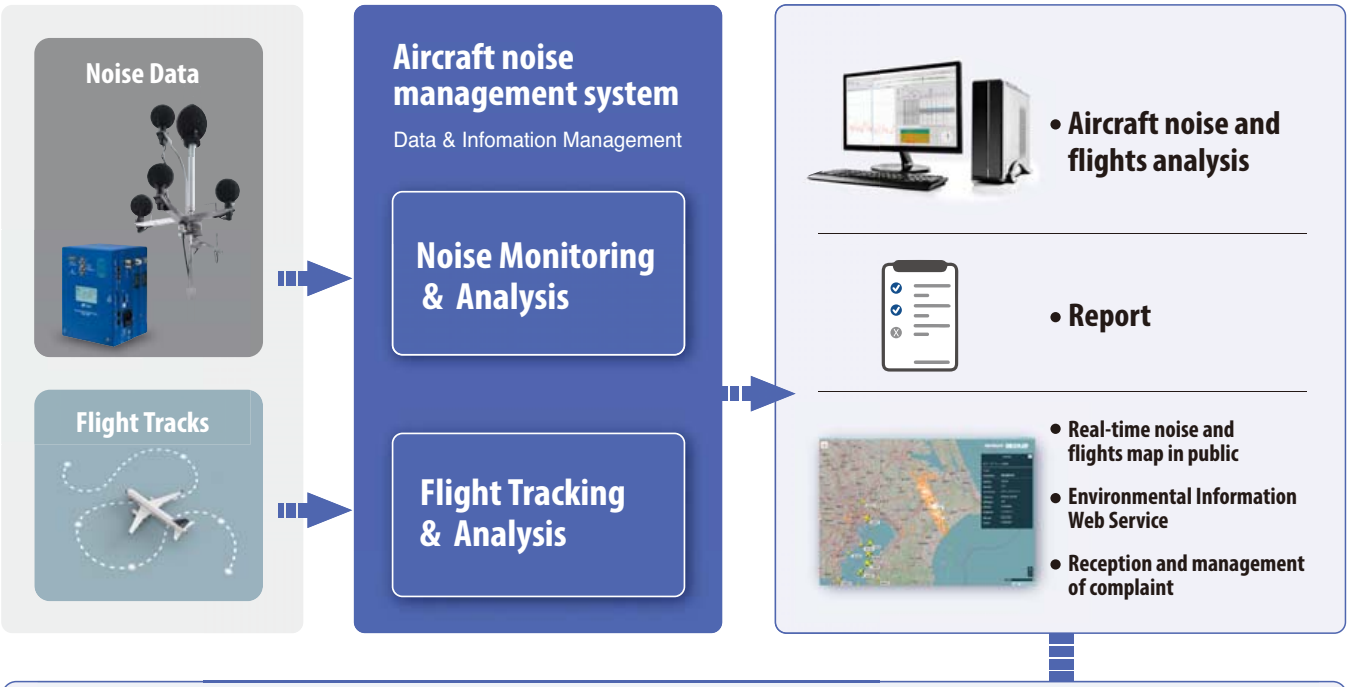


PSSR (Passive Secondary Surveillance Radar)

- Observe the positioning information of an aircraft by receiving interrogation radio waves from the air traffic control radar and response radio waves from the transponder installed on the aircraft.

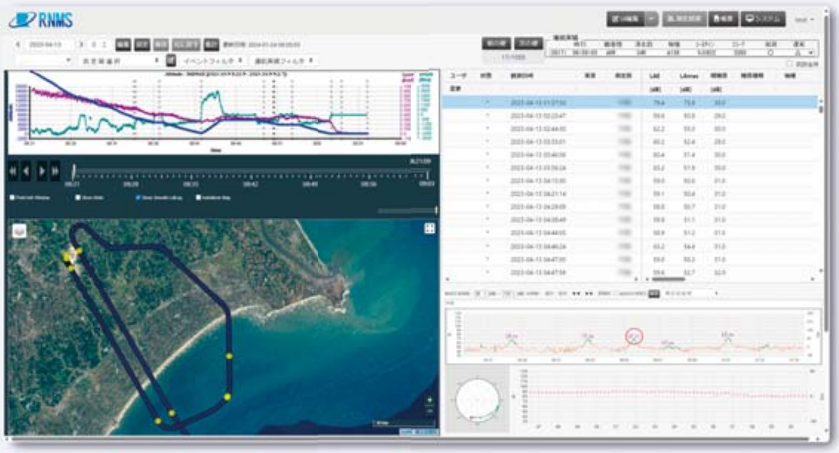


R-EMS supports...



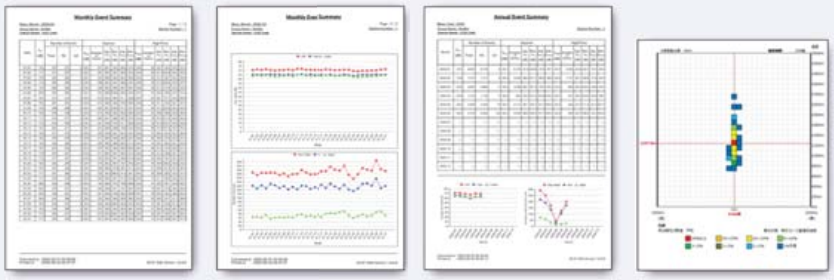
Aircraft noise and flights analysis

- Automatically identifies which aircraft generated the observed noise data. Calculates noise evaluation values (L_{dn}, L_{den}, etc.) and analyzes noise generation status by time of the day.



Report

- Creates an annual noise report for environmental impact.
- Creates period summary report for publishing breaking news for surrounding residents.



Real-time noise and flights map in public

- Flight track information and preliminary noise data can be published on the Internet in real-time.

Environmental Information Web Service

- Provides easy-to-customize web platform where you can introduce your environmental policy, noise monitoring network, noise measures and other initiatives being implemented.

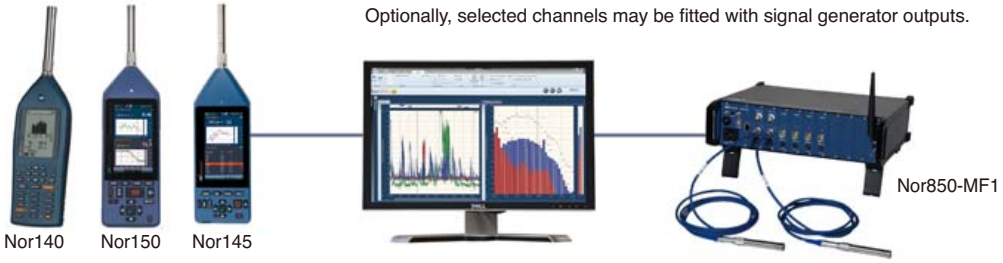
Reception and management of complaint

- Residents can post noise complaints with necessary information through dedicated contact form.
- The complaint information is associated with flight track information and noise data so that an operator can understand the relevance between complaint and flights.

Acoustics

Nor850-MF1 CE

The Nor850-MF1 rack is designed to contain up to 10 measurement channels. Each channel module has the same features and specifications as the Nor140, but can only be remotely controlled from the Nor850 Suite via LAN interface. For wireless connection, a router is attached to the LAN connector. The rack is powered by 115/230 Vac or by 12Vdc. The Nor850-MF1 rack is delivered with a selectable number of measurement channels, and may be upgraded with additional channels as the needs grow. Multiple racks may be used in the same system alternatively in a mix with Nor140, Nor145 or Nor150 Sound Level Meters as additional frontends. Optionally, selected channels may be fitted with signal generator outputs.



Measurement System
Nor850

The Nor850 measurement system is the state-of-the-art acoustical analyser from Norsonic. Using the experiences and accumulated knowhow from the previous generations of analysers such as Nor811, Nor823, Nor830 and Nor840, Norsonic is offering a unique multichannel system.
The software Nor850 Suite is connecting a variable number of individual measuring units to create the optimal system that suits any measurement task. Dedicated user-friendly offer the following application packages.

General Analyser Mode

The General Mode allows the user to make multispecter measurements in all channels simultaneously with various settings for frequency range and level profiles. The profiles have user-defined period lengths from a few msec to several minutes. The results are presented in user-defined setups with both level vs. frequency and level vs. time views as well as tables. Special views for 3D or Spectrogram are also available.

Building Acoustic Mode

The basic Building Acoustics application package includes all required features for performing sound insulation tests in the field. Both the traditional ISO 140 Standards as well as ISO 16283 Standards are included, plus national varieties of these. The ASTM tandards E336, E90 as well as the E413 are also included. In the extended Building Acoustics package the more advanced laboratory test such as ISO 10140 as well as ASTM E1007, E492 and E989 are included together with absorption coefficient testing in accordance with ISO 354 and ASTM C423.

Sound Power Mode

The basic Sound Power application package includes all features required for making sound power test in accordance with the various Standards in the ISO 3740 series. The extended Sound Power application package contains required features for making more special tests such as dual-chamber testing of heat-pumps, dynamic testing of earth moving machinery, and similar. The entire test procedure may be controlled by a user defined Scheduler for easy test repetitions.

Appliance Noise Mode

The Appliance Noise application package includes the requires features to perform a full laboratory test of the ISO 3822 Noise emission from appliances and equipment used in water supply installations.

Tapping Machine Light Floor Impact Sound Generator
FI-01A/Nor277

Specifications

Applicable standards	ISO 10140-5, ISO 16283-2
Hammers Number and Spacing	5 hammers are arrayed at 100 mmintervals in a straight line
Average time between floor impacts of each hammer	100 ±5 ms
Interface	RS-232C
Dimensions, Weight	Approx. 230 (H) x 265 (W) x 557 (D) mm, approx. 10 kg

Impact Ball
YI-01

Specifications

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

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)


(Nor282)

Dodecahedron Loudspeaker

Nor283 CE

- Dodecahedron loudspeaker
- High power loudspeaker with omnidirectional characteristics
- Fulfils the directional characteristics required by the ISO 10140 and ISO 16283 Standards
- Supplied with individual omni directional calibration certificate
- Fulfils ISO 3382-2
- Delivers a continuous sound power level of 123 dB when driven with pink noise over the frequency range 50 to 5000 Hz via the Nor282 Power Amplifier

Power Amplifier

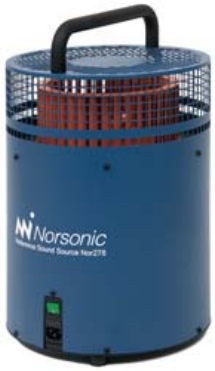
Nor282 CE

- Specially designed for building acoustic and room acoustic measurements.
- Battery operated (90 minutes at full power)
- Graphical user defined equalizer to optimize acoustic output from speaker.
- Wi-Fi for easy connect to Norsonic measuring equipment.
- Compact, lightweight, and rugged construction.
- Self-contained noise generator.
- Emits 120 dB sound power level in the 50 to 5000 Hz frequency range when used with Norsonic loudspeakers types Nor275 or Nor276.
- Wireless Noise on/off hand switch.

Microphone Boom

Nor265A CE

- Oscillating microphone boom for spatial averaging in building acoustics or sound power measurements
- Building acoustics measurements in accordance with ISO 10140 and ISO 16283
- Reverberation time measurements in accordance with ISO 354
- Sound Power measurements in accordance with ISO 3740 series.
- Directional response measurements of loudspeakers and microphones
- Accurate positioning
- Sweep of ±90° and ±180°
- Direct control or remote control from a PC via LAN interface
- Supported by Nor850
- User defined sweeps. Selectable sweep times
- Boom length adjustable from 0,8
- Nor265A may be equipped wth a turntable (optionally)



Reference Sound Source

Nor278 CE

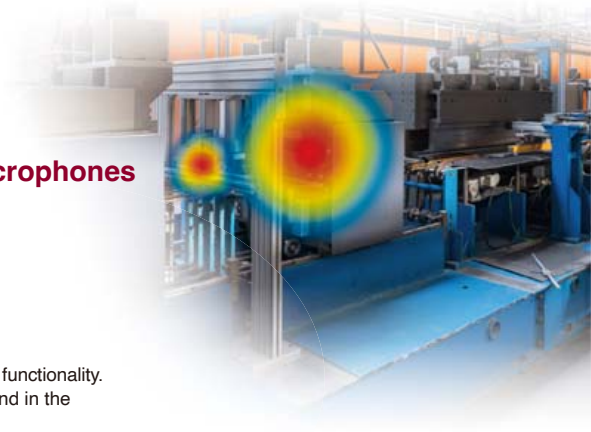
Applications

- Substitution and juxtaposition methods for determination of sound power of noise sources according to ISO 3747
- Comparison method for determination of sound power of noise sources according to ISO 3741, ISO 3743-1, ISO 3744 and 3747

Features

- A-weighted Sound power output : 93 dB re 1 pW (50 Hz line frequency)
- Sound power 50 Hz to 20 kHz: 94 dB re 1 pW (50 Hz line frequency)
- Fulfils ISO 6926 for reference sound sources in the extended frequency range 50 Hz to 10 kHz
- Individually calibrated (accredited calibration optional)
- Long-term stability
- Rugged

Acoustics



Achieves high dynamic range using overwhelming number of microphones

Acoustic camera
Hextile/Multitile/Multitile-LF (for low-frequency analysis)

- Realtime display of high-resolution color maps generated by high-speed data processing and beamforming
- The hexagonal microphone array module offers expandable functionality. The Multitile-LF for low-frequency analysis can process sound in the 120 Hz–1 kHz frequency range.
- Recorded data is stored in MP4 format for subsequent reanalysis.
- Available display modes include FFT analysis, octave band analysis, and spectral mapping.
- The array of microphones can be connected using USB cables to allow easy settings and power supply.
- Camera view lets users experience sounds (virtually) at a specified point simply by selecting a point with the cursor.

