VM-56

Tri-axial Groundborne Vibration Meter

Ryo Hosoi

CONTENTS

SECTION 1
ABOUT VM-56

Overview

- The VM-56 is a **groundborne** vibration meter capable of simultaneously calculating the measurement quantities defined by **DIN 45669-1**, **ISO 8041** and other national measurement standards.

Vibration from..

Transportation such as road, highway, railway, subway, etc.

Construction such as piling work, construction vehicle, tunnel excavator/ shield, demolition work, etc.

Mining such as blasting.

Vibration causes

- Reduction of wellbeing and health
  - Annoyance (discomfort)
  - Disturbance (sleep trouble)
- Building damage
  - e.g. cracking
- Damage to an sensitive equipment
  - e.g. optical microscope or medical equipment

Environmental consultant

Construction company

Mining company

VM-56 USERES

Railway company

System integrator for construction site

Local government

5 KEYWORDS

Simultaneous PPV&VDV

Easy to use

High Quality

Wave recording& 1/3 octave

Attended, Unattended, Live-to-web

- Simultaneous measurement of multiple parameters including PPV and VDV
- Setting menu, store mode and interface are same with the NL-52. It is not necessary for SLM customers to learn the VM-56 operation again
- Very reliable, sufficient functions and long life based on our long experience in the environmental measurement field for more than 50 years.
- Flexible product configuration with waveform recording function and 1/3 octave band analysis function available as optional programs
- Suitable for use in a attending measurement, unattended measurement, unattended (live-to-web)

Specifications

Applicable standards	DIN 45669-1: 2010-09 (Frequency, Measurement range compliance), SB en beoordelen van trillingen, Deel A: Schade aan gebouwen 2010, Deel voor personen 2013, ISO 8041: 2005, ISO 8041-1: 2017, CE marking, WE
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 KBFmax
	Maximum cycle-averaged KBF value KBFT
In accordance with ISO	Corrected acceleration effective value Acc.
	Maximum transient vibration value MTVV
	...ose value VDV
	...F.
	...eighted vibration value veff, max
	...m veff over 30-second cycle veff, max, 30
	...lacement (0-p value) Disp.
	...bined PPV ...es PVS
	...me veff ...erati...

SECTION 2

Standards and regulations

Main applicable standards

DIN 45669-1 : 2010-09

Measurement of vibration emission
–Part1
:Vibration meters – Requirements and tests

**ISO 8041 : 2005,
ISO 8041-1 : 2017**

Human response to vibration–
Measuring instrumentation

Other standards

BS 6472-1
Guide to evaluation of human exposure to vibration in buildings part 1 : Vibration souces other than blasting

BS 6472-2
Guide to evaluation of human exposure to vibration in buildings part 2 : Blast-induced vibration

BS 7385-2
Evaluation and measurement for vibration in buildings part2. Guid to damage levels from groundborne vibration(4-250Hz)

DIN 4150-2
Structural vibration Part 2: Human exposure to vibration in buildings

DIN4150-3
Structural vibration Part 3: Effects of vibration on structures

RD-1367

Circulaire 23 Juillet 1986

UNI 9614
Vibration Measurement In Buildings And Annoyance Evaluation

UNI 9916
Criteria For The Measurement Of Vibrations And The Assessment Of Their Effects On Buildings

UNI 9942
Vibrations On Bridges And Viaducts - General Guidelines For The Execution Of Dynamic Tests And Investigations

UNI 10985

SBR-A/B
Vibration standard building damage/Human annoyance

Features and functions

Features and functions

High Quality

VM-56 is very reliable and high accuracy

→**User's measurement is fully secured**

→**This high quality allows use in long-term monitoring such as live-to-web system**