USB cable

Computer

Hextile

Multitile

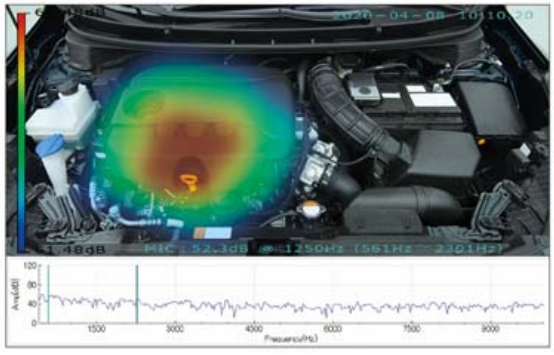
Multitile-LF (for low-frequency analysis)

Specifications for microphone array	Hextile	Multitile	Multitile-LF (for low-frequency analysis)
Measurement frequency range	410 Hz to 20 kHz	220 Hz to 20 kHz	120 Hz to 1 kHz
Number of microphones installed in unit	128	384	384
External dimensions	ϕ48 cm	ϕ96 cm	ϕ146 cm
Measurement level range (system)	9 dB to 120 dB		
Minimum measurement distance	0.5 m		
Frame rate (at camera resolution of 2,592 × 1,944)	15 FPS		
Operating temperature range	-40 °C to +85 °C		
Water resistance	IP40		
Computer	MacBook Pro　Intel Core i7、SSD、RAM：8 GB or more		
DC power source	USB 5 V		

Easy × Light × Compact × Visualization

Acoustic Camera
SC-AC043

- 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)

Normal incidence sound absorption coefficient measuring device using two-microphone method

Normal incidence Acoustic Measurement System Impedance Tube

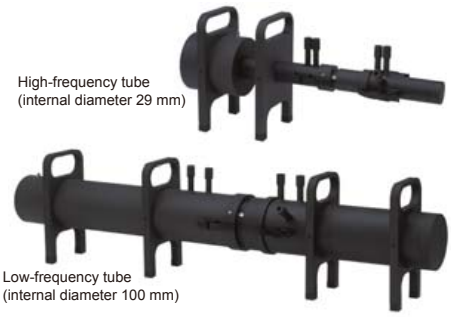
- Within an Impedance tube, the reflected sound or transmitted sound from sound hitting the sound absorbing material or sound insulation material surface vertically is captured to measure the sound absorption coefficient, acoustic impedance, and related values, as well as the sound reduction index of 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	Model 9305
Applicable standards		JIS A 1405-2, ISO 10534-2		JIS A 1405-2, ISO 10534-2, ISO 13472-2	JIS A 1405-2, ISO 10534-2
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	—	1 000 Hz to 10 000 Hz
Application		Measurement of the sound absorption coefficient and acoustic impedance related items of sound absorbing Material Measurement of normal incidence sound reduction index of sound insulation material	Measurement of the sound absorption coefficient and acoustic impedance related items of sound absorbing material	—	High frequency measurement up to 10 000 Hz Ideal for measuring acoustic characteristics of sound absorbing and insulating materials for use in electric vehicles and other applications

Model 9301 Normal 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 Normal incidence Sound Absorption Coefficient Measurement System

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

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.

Model 9305 Normal incidence Sound Absorption Coefficient/ Sound Reduction Index Measurement System for High Frequency Measurement

Measures frequencies up to 10000 Hz; ideal for measuring acoustic characteristics of sound absorbing and insulating materials for use in electric vehicles and other applications.

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
- Wedge-shaped absorber layer provides high sound absorption efficiency
- 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

Anechoic Room

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

Sound insulation performance (Type L/Type H)

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

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

∗Deviation –3 dB or more ∗Figures in brackets are reference values

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, hearing level 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

Acoustics

Condenser Microphone UC Series

- 1” microphone: For ultra-low sound pressure levels: upper measurement frequency up to about 10 kHz
- 1/2” microphone: For a wide range of acoustic applications
- 1/4” microphone: For 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-06B	NH-34 supplied	NH-35 supplied	NH-04B/ 05B/12A	NH-04B/ 05B/12A	NH-04B/ 05B/12A	NH-17/ 17A/22A	NH-17/ 17A/22A	NH-17/ 17A/22A	NH-05B (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-06B	NH-04B	NH-12A	NH-17	NH-17A	NH-22A CE	NH-05B
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

For a wide range of high-precision acoustic measurements

Measuring Amplifier
NA-42
(without microphone)

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

Specifications

Measurement functions	Sound pressure level L_p, maximum sound level L_{max}, peak sound pressure level L_{peak}
Measurement frequency range	1 Hz to 100 kHz (main unit characteristics)
Frequency weighting characteristics	A, C, FLAT
Time weighting characteristics	F (Fast), S (Slow), I (Impulse)
External filter input/output connector	BNC connector

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
- Linking with Interface Unit UV-22 allows setup and control from a computer, and transfer of measurement values

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)
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)

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%

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

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

Class 1 Sound Calibrator
Nor1256 CE

- Conforms to IEC 60942 : 2017 Class 1 and ANSI/ASA S1.40-2006 (R2016) Class 1
- Ultra-stabile silicone reference microphone
- Fully compensated for static pressure, humidity and temperature
- Robust, compact and battery operated.
- 114 and 94 dB @ 1000 and 250 Hz
- Built in display
- Measurement of humidity, temperature and static pressure
- Supplied with accredited calibration certificate

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	WS-16

Dual Windscreen to minimize influence of wind noise

Noise Measurement for wind turbine

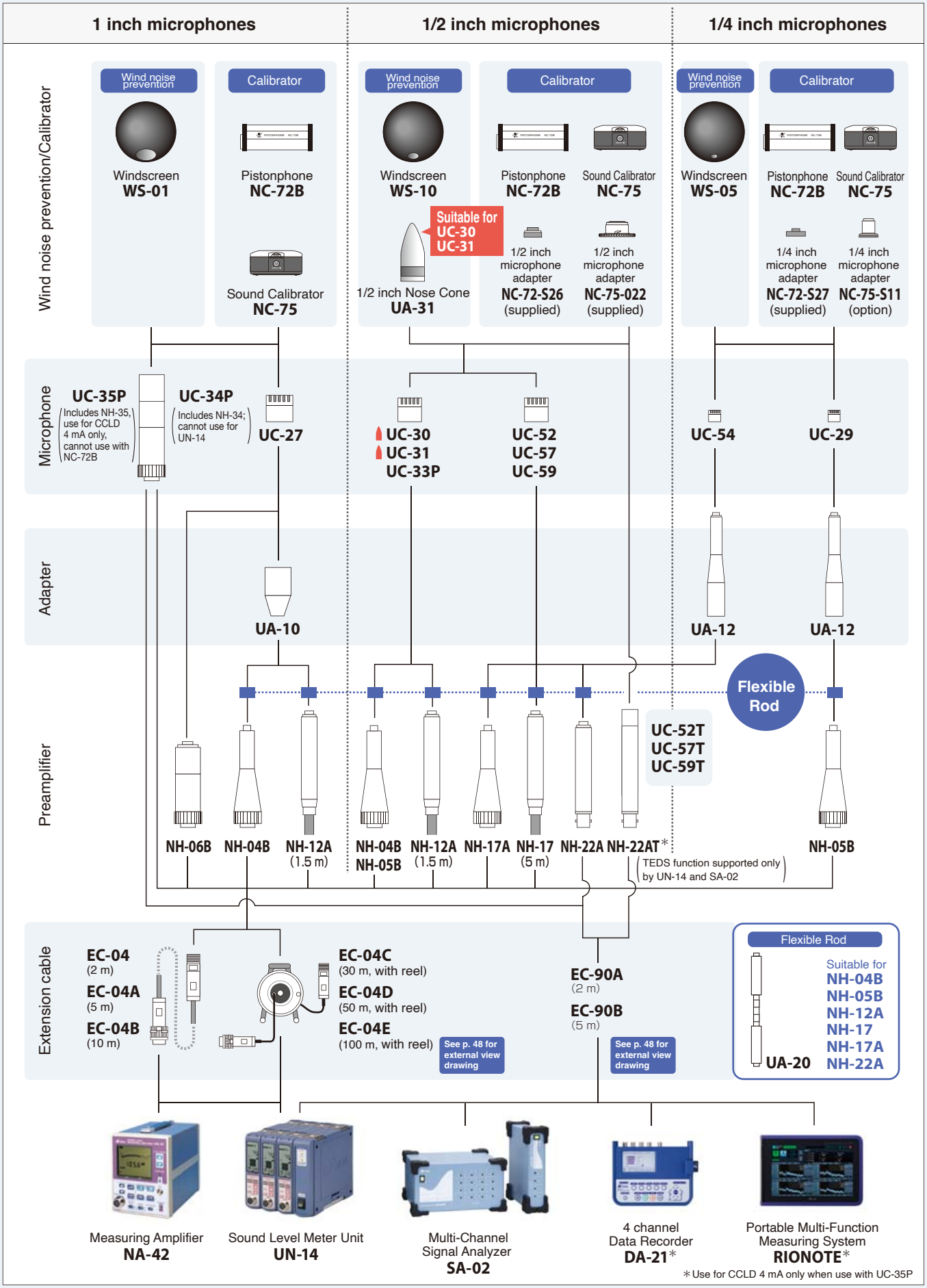
Dual Windscreen for Wind Turbine Noise Measurement
TWS-01

Acoustic Power Level measurement for wind turbine

Windscreen
KWS-03

Acoustics

Measurement Microphone Combination Examples



SD-CARD CF-CARD **Memory card compatible model**

Sound Level Meter Connection Examples

AC Adapter

AC Adapter **NE-21P**

Battery Pack **BP-21A***
*Required CC-43J

AC Adapter **NC-98E**

AC Adapter **NC-98E**

AC Adapter **NC-99A**

Battery Unit **BP-17**

Sound Level Meter

Meter with integrated microphone

Sound Level Meter **NL-43** SD-CARD

Sound Level Meter **NL-53** SD-CARD

Sound Level Meter (With low-frequency sound measurement function) **NL-63** SD-CARD

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

Meter with separate microphone option

Measuring Amplifier **NA-42**

Sound Level Meter Unit **UN-14**
Interface Unit **UV-22**

Connection Cable

USB Type-C Cable — **Computer**

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

AC/DC Output splitter Cable **CC-43S** — * — **Peripheral device with BNC connector**
*BNC-Pin output code of CC-24 or CC-24S must be connected to each output port.

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

Comparator Output / Trigger Input Cable **CC-43CT** — **Peripheral device with BNC connector**

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**

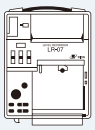
Computer

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

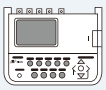
External device

Rotating light, alarm etc.

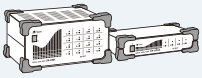
Peripheral device with BNC connector



Level Recorder **LR-07**



Data Recorder **DA-21**

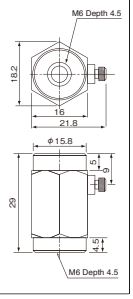
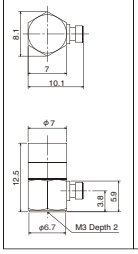
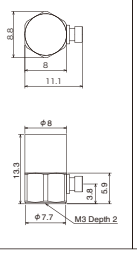
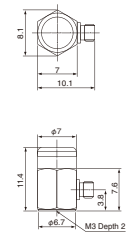
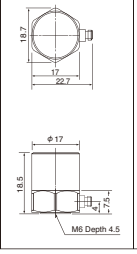
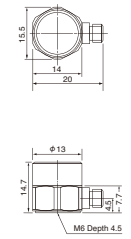
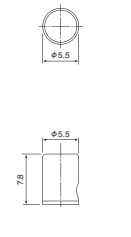
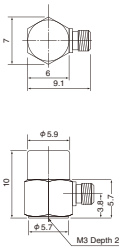
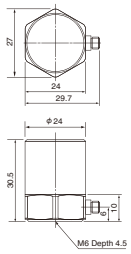


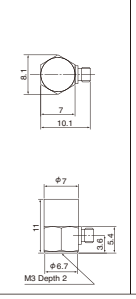
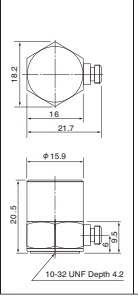
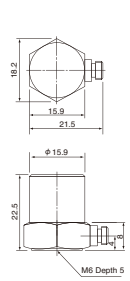
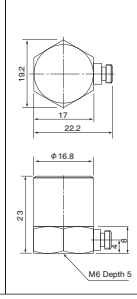
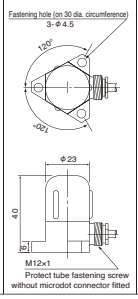
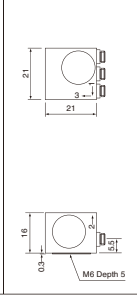
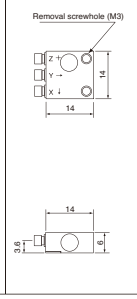
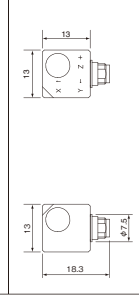
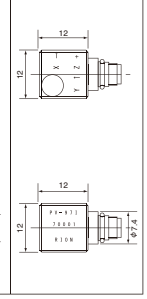
Multi-Channel Signal Analyzer **SA-02M/02A4**

Portable Multi-Function Measuring System **RIONOTE**

Vibration

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									

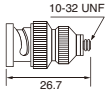
Type	High-temperature				Waterproof insulation	Triaxial type			
External view									
	PV-90H	**PV-44A**	**PV-65**	**PV-63**	**PV-10B**	**PV-93**	**PV-97C**	**PV-97**	**PV-97I**
Principle	Shear	Compression	Shear	Shear	Compression	Shear	Shear	Shear	Shear
Weight g	2	29	26	28	120	30	4.7	10	8
Charge sensitivity 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 (±10 %)	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 %)

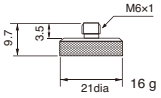
Note ● The piezoelectric element in a piezoelectric accelerometer may be damaged by excessive shock. Take care not to drop the accelerometer, and handle it with care when using the magnetic attachment.

Attachments

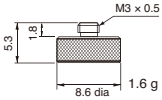
BNC Adapter
VP-52C



Magnet Attachment
VP-53S



Magnet Attachment
VP-53T



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) × 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) × 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) × 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

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

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_{FTmax} 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, 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

RION Waveform Recording Program 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

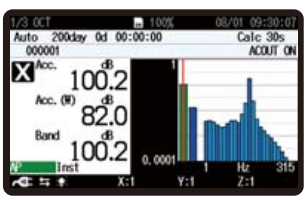
Max. recording time (at 16 bit)

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

RION 1/3 Octave RTA Program 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 Level Meter compliant with the Japan Measurement Act, JIS C 1510: 1995 and JIS C 1517: 2014 and Korea Vibration Measurement Act. Vibration evaluation using Vibration Criterion (VC) at precision machinery installation such as semiconductor manufacturing equipment

＊Optional program NX-43RT is required

WATER RESISTANT

SD-CARD Memory card compatible model

Designated manufacturer of special measurement instrument
Designation number: 351301

Vibration Level Meter
VM-57 CE

- Newly equipped with a LAN port to enhance connection with communication devices and to networks
- Can be powered by a commercially available mobile battery via a USB Type-C port to allow extended measurements even at sites without access to power outlets
- Simultaneous measurement of vibration level (L_v),and vibration acceleration level (L_{va})
- Optional program VX-57RT allows easy evaluation based on VC curve＊

＊VC curve is used as a method of evaluation that specifies the minimum vibration criteria for proper machine operation

Specifications

Applicable standards	Vibration Level Meter compliant with the Japan Measurement Act JIS C 1510: 2023, JIS C 1517: 2014, CE Marking (EMC Directive, Low Voltage Directive, RoHS Directive), WEEE Directive, China RoHS, KC mark
Measurement functions	1 direction (Z) or simultaneous measurement in 3 directions (XYZ) Vibration level L_v and vibration acceleration level L_{va} Maximum value hold for vibration level and vibration acceleration level
Calculation measurement	Equivalent continuous level of vibration level and vibration acceleration level L_{eq} Percentile levels of vibration level and vibration acceleration level L_5, L_{10}, L_{50}, L_{90}, L_{95} Maximum value of vibration level and vibration acceleration level L_{max} Minimum value of vibration level and vibration acceleration level L_{min}
Measurement frequency range	Vibration level : 1 Hz to 80 Hz, Vibration acceleration level : 1 Hz to 80 Hz
Measurement level range	Vertical direction of vibration level：25 dB to 129 dB、Horizontal direction of vibration level：30 dB to 122 dB、Vibration acceleration level：30 dB to 129 dB
Store modes	Manual, Auto*, Timer Auto*
Power supply	AA batteries(x8) or external power source, AC adapter（Option: NE-21P）, Battery pack（Option: BP-21A）
Dimensions, weight	Approx. 150.5 mm (H) × 173.2 mm (W) × 44.0 mm (D)）, 1,110 g (including main unit, 3-axis accelerometer PV-83E, connection cable EC-54S, and batteries)

＊ VX-57EX 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-83E (supplied)	Sensitivity: 60 mV (m/s²), Temperature range for operation: -10°C to +50°C, Dimensions, weight: Approx. dia 67 × 41 (H) mm, Approx. 300 g

Extended Function Program
VX-57EX

512 MB

After installation, the card can be used as a 512 MB SD memory card.

＊Once installed, the VX-57EX cannot be uninstalled.

The VX-57WR and VX-57RT can be added by installing the VX-57EX.

VX-57EX → Added function: Auto store function (simultaneous and continuous recording of instantaneous values and processing values); LAN function / four types of marker function / comparator function / continuous data output function (serial communication)

\+

VX-57WR → Added function: Vibration waveform recording

\+

VX-57RT → Added function: 1/3 octave real-time analysis / 1/3 octave band filter output / VC value measurement function

Waveform Recording Program
VX-57WR

Allows simultaneous vibration level processing and waveform recording. Recorded data can be analyzed on a computer to perform frequency analysis. (Saved as non-compressed WAVE files)

2 GB

After installation, the card can be used as a 2 GB SD memory card.

Sampling at 1 kHz, 24-bit or 16-bit selectable

Maximum recording time
(when set to 3-axis, auto store, 16-bit, Lv store cycle of 100 ms)

Memory card / Added function	512 MB	2 GB	32 GB
Sampling Frequency 1 kHz	Approx. **14 hours**	Approx. **57 hours**	Approx. **880 hours**

1/3 Octave Real-time Analysis Program
VX-57RT

Allows real time 1/3 octave band analysis. Saved analysis results can be read for viewing.

512 MB

After installation, the card can be used as a 512 MB SD memory card.

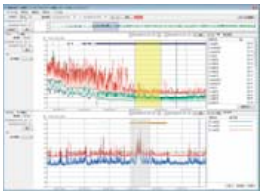
1/3 octave band analysis screen (simulated image)

Adds support for handling data measured with VM-57 to AS-60
Data Management Software for Environmental Measurement (Includes the vibration level data management software)
AS-60VM

Supported models

■ VM-57/55/53A＊ ＊Auto store data only

See p. 9 for AS-60 specifications



Adds support for handling data measured with VM-57 +VX-57EX + VX-57RT to AS-60
Data Management Software for Environmental Measurement (Includes the 1/3 octave data vibration level data management software)
AS-60VMRT

Vibration

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

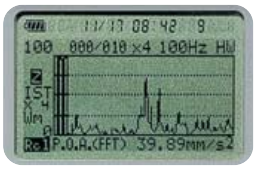
Inputs	3 channels (with 3-channel vibration input preamplifier)
Measurement frequency range	0.5 Hz to 5 000 Hz
Measurement mode (instantaneous 3-axis value)	Acceleration m/s²
Outputs	Separate AC outputs for 3-axis signals
Power	Four IEC R14 (size C) batteries, continuous operation 16 hours
Temperature/humidity 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

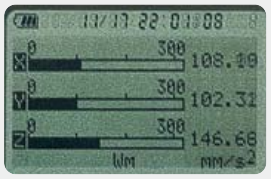
Display items	1. FFT processed spectrum display 2. Effective value (O.A.) calculated from time domain 3. O.A. value＊ calculated from frequency domain (FFT result) ＊Partial overall value for specified frequency range can also be calculated.
Display functions	Dependent on respective program card
Measurement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

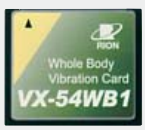
Specifications

Applicable standards	ISO 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



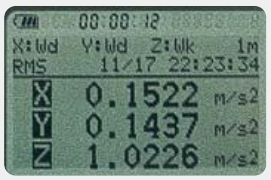
- Measure and evaluate vibrations as specified in ISO 2631 and JIS B 7760 regarding vibration perception
- Whole-body vibration measurement system consists of Seat Measurement Accelerometer PV-62, 3-Axis Vibration Meter VM-54, and Whole Body Vibration Card
- Measurement data can be stored on memory card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

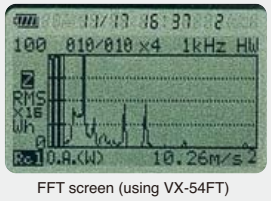
Hand-Arm Vibration Card
VX-54WH

- 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 22.



FFT screen (using VX-54FT)

Specifications

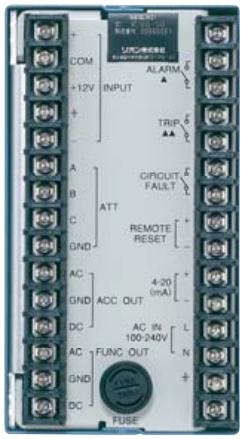
Applicable standards	ISO 5349-1: 2001, ISO 5349-2: 2001, ISO 8041: 2005, JIS B 7761-1: 2004, JIS B 7761-2: 2004, JIS B 7761-3: 2007
Input	Piezoelectric Accelerometer PV-97C/97I (triaxial), etc
Measurement frequency range	8 Hz to 1 000 Hz
Frequency weighting	Wh
Processing functions	RMS, MTVV, VDV, Synthesized 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

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

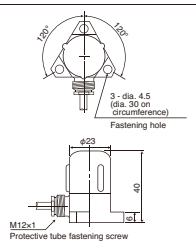
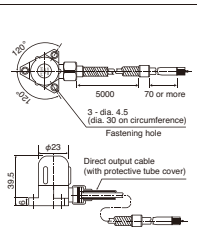
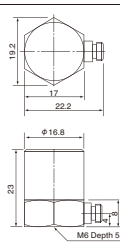
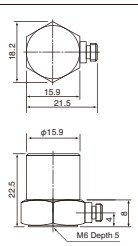
4-20 mA Isolation Unit
UG-33
4-20 mA current output
＊Factory option

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 1x10⁷ 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

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, 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

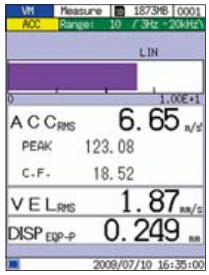
Charge converter	VP-40
Charge converter	VP-42
BNC-RCA output cable	CC-24

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

Vibration Analyzer
VA-12 CE

SD-CARD
Memory card compatible model

2011TPM優秀商品賞 開発賞
TPM Awards



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

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

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

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**

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**

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-40**

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

BNC Adapter **VP-52C**

BNC Adapter **VP-52C**

VM-83
UV-15
UV-16

SA-02
DA-21
RIONOTE

VM-83
UV-15

UV-16

SA-02
DA-21
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

Vibration Meter

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

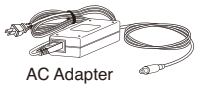
General-Purpose Vibration Meter
VM-83

Servo Accelerometer Power Supply
LF-20

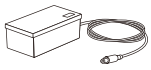
Vibration Meter Connection Examples

SD-CARD
Memory card compatible model

AC Adapter	Vibration Meter	Connection Cable	Peripheral Equipment



AC Adapter
NE-21P



Battery Pack
BP-21A＊
＊Required CC-43J

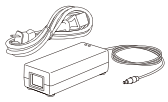
Vibration Level Meter
VM-57
SD-CARD

USB Type-C Cable → Computer

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

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

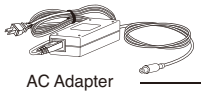
Comparator Output / Trigger Input Cable **CC-43CT** → Peripheral device with BNC connector



AC Adapter
NC-99A

Vibration Analyzer
VA-12
SD-CARD

USB A-mini B Cable → Computer



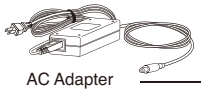
AC Adapter
NC-98E

General-Purpose Vibration Meter
VM-82A

USB A-mini B Cable → Computer

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

Accelerometer sold separately
＊For details, see "Accelerometer Selection" on page 32.



AC Adapter
NC-98E

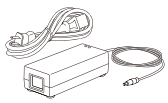
General-Purpose Vibration Meter
VM-83

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

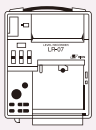
Computer

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

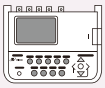
External device

Rotating light, alarm etc.

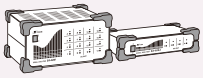
Peripheral device with BNC connector



Level Recorder
LR-07



Data Recorder
DA-21



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

Portable Multi-function Measuring System
RIONOTE

Frequency Analysis

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

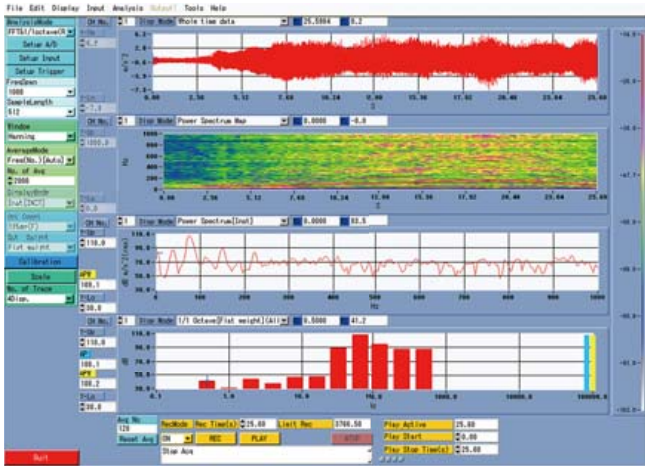
4-Channel Signal Analyzer
SA-02A4

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

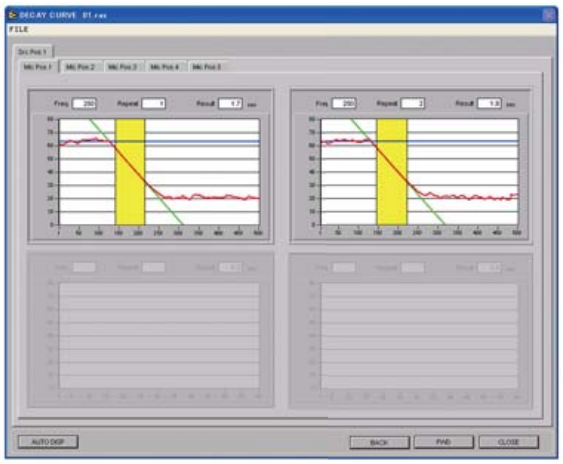
Standard compliance	1/1, 1/3, 1/12 octave band filters: IEC 61260-1: 2014 class 1 (JIS C 1513-1: 2020 (Filter) JIS C 1514: 2002 class 1), WEEE Directive, RoHS Directive, Chinese RoHS Directive				
Frequency range	DC to 40 kHz				
FFT analyzer section	Analysis frequencies	100 Hz / 200 Hz / 500 Hz / 1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

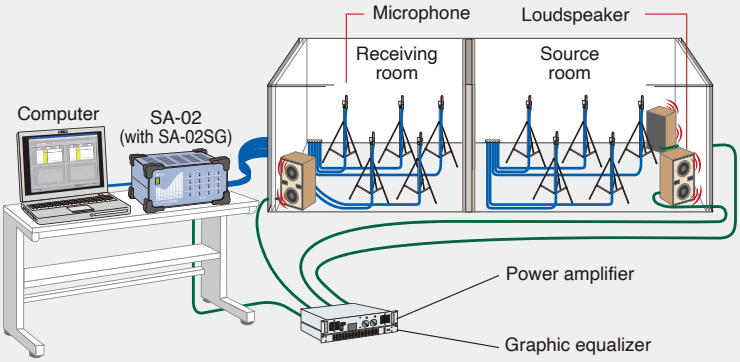
Options

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

Dedicated Analysis Software

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





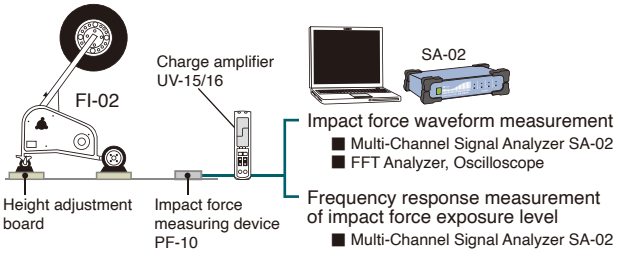
- Designed for sound insulation measurement of buildings and building materials based on ISO specifications. Measurement and evaluation for the categories of reverberation time, floor impact sound and attenuation, airborne sound, and sound absorption in a reverberation room are possible.
- Applicable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