Easy to Use

Menu setting, Store operation and interface are similar to NL-52

→**No need to learn VM-56 operation**

→**Can avoid error in setting**

Attended

Unattended online

Network

Unattended offline

High quality allows use in various scene

Attended（Short-term measurement）

Unattended（Long-term measurement/ Offline）

Live-to-web（Long-term measurement/ Online）

NL-52

VM-56

Similar menu setting as NL-52

No need to learn VM-56 operation

The same store mode as NL-52

Date store	Internal memory/SD card -max, 1000 tri-axial data sets -dependent on card capacity Calculation store:
Evaluation values	PPV, D.F., KBFT, Acc., MTVV, VDV, C.F., DISP., PVS., OVER / UNDER

Manual store

Date store	Data stored on SD card Instantaneous store: (Acc.rms data stored every 100 ms) Calculation store: (Calculation cycle:1s to 24 h) Level trigger store:
Evaluation values	PPV, D.F., KBFT, Acc., MTVV, VDV, C.F., DISP., PVS., OVER / UNDER

Auto store

Date store	Data stored on SD card Evaluation values are continuously recorded for each store cycle at the set measurement start / stop time. Instantaneous store: (Acc.rms data stored every 100 ms) Calculation store: (Calculation cycle: 1 s to 24 h) Level trigger store:
Evaluation values	PPV, D.F., KBFT, Acc., MTVV, VDV, C.F., DISP., PVS., OVER / UNDER

Timer Auto store

3 modes (Manual, Auto, Timer Auto), Data format: CSV

Features and functions

Simultaneous measurement PPV&VDV

No need to buy 2 instruments/ No need to measure two times

→**Save time & cost reduction**

→**Could be a global standard equipment**

Tri-axis Compact & Light

Main unit is just 780g (sensor 450g)

→**Very suitable for attended measurement**

Tri-axial accelerometer and its mounting option are also RION-made

→**High quality & Reliable**

Simultaneous measurement of
PPV and VDV

Table 1
Simultaneous measurement capability of VM-56

	Building Damage	Human Exposure
Simultaneously	SBR	SBR
Simultaneously	DIN	DIN
Simultaneously	DIN	ISO

Evaluation value of DIN	Evaluation value of ISO
Peak particle velocity |v|max (**PPV**) Dominant frequency fmg (**D.F.**) Weighted vibration maximum value **KBFTmax** Maximum cycle-averaged KBF value **KBFT**	Corrected acceleration effective value **Acc.** Maximum transient vibration value **MTVV** Vibration dose value **VDV** Crest factor **C.F.**

Table 2

Comparison to simultaneous measurement capability of products by other manufacturers

	Building Damage	Human Exposure	Competitors
Simultaneous measurement supported	SBR	SBR	A French company A Hollandisch company A Swedish company
	DIN	DIN	
	DIN	ISO	A French company A Polish company
Simultaneous measurement not supported			A German company, Danish company, Swiss company and Canadian company

Tri-axial a accelerometer
PV-83D

Our home-made sensor PV-83D with level display provides a waterproof IP7.

Rated sensitivity: 60 mV/(m/s2)

Tri-axial Frequency range: 0.5 Hz to 315 Hz

Accelerometer Usage temperature range: -20 ºC to +60 ºC (no condensation)

PV-83D Waterproofing: IPX7by using integrated cable.

Dimensions and weight: Approx 67 mm (dia.) x 50.5 mm (D), approx. 450 g, cable 1.5m

On the ground

■Using RION DIN-plate VP-54D, the PV-83D can be installed on the a soft ground such as sand, muddy ground.

Covered frequency range:1-100Hz

On the wall

■Using RION L-bracket VP-54L, the
 PV-83D can be installed on the wall

Covered frequency range: 1-40 Hz

Features and functions

CSV file

CSV data can be opened with excel, so no need to use any special software

→**Cost reduction**

Rion provide free excel macro for reporting

→**Easy to use & cost reduction**

Data is stored on SD card

→**Save time**

Comparator

Has real time comparator function conforms to DIN 4150: Part 3 and User can also define own criteria level.

→**Very flexible, so can be used in local** regulations

Real time comparator output

→**Can prevent a building damage ***

Excel macro provided free of charge helps you to make the report
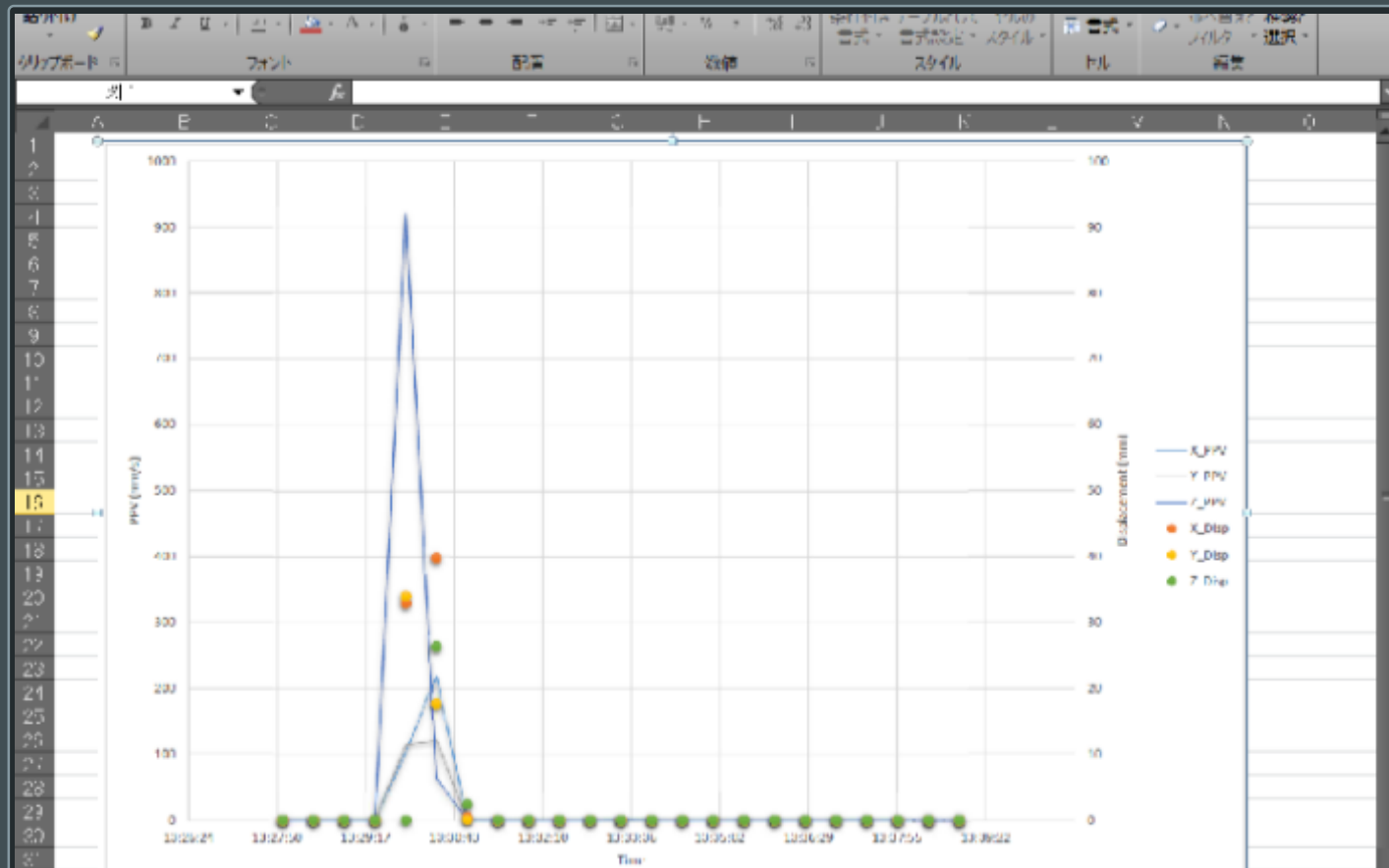
■ Data types: VM-56 auto store data, VX-56RT auto store data *Manual store data are not supported

■Measurement target: PPV, displacement, acceleration (rms), VDV, MTVV, KBF max, veff max. etc.