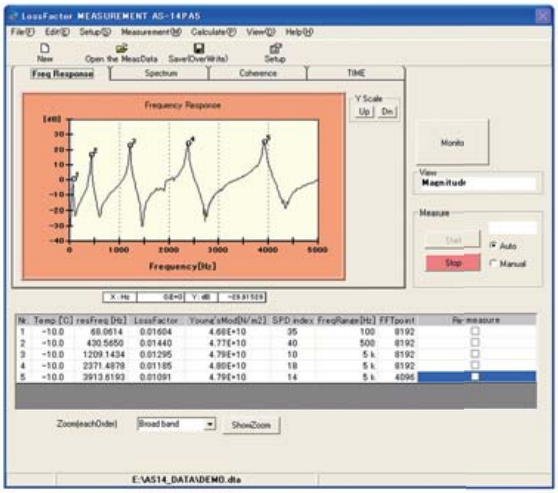
Impact Force Measuring Device
PF-10

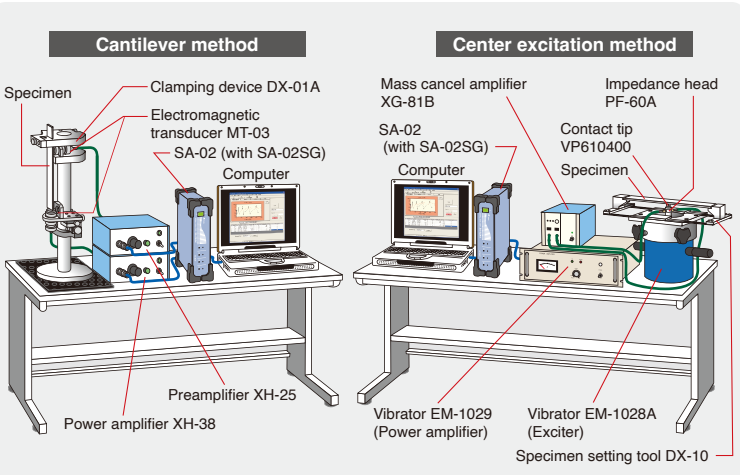
Impact force measurement using an impact ball

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



Loss Factor Measurement Software
AS-14PA5





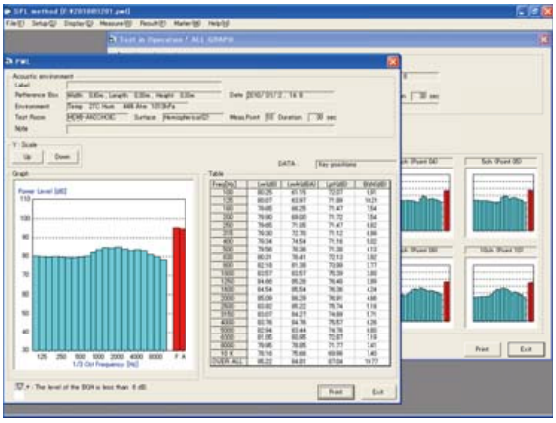
- Using the center excitation method or cantilever method, the frequency response of a strip specimen is measured, and the resonance characteristics are used to determine the loss factor and Young's modulus (or shear coefficient) of the specimen according to the half-power bandwidth method.
- Automatic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

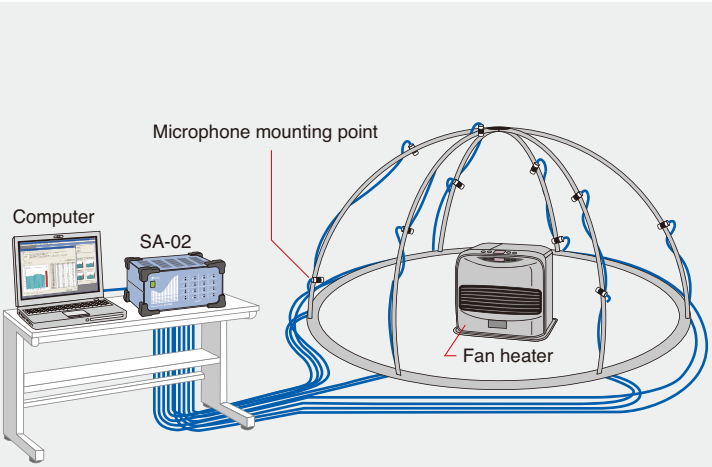
* When performing vibration attenuation testing for non-constraint compound damping, "Monogram display of damping material characteristics" is supported with optional software.

Frequency Analysis

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

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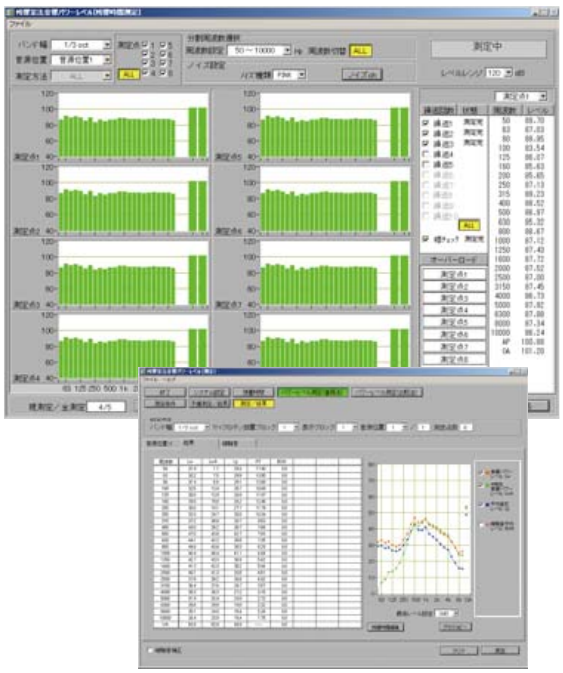
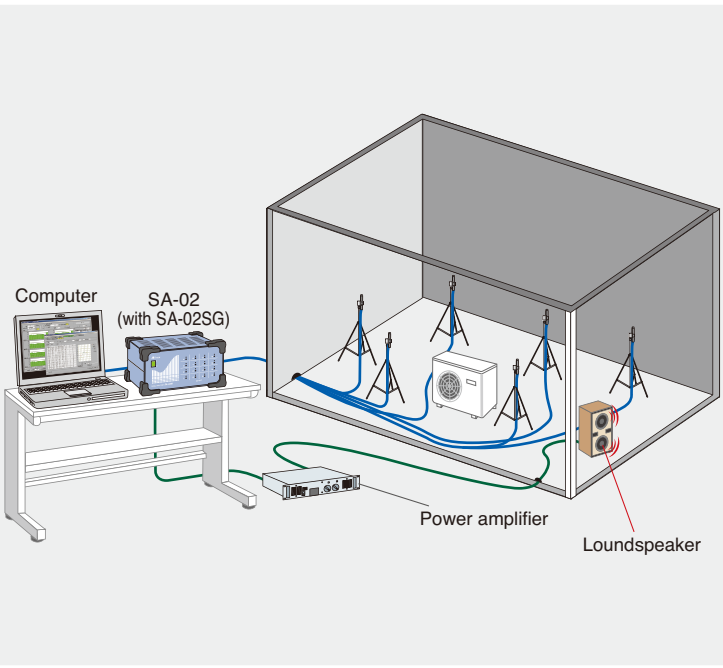
Sound Power Level Measurement Software for Reverberation Room
AS-31PA5

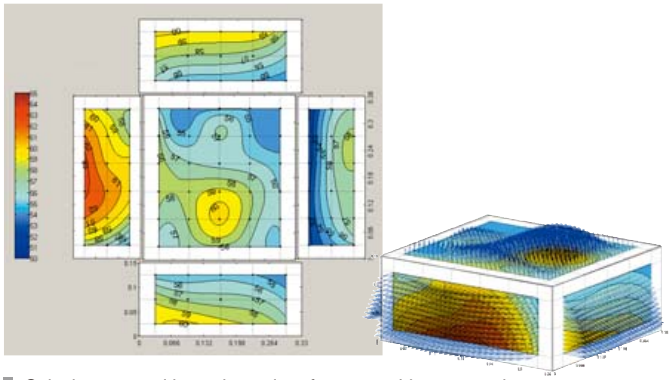


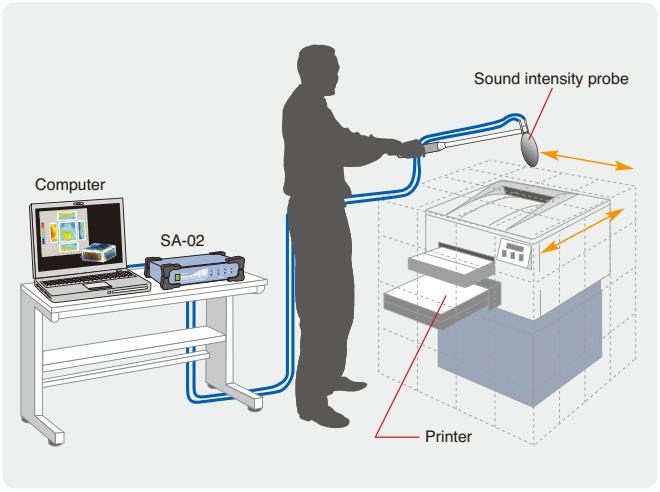


- Supports direct and comparative measurement. Also allows reverberation time measurement.
- Supports multi-channel measurement and microphone rotator use.
- Simultaneous power level measurement for up to 32 channels possible (up to 8 channels for reverberation time measurement).
- Applicable standards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

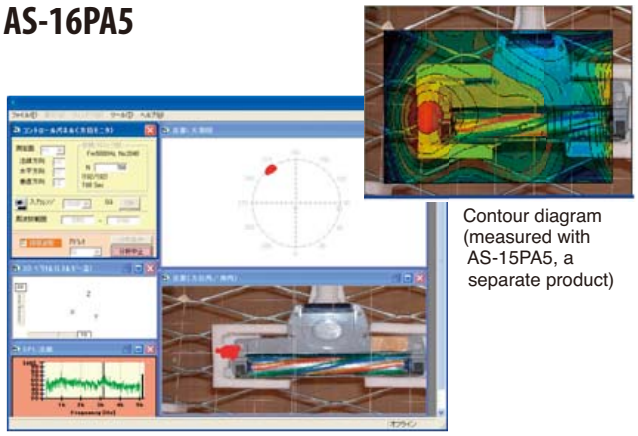
Sound Intensity Measurement Software
AS-15PA5



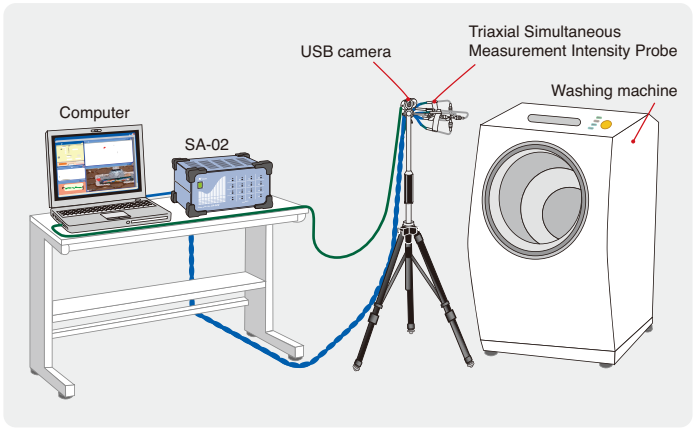


- Calculates sound intensity and performs graphics processing.
- Displays frequency spectrum, band level, and intensity spectrum information as spectrum line diagram, contour diagram, or mesh diagram, and shows sound power levels.

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

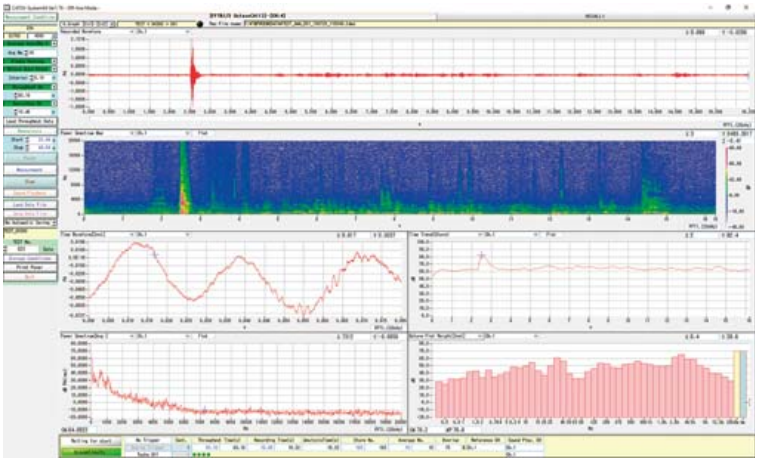
- Allows simultaneous measurement of sound intensity in all directions of a three-dimensional orthogonal coordinate system
- Dedicated microphones capable of capturing an intensity vector as a three-dimensional spatial vector
- Three sets of 1/2 inch electret microphone pairs UC-53I with matching phase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

Specifications

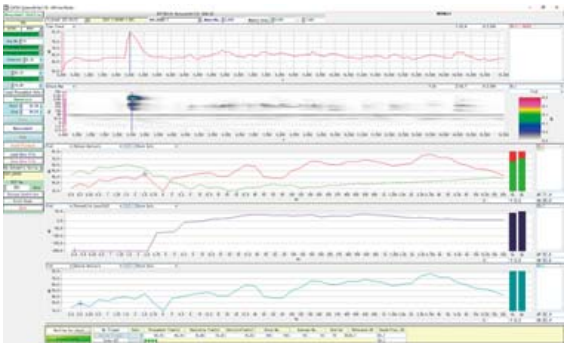
Construction principle		Face to face, with integrated preamplifier
Shape	Effective acoustic distance	31 mm: 100 Hz to 2 kHz 50 mm: 50 Hz to 1.2 kHz

Frequency Analysis

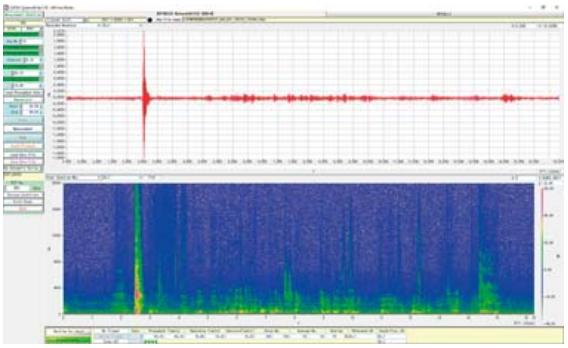
Dedicated Analysis Software



Basic screen



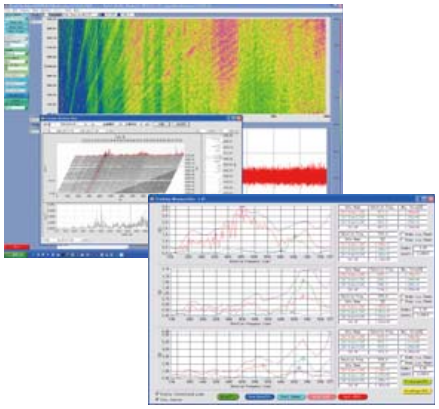
Recall screen



Spectrum map screen

Sound and Vibration Measurement System
CAT-SA02-Pro

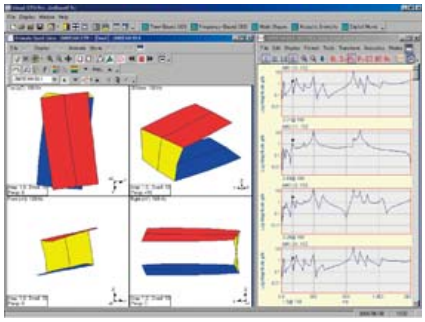
- Supports simultaneous FFT analysis, octave band analysis, and recall processing while recording time waveform data
- Allows combined viewing of downsampled FFT analysis results
- Supports simultaneous analysis for two sets of frequencies and number of sampling points
- Supports long-term time wave 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.