Comparator function

When the signal exceeds the limit value, an output signal is activated.
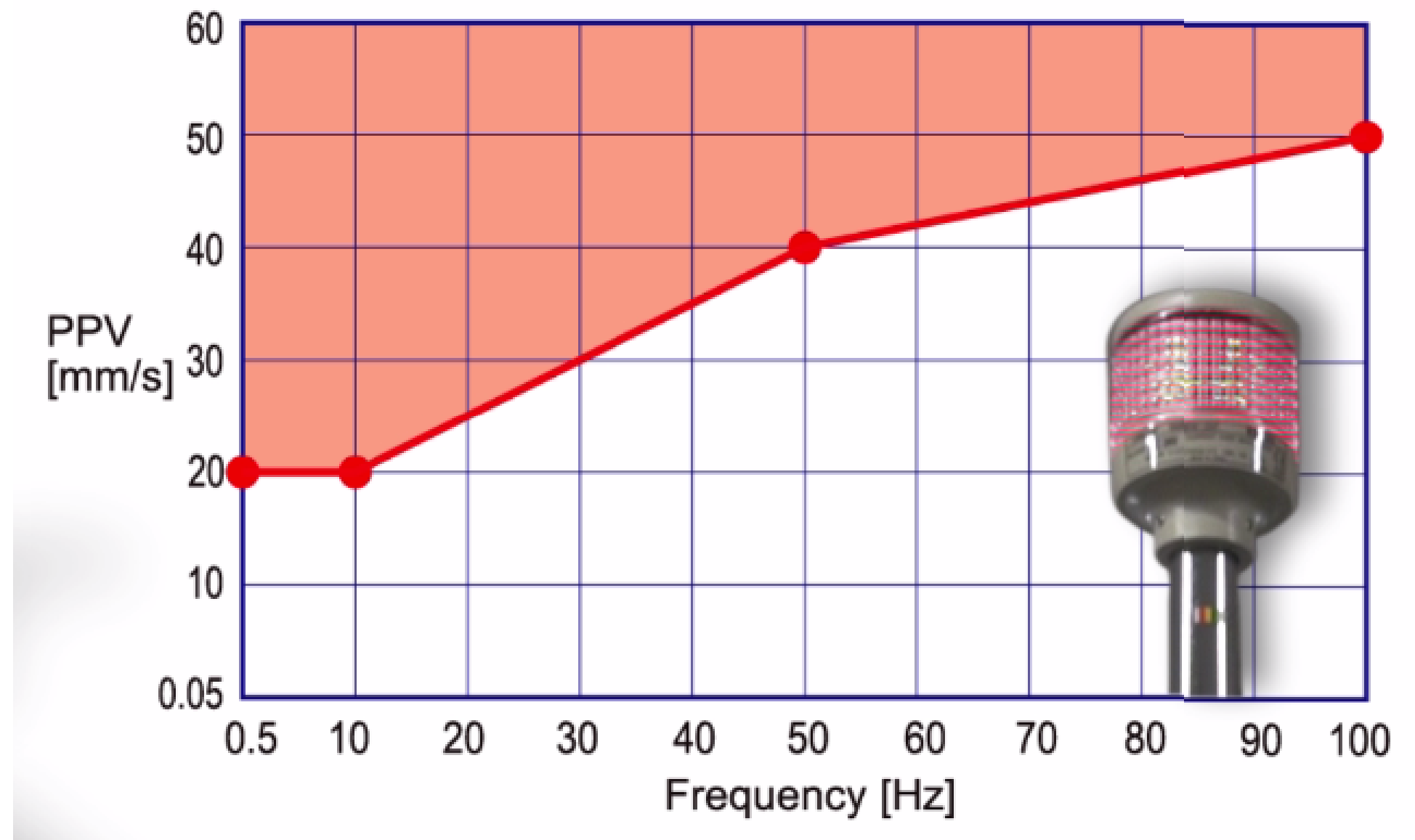
Open-collector output (using I/O port)