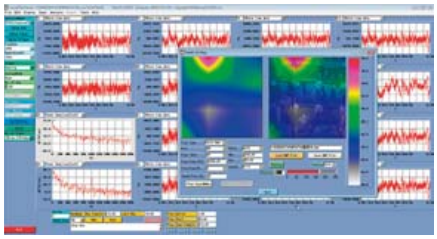
Sound Quality Evaluation Software
CAT-SA02-SQ

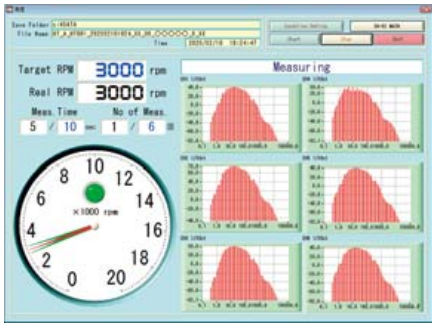
(This software is a product of Catec Inc.)

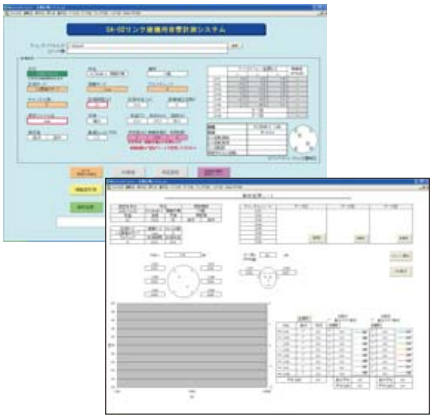
- WAVE data collected with the SA-02 and similar data can be imported into a measurement data file and used to calculate psychoacoustic evaluation quantities.
- Calculates loudness (steady-state and transient*), sharpness, roughness, intensity fluctuation, and tonality evaluation parameters.

  *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.)

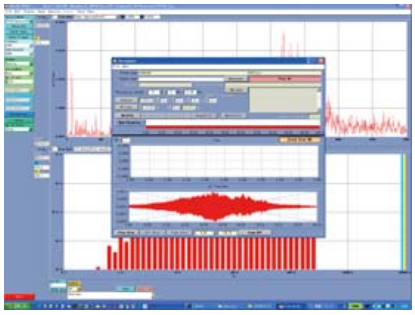
- Sound pressure level fluctuations and changes are made visible using a 32-microphone array.
- Visualization can be performed separately by frequency or overall. Microphone frequency analysis results can be displayed for each mode.
- Power spectrum and 3-D spectrum map can be observed for each array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

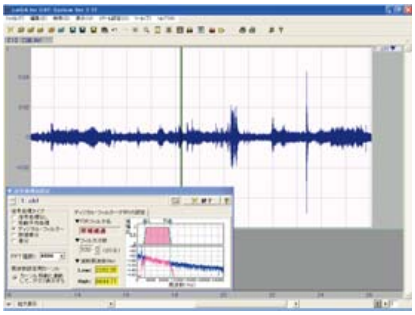
Hand-arm Vibration Measurement Software
CAT-SA02-HT
(This software is a product of Catec Inc.)

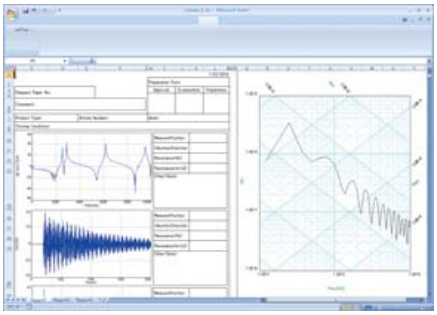
- Frequency-weighted acceleration rms values are measured for the X, Y, Z axes simultaneously. From these values (a_{hwx}, a_{hwy}, a_{hwz}), the software determines the triaxial combined value a_{hv}.
- Applicable standards
  ISO 8041 / ISO 5349-2

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

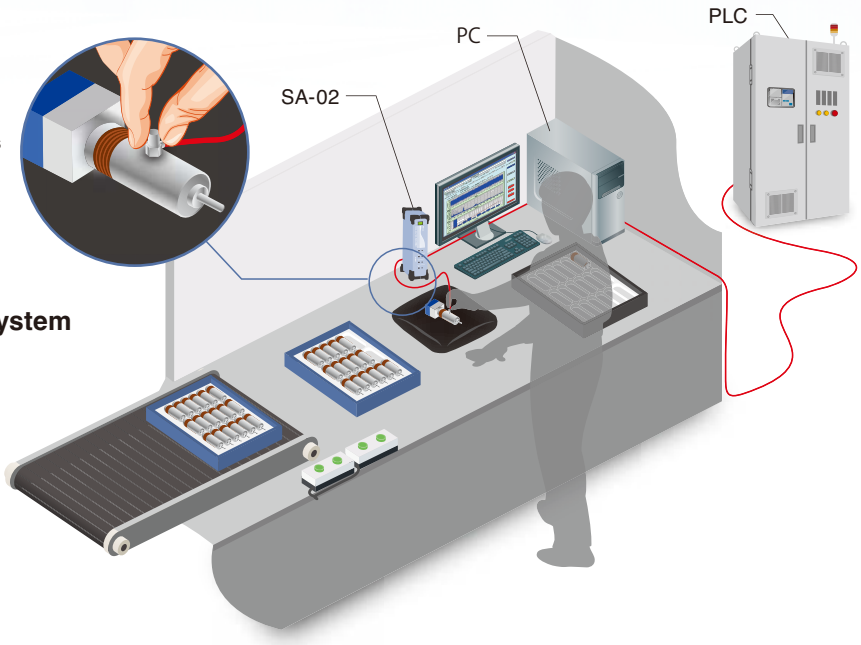
Frequency Analysis

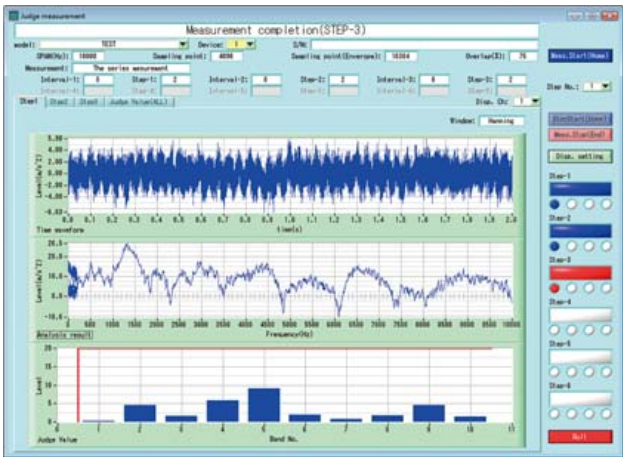
Dedicated Analysis Software

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





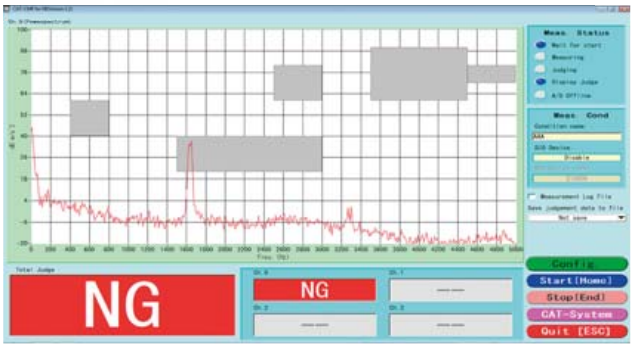
Self-learning Evaluation System
CAT-CMP-MTA

(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

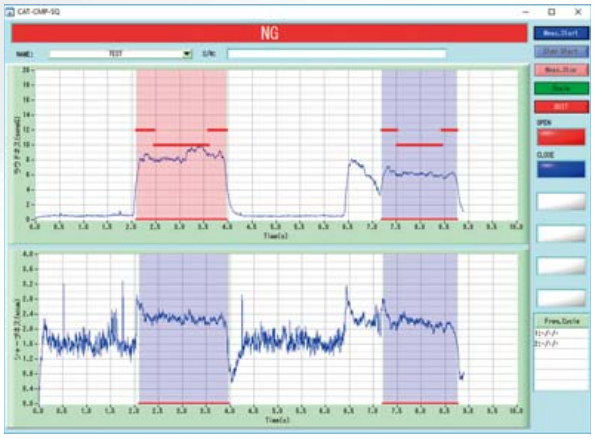
Reference Level Comparison Method Evaluation System
CAT-CMP-REF

(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 Analysis

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

SD-CARD
Memory card compatible model

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)
Supplied accessories	Rechargeable Li-Ion battery, AC adapter, SA-A1 file converter, AS-70 Viewer, Instruction manual

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.

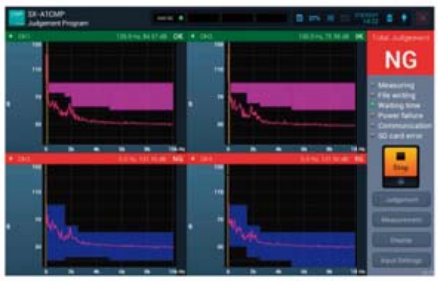
- All essential vibration measurement functions are provided, enabling equipment diagnosis and trend management for industrial machinery.
- The program also supports detailed diagnosis including FFT analysis and envelope processing.

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

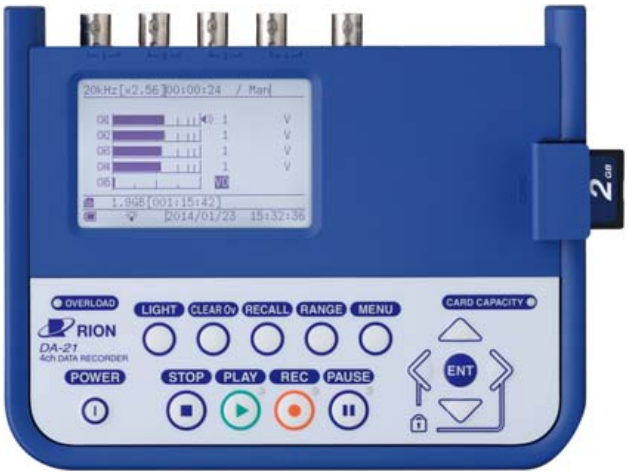
Recording

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

- 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)

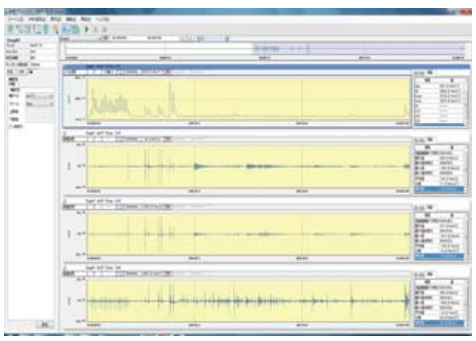
Supported models : RIONOTE, NX-43WR, NX-42WR, NX-28WR, SA-78WR, DA-21/20/40, VA-12, VX-55WR/57WR, SX-A1VA

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

Specifications

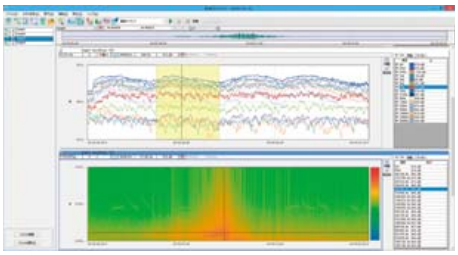
Waveform	Display functions	Amplitude waveform, level waveform
	Weighting functions	10 ms, F (Fast), 630 ms, S (Slow), 10 s

*Supported operating system: Microsoft Windows, 10 Pro 64 bit, 11 Pro 64 bit

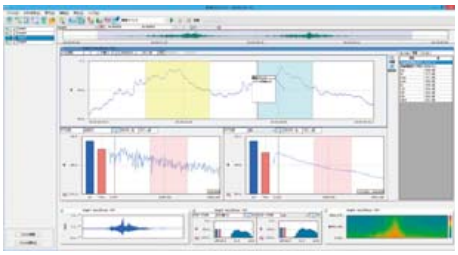


4-channel display screen

Waveform Analysis Software
AS-70



Waveform analysis screen example



Waveform analysis screen example

Supported models : RIONOTE, NX-43WR, NX-42WR, NX-28WR, SA-78WR DA-21/20/40, VA-12, VX-55WR/57WR, 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.

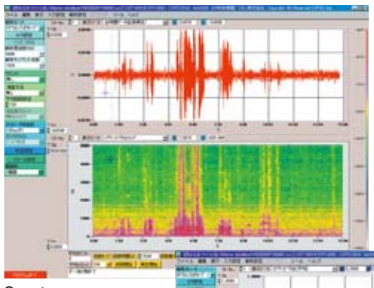
Specifications

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)
	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)

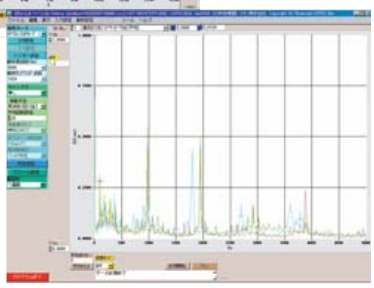
Recommended operation environment

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, 10 Pro 64 bit, 11 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

Allows easy measurement of fluid viscosity

Viscometer

VT-06 CE

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, Ni-MH 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 Viscometer cannot measure accurately with anything other than supplied cups or the JIS 300 mL beaker.

*1 JIS R 3503 : 1994, φ78×103 (H)

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 immersing a rotor in the fluid. The resistance to rotor movement caused by the viscosity (torque) is measured to obtain direct readings.

- Compact and lightweight make the unit easily portable and allow operation with one hand
- Can be powered by alkaline batteries, nickel-hydride rechargeable batteries, or AC adapter
- Direct indication of viscosity in decipascal-seconds (SI units)
- Dedicated stand for measurement available as option

Options

Stand	VA-04
AC adapter	VA-05JA

VA-04

Applications

Thanks to its great usability, portability, and reliability, RION's viscometer VT-06 has been gaining good reputations from various industries, all over the world.

Food Industry

Thickness is an essential component for foods such as soup, sauce, paste, and oils.
To control these characteristics will directly contribute to maintain the quality of the final product. As food viscosity shall be strongly affected by its temperature, understanding coherence of viscosity and temperature for each product is also important. Examples: Tomato paste, Condensed soup, Curry, Fresh juice Smoothie, Olive oil, Chocolate, Creme

Paint

Today, it seems impossible to find something that is not painted. Not just coloring, paint has important tasks of adding protecting function. As painting has been playing important part of manufacturing, quality of the paint is strictly controlled. If you use inadequate paint product, it may have some problem; it is not easy to apply, it will not sufficient performance.

Chemicals

With its wide measurement range, the VT-06 can be applicable to chemical industries. It can measure grease, oil, adhesive, resin, detergent, and so on. VT-06 is very easy to carry and you can instantly start the measurement, so you can do the measurement wherever viscosity matters. Examples: Engine oil, Lubrication grease, Adhesive, Resin, Detergent, Gum, Cement

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

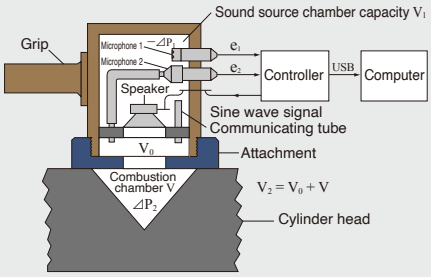
Acoustical Volumeter (For combustion chamber volume measurement)

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.
- Capacity measurement : repeat precision ±0.05 cm^3
  (When a volume of 50 cm^3 is measured under standard environmental conditions (20 °C, 50 %)

＊For cylinder head

＊For complete engine



Cross-sectional drawing

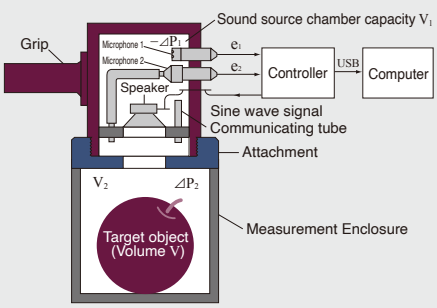
- Prior to the measurement, use a few types of reference standards for calibration and obtain the required parameters.
- Measurement is done by attaching the sound source chamber to the object.

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.
- Volume measurement : repeat precision ±0.1 cm^3
  (When a volume of 100 cm^3 is measured under standard environmental conditions (20 °C, 50 %))

[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.



Cross-sectional drawing

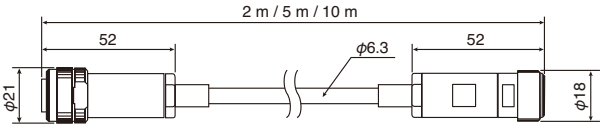
- Prior to the measurement, use a few types of reference stndards for calibration.
- Put the object into the measurement enclosure for measurement.
- To measure the density, measure the mass of the object in advance.

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)

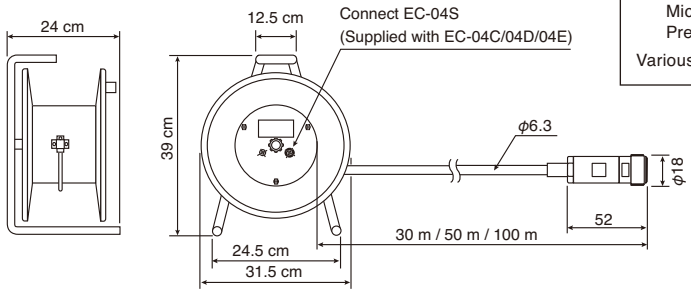
● **EC03001**

Sensor	Main Unit
Microphone Preamplifier Various See p. 20	Mearuring Amplifier **NA-42** Sound Level Meter Unit **UN-14**

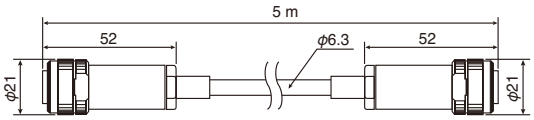
Can also be used as extension cable for these sound level meters

NA-28, NA-42, NL-43/53/63

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

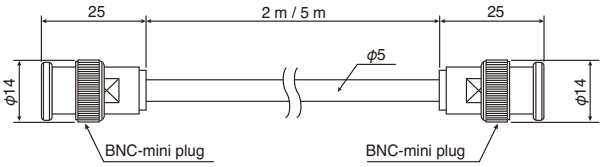


EC-04S (for connection of sound level meter to reel)



BNC-BNC Coaxial Cable

EC-90A/90B

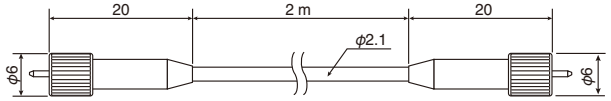


Type	Model	Length
BNC-BNC Coaxial Cable	**EC-90A**	2 m
	EC-90B	5 m

Sensor	Main Unit
Microphone Preamplifier Various See p. 20	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

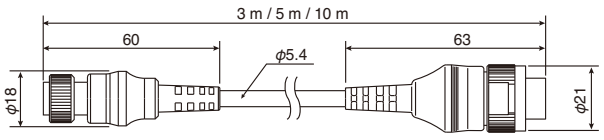


Type	Model	Length
Standard Cable	**VP-51A**	2 m～

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

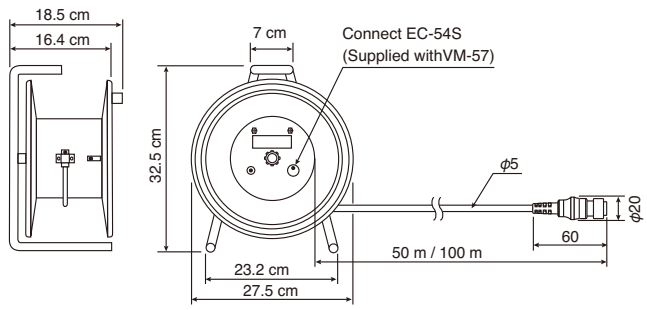


Type	Model	Length
Extension Cable	**EC-54S**	3 m
	EC-54SA	5 m
	EC-54SB	10 m
Vibration Level Meter/ Vibration Meter Cables	**EC-02SD**	50 m (with reel)
	EC-02SE	100 m (with reel)

Sensor	Main Unit
Triaxial Accelerometer (Supplied with main unit) See p.25	Vibration Level Meter **VM-57**

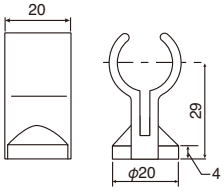
EC-02SD/02SE (with reel)

＊It is also possible to connect the EC-04 series



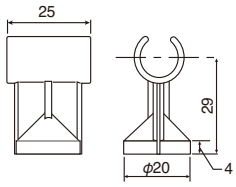
Microphone Holders

● **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.)?**

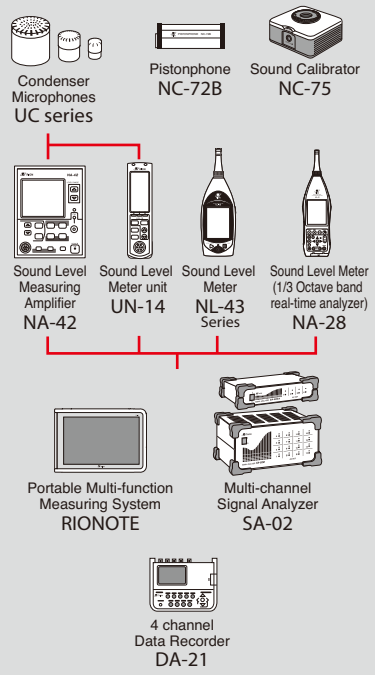
Depending on these factors, the measurement method, type of measuring instrument, and choice of peripheral equipment will differ. Selecting the right combination of products is essential for achieving accurate and reliable results. The following pages are intended to help with the selection of equipment,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

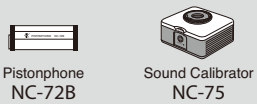
● Calibration of sound level meters and similar devices

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



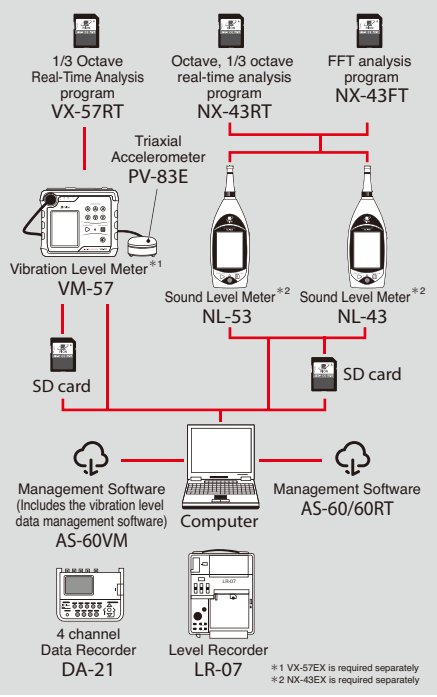
Calibration of vibration meters and similar devices

Measuring Instrument Combinations

3

Sound Level Meters and Vibration Level Meters in the Field

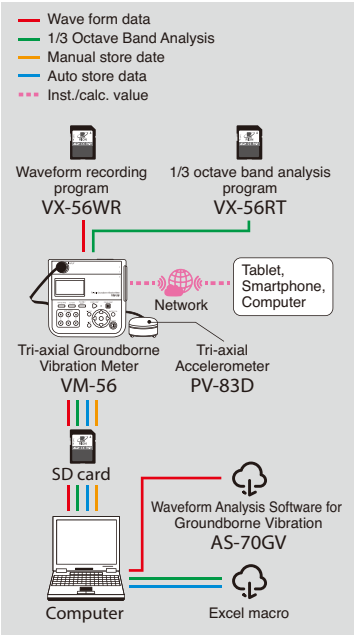
The basic model lineup for JIS and IEC standard compliant sound level meters is the NL series.
For on-site measurements of vibration levels, the Japan Measurement Law and JIS compliant Vibration Level Meters VM-57 are suitable.
The NL-43 series (SD cards) and the VM-57 series (SD cards) use memory cards 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-43 series supports use of the Octave Band and 1/3 Octave Band Real Time Analysis Program NX-43RT and the FFT Analysis Program NX-43FT.
The Data Management Software AS-60 allows playback of real sound files. Analysis data saved with the NX-43RT can be displayed, edited, and processed using the Data Management Software (With Octave and 1/3 Octave Data Management Software) AS-60RT.
The VM-57 allows use of the 1/3 Octave Real-Time Analysis program VX-57RT 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.



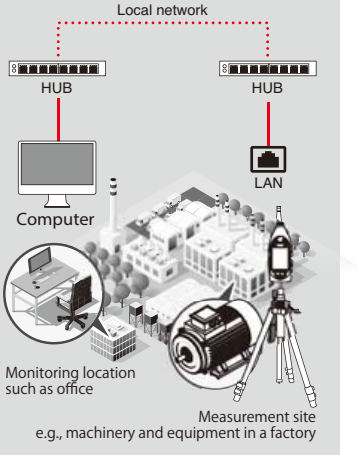
5

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-43 series with the Level Recorder LR-07 and an all-weather windscreen can be used (Figure 1).
We recommend the NL-43 series of sound level meters (controlled from a web browser) for factory noise monitoring. Simply connect the sound level meter to a network to remotely monitor the measurement status of the sound level meter from a web browser. Web browser functions include viewing of the measurement data, remote operation of the sound level meter (measurement settings, start and stop of measurement, time synchronization, etc.), real-time audio playback, file download, and a marker function. This range of functions makes it possible to perform noise monitoring of equipment and machinery at factories. (Figure 2)

Figure 1

Figure 2

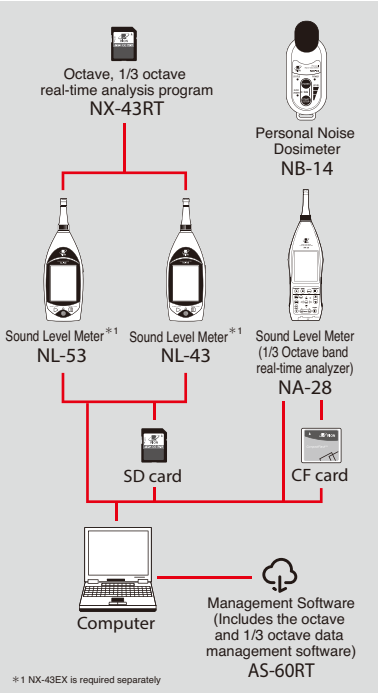


*A NX-43WR is required to listen to the sound during noise measurement on your browser.

6

Noise Measurement at Working Places

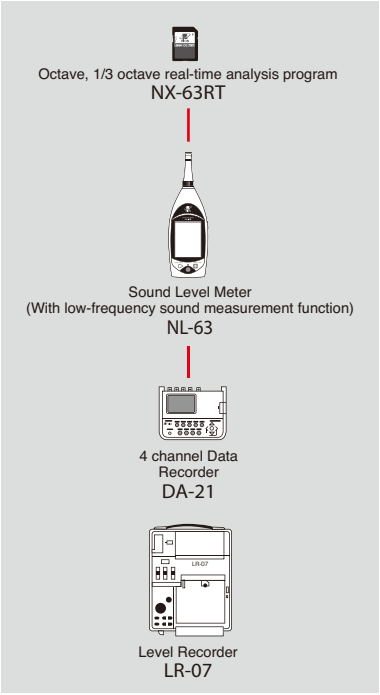
The measurement of sound exposure levels is an important prerequisite for protecting personnel working in an environment with high sound level from hearing damage. Regulations to control generation of noise at work places have come into force in many countries.
For instance, The Noise Prevention Guideline 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-43 series is suitable for such measurements.
When the NL-43 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-43RT 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-43RT 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

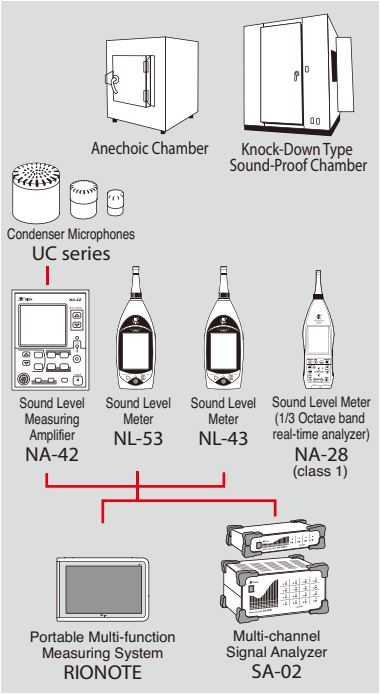
So-called infrasound in the range below the human hearing threshold, from 1 Hz to about 20 Hz, can have a physiological impact on humans if sound pressure levels are very high. It can also cause other unwanted effects such as window rattling and develop into an environmental problem.
To measure sound in this range, the Sound Level Meter NL-63 + NX-63RT 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-43 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.