Max. applied voltage: 24 V

Max. drive current: 50 mA (with 24 V applied voltage)

Monitored Parameter: PPV (broad-band or user-definable PPV vs frequency

Features and functions

Waveform Recording Program VX-56WR

VX-56WR record the raw wave file which is not affected by setting Stored file can be reanalyzed on AS-70GV

→**User can get right result even if the setting was incorrect, it means the measurement is very Secure**

Frequency analysis is possible

→**Suitable for designing foundation of structure**

Vibration is hearable

→**Could be new approach for vibration countermeasure**

1/3 Octave Band Analysis Program   VX-56RT

1/3 Octave analysis is suitable for countermeasure for vibration emitted by Ground borne. In some countries ISO2631-2 is used for vibration control. User weighting function of VX-56RT meets that standard.

→**Provides very Professional & Global solution**

Waveform Recording Program
VX-56WR

VX-56WR allows recording Waveforms on SD card.

The recording process is carried out simultaneously with the standard

VM-56 functions.

*Wave data can be analyzed with AS-70GV which is released

soon.

Max. recording time (at 16 bit)			
Memory card Sampling frequency	512 MB	2 GB	32 GB
2 kHz	Approx. 6 hours	Approx. 27 hours	Approx. 470 hours

Wave data from VX-56WR can be analyzed on AS-70GV

Waveform Analysis Software 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.

1/3 Octave Band Analysis Program
VX-56RT
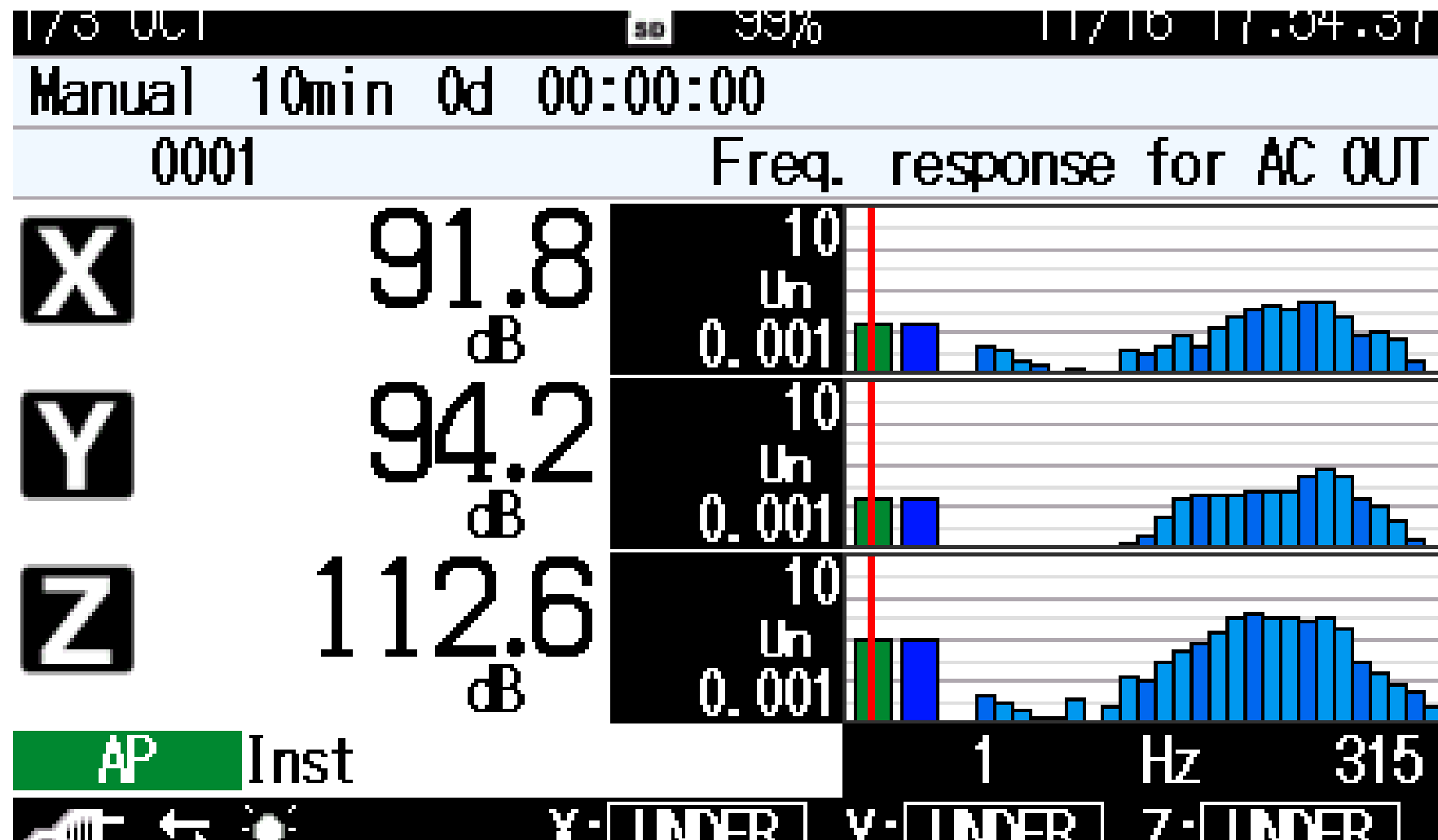
VX-56RT enables measurement and logging of 1/3 octave acceleration levels simultaneously with broadband parameters (e.g. PPV, D.F. VDV, MMTV).