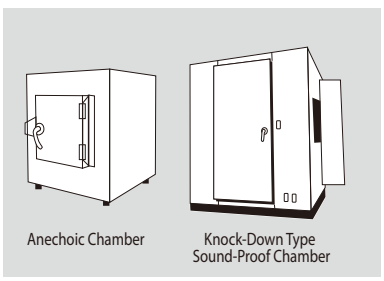
- Low-noise environment
  Using a sound-proof chamber or box, when the sound level emitted by equipment is low, ambient noise can influence a measurement. To prevent this, place the measurement target in a sound-proof chamber or box. In some cases, using an anechoic chamber or box where the influence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



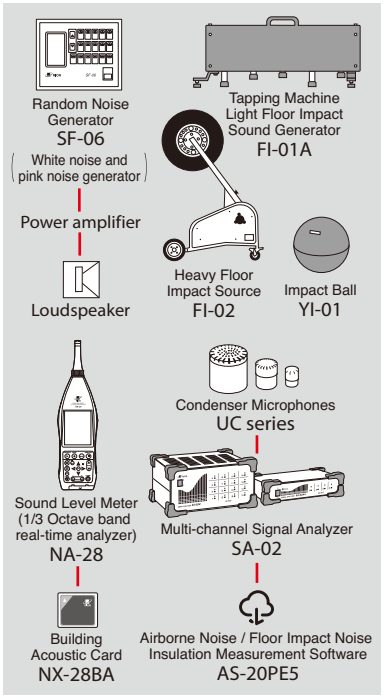
10

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

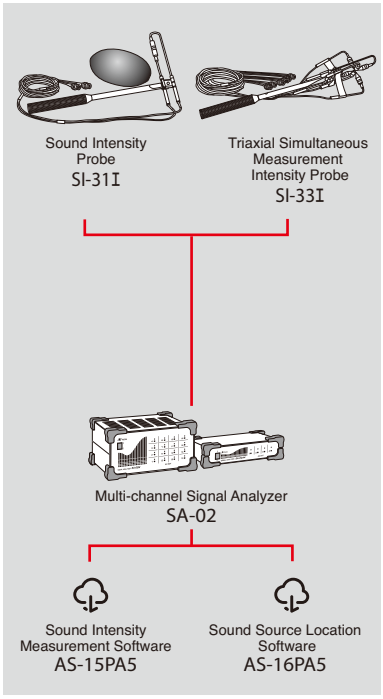
To create the white / pink noise required for these measurements, the Random Noise Generator SF-06 is used. Suitable impact sound sources are the Tapping Machine FI-01A, the Bang Machine FI-02, and the Impact Ball YI-01.
For evaluation complying with the standard stipulations, frequency analysis must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

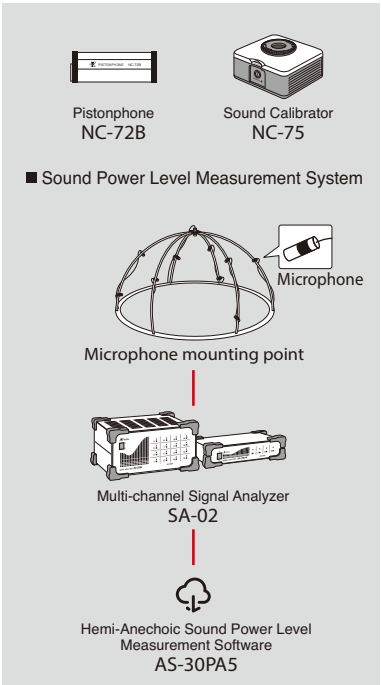
Even if emitting noise of the same energy level, the actual ambient noise level in the vicinity of mechanical or electrical machinery, office equipment etc. will differ, depending on various conditions. When predicting expected noise levels associated with installation or removal of a given piece of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

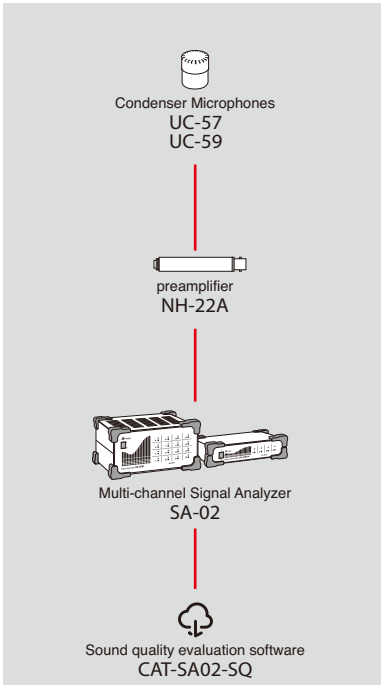


13

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.



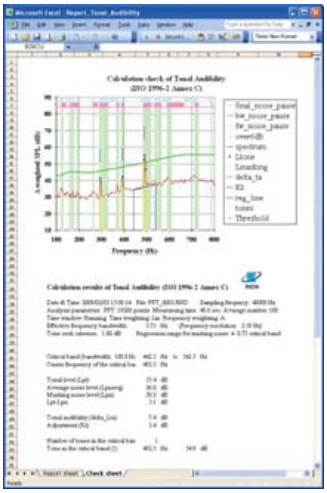
14

Pure tone evaluation

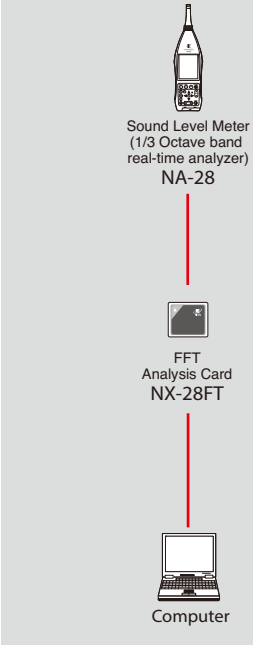
The Tonal Audibility Calculation Program (Excel macro) can be used for pure tone evaluation.
ISO 1996-2:2007- Annex C

- 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



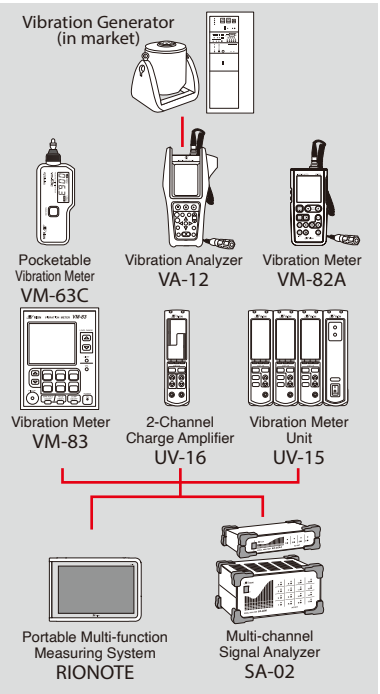
Measuring Instrument Combinations

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.

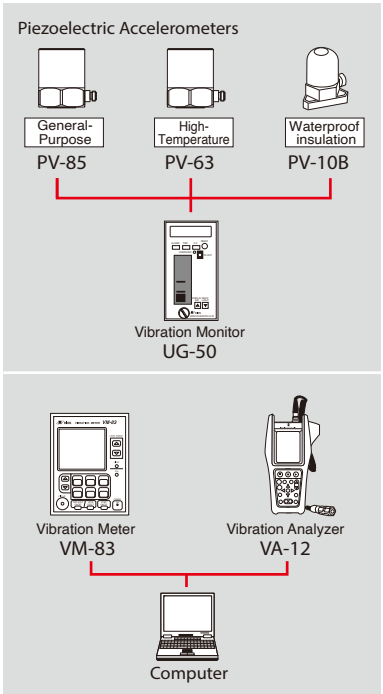
※ SA-02 only
＊ RIONOTE is optional



16

Vibration Monitoring

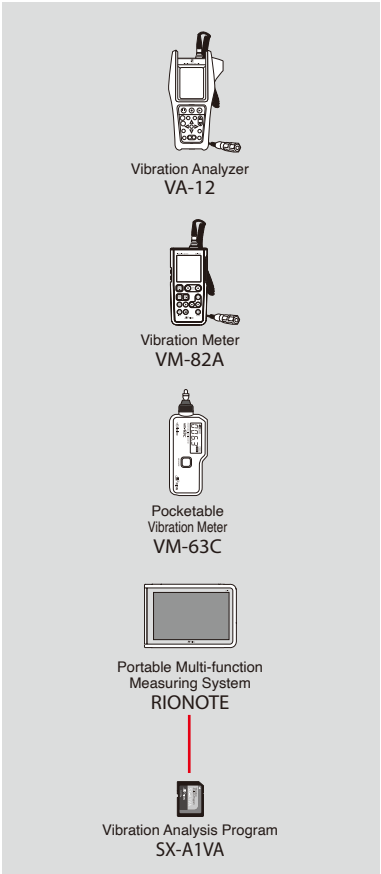
Vibration monitoring is an important tool for detecting symptoms of impending problems in machinery and for implementing preventive maintenance.
In the semiconductor industry and other sectors that require high accuracy manufacturing, vibration monitoring helps to improve yield and facilitates quality 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.



17

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.



18

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

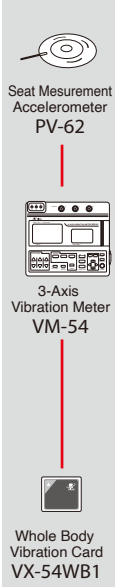


Figure 2

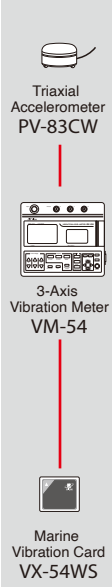
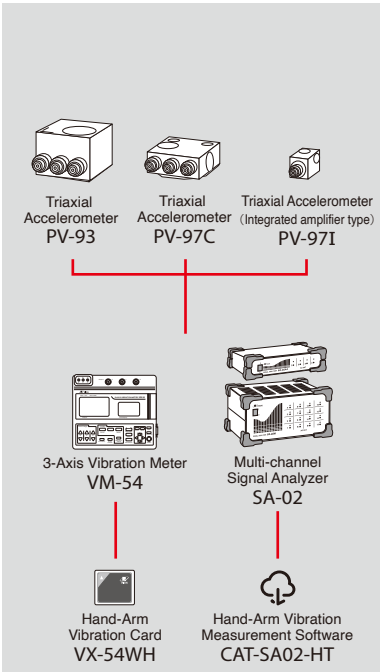


Figure 3

19

Hand-arm Vibration Measurement

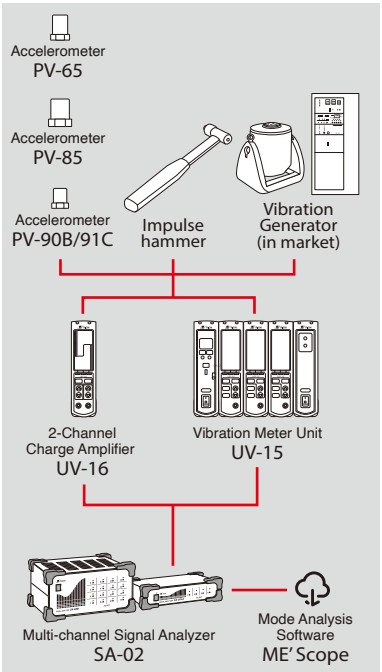
In the work environment, hand-arm vibration leading to an ailment called Raynaud's disease can pose a serious problem. This kind of vibration-related ailment, where blood circulation in the hand and fingers decreases causing them to appear white, is often due to the use of chain saws, rock drilling machines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



20

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.

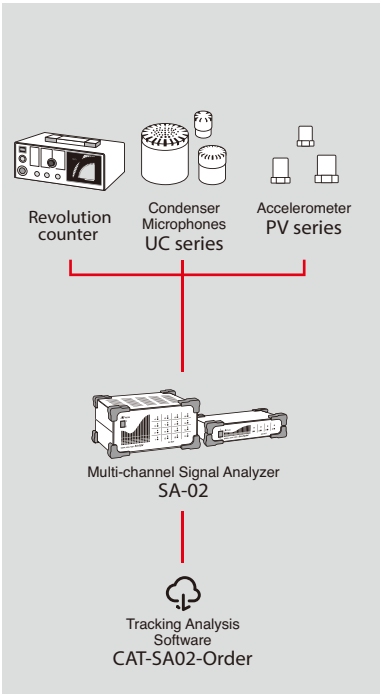


21

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.

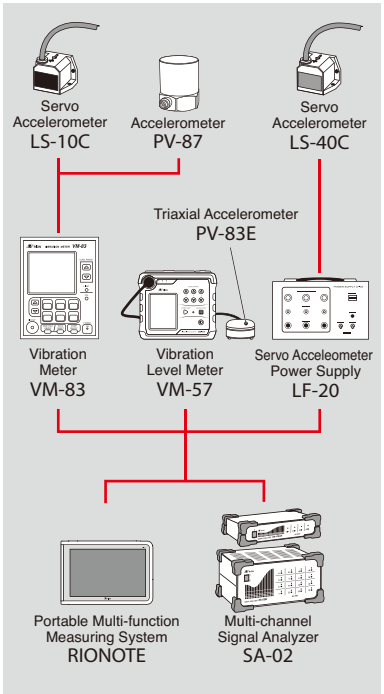


22

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-57 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.

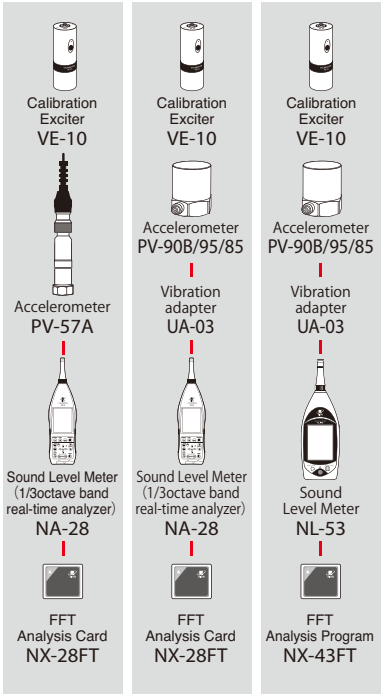
* RIONOTE is optional (FFT analysis program or 1/3 Octave analysis program can be chosen.)



23

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.

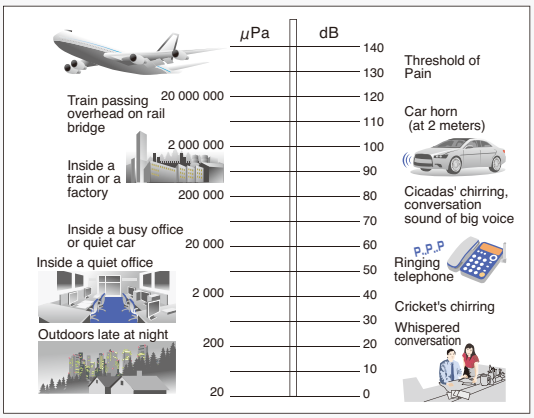


Fig. 1 Sound pressure and sound pressure level

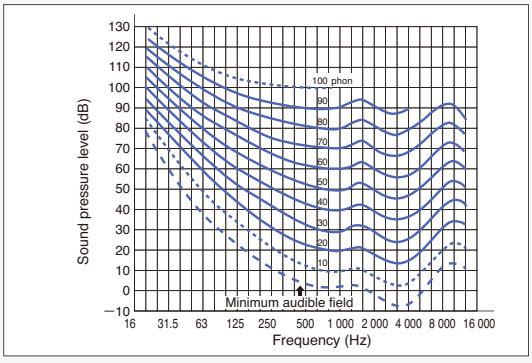


Fig. 2 Equal loudness curves of sound

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}?

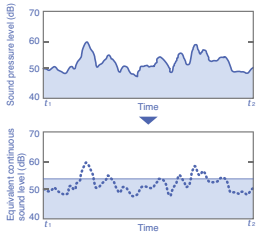
Equivalent continuous sound level L_{eq} is used for environmental noise evaluation.

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.

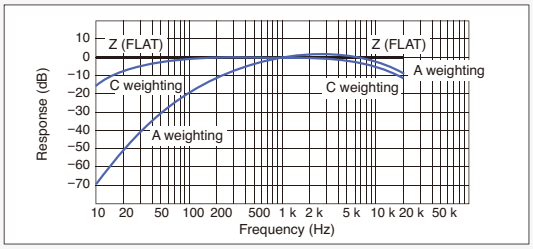


Fig. 3 Frequency weightings of sound level meters

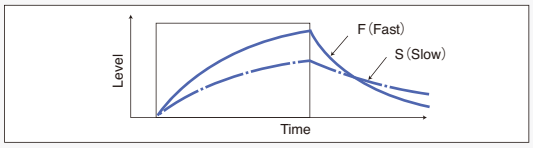


Fig. 4 Time weightings of sound level meters

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-63 with NX-63RT/43FT, NL-53/43 with NX-43RT/43FT)
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-63 with NX-63RT)
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

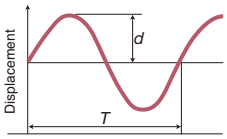
VIBRATION AND VIBRATION METERS

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

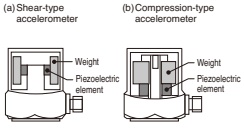
Vibration Meters for Mechanical Vibrations

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.

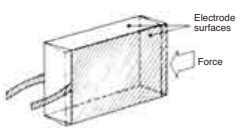
Fig. 1 Piezoelectric accelerometer types



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



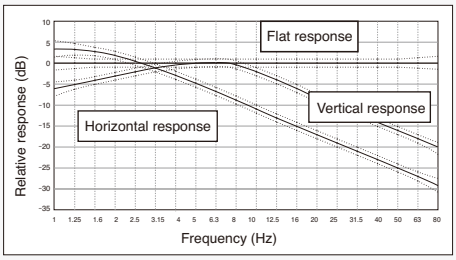
Compression-type accelerometer

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)

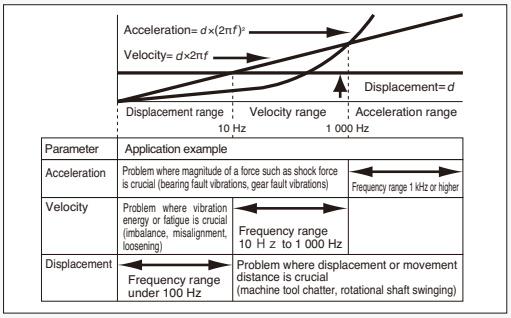
The evaluation of vibrations considered as environmental pollution uses the vibration level (dB), which is based on the pattern of human sensitivity to vibration. This is the same principle employed for the measurement and evaluation of sound pressure levels considered noise. Compensation according to 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-63RT (NL-63) NX-43RT (NL-43/NL-53) VX-57RT (VM-57)
● 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-43FT (NL-43/53/63) 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.

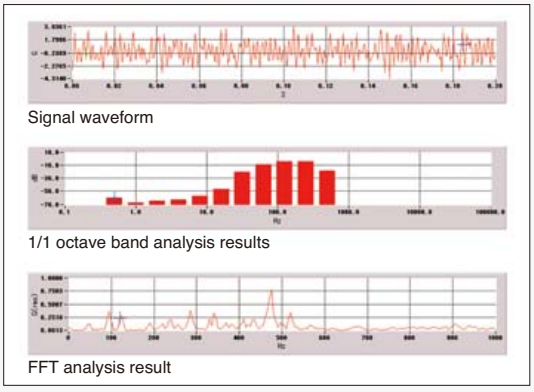


Fig.1 1/1 octave band analysis results, FFT analysis result

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.

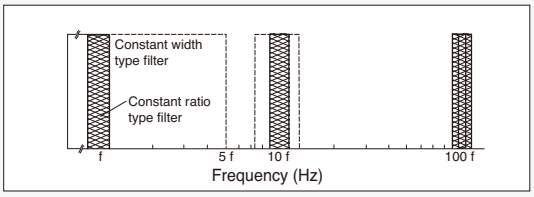


Fig. 2 Bandwidth representation for constant ratio and constant width filter on logarithmic scale

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.

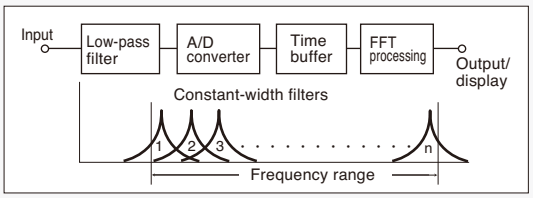
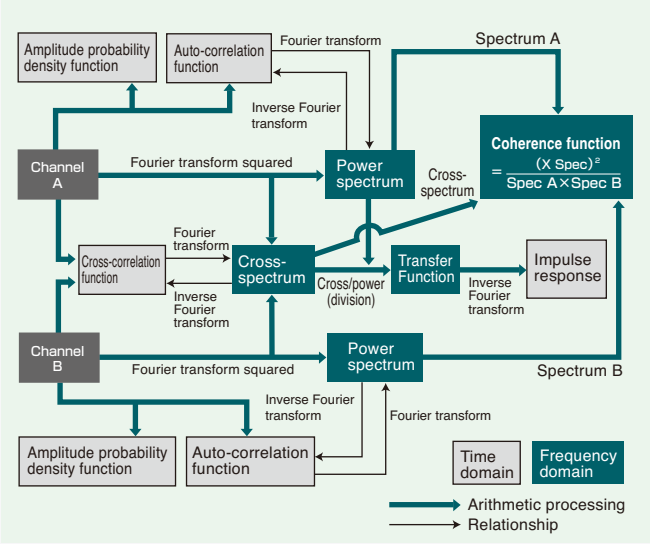


Fig. 3 FFT spectrum analyzer (spectrum analysis)

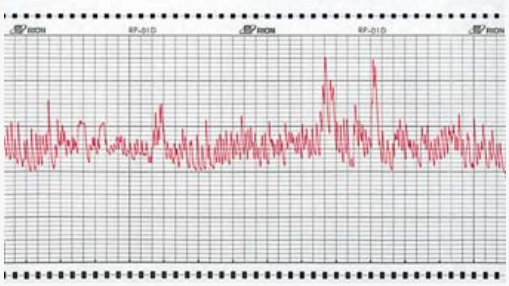
table 2 Relationship btween varioas FFT analyzer functions



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.

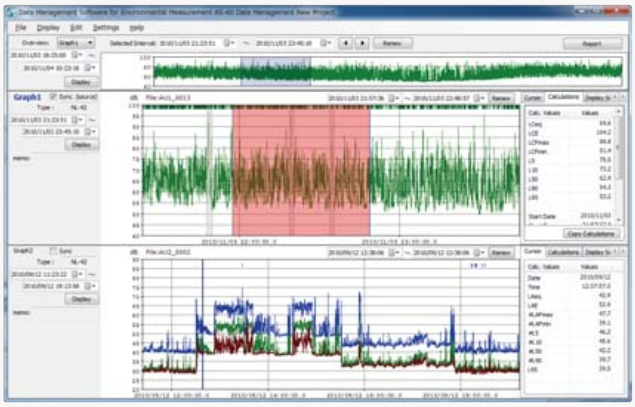


Sound level recording on Recording Paper RP-01D

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-43/53/63, VM-55).

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

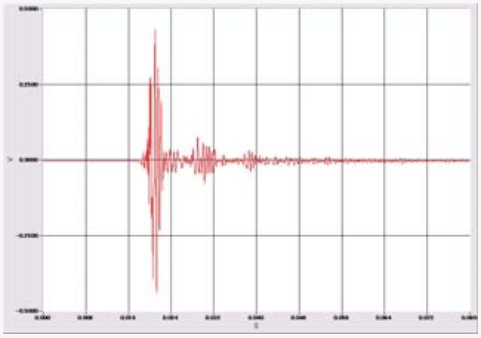
	Sound level meter	Vibration level meter (3-axis)
512 MB	2.4 days	2.5 days



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-43WR, 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.

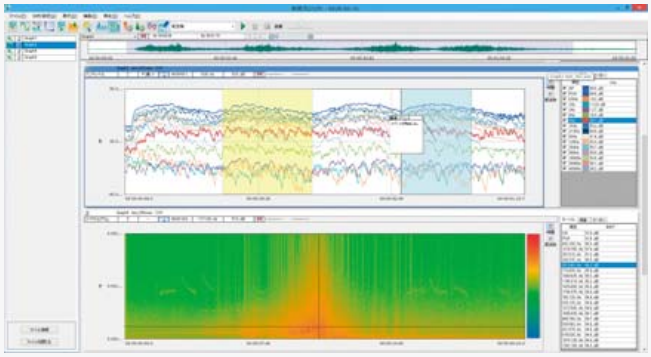
③Waveform data recorded on a memory card can be displayed and analyzed using dedicated application software (such as the Waveform Analysis Software AS-70). Recorded sound data (WAVE files) can be played back as real sound using Media Player or other suitable software.

■ 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.

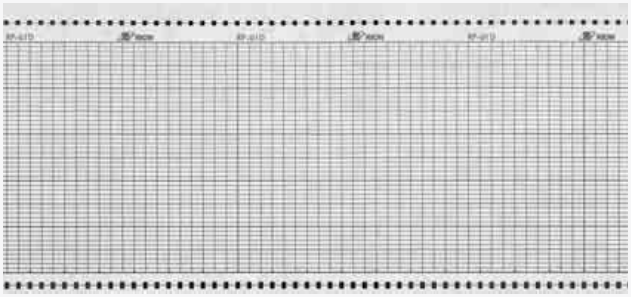
Waveform analysis screen example



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-63 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?

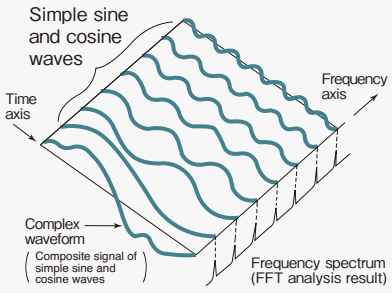
Sound and vibrations commonly have complex waveforms consisting of many different frequency components. The process of dividing such a complex waveform into discrete frequency components in order to examine the nature of the sound or vibration is called frequency analysis. Commonly used types of frequency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

Company Outline

RION CO., LTD.

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

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.

Founded: June 21, 1944
President & CEO: Kiyokatsu Iwahashi
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)

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

Company Outline

RION has recently conlcuded a share transfer agreement on the acquisition of the shares of Norsonic for the purpose of strengthening its business in the European and U.S. markets through the acquisition of new sales channels and the enhancement of product ranges with respect to sound measuring instruments.
We believe that integrating Norsonic's products, related technologies and sales networks and those of the Group is very effective for developing high value added products and increasing market share. By taking advantage of synergies, the Group will focus its efforts on developing products and services that the market has not seen before.

Norsonic

Norsonic, a company headquartered in Norway, has many users operating chiefly in the Norwegian and overseas architectural acoustic product markets, including the environmental measurement market that primarily consists of European or U.S. governmental organizations and universities.
It is one of the world's leading manufacturers, and matches the Company in the development and production of sound measuring instruments such as sound level meters. It enjoys leading market shares in European countries.

Looking at markets associated with sound measurement, environmental monitoring systems, which remotely monitor noises and vibrations generated in a range of places, such as construction sites, factories and roads, and provide customers with data thereof that are stored on the cloud, are becoming mainstay products, especially in Europe and the United States.
Norsonic's "NorCloud" environmental monitoring system is a powerful product that responds to these market needs, and it already has a broad range of users in Europe.

Sound Analyser Nor145, 150

NorCloud

Reference Sound Source Nor278

Power Amplifier Nor282

Other services offered by RION Group

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

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).

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.

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.

Aircraft noise measurement system

Custom-made cables

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

Kobayasi Institute of Physical Research

E-mail info@kobayasi-riken.or.jp
URL https://www.kobayasi-riken.or.jp/

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

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)

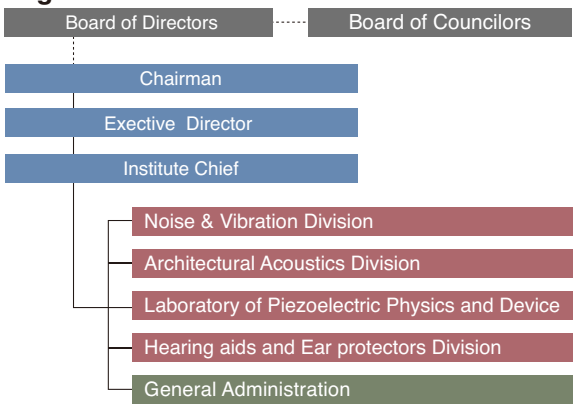
■ History

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.

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.

Organization



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.

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.

INDEX(Model)

INDEX(Name)

Sound and Vibration

https://rion-sv.com/

https://www.norsonic.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.

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