Can be used concurrently with VX-56WR.

Stored data can also be displayed on Excel macro.

Features and functions

Live-to-Web

VM-56 has RS-232C communication and simple command for communication

**→User can flexibly develop the system with any type of main station.**

VM-56 take the way not to have 3G or 4G module in the unit, because communication technology is advancing quicker than measuring instruments.

→Rion hope user continues to use the product for more 10 years. This will require to adopt new communication technologies.

Live-to-web system

Unattended measurement

Wherever you are,
you get the real
time vibration
value.
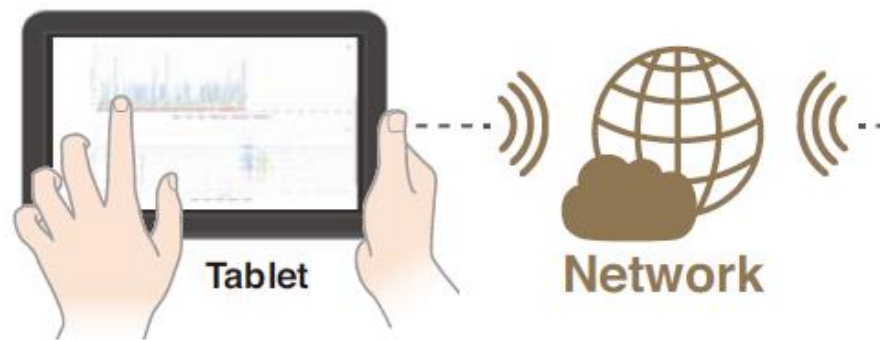
Configuration Example for Remote Continuous Monitoring

Using RS232/USB communication port the measurement results and data from the VM-56 can be accessed by computers,
tablets or smartphones via a network connection for continuous remote monitoring. (please contact us for further details).

Specifications

■   Directive for safety export:

CE marking, WEEE directive

■ Measurement range

Velocity: 0.03 to 100 mm/s

Acceleration: 0.0003 to 10 m/s2

Displacement (0-p): 0.01 to 10 mm (0.5 to 4 Hz)

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)

■Frequency Range

0.5 Hz to 315 Hz

Specifications

■Communication interface

-USB

SD card recognized as removable disk

Supports command based communication
(virtual COM port)

-RS-232C

communications Using dedicated cable
(I/O terminal)

-Comparator output

Open-collector output (using I/O port)

Specifications

■Power supply

-IEC R6 [size AA] battery x 8
or external power supply
AA battery is easy to export and chargeable on site!

-Battery life 24 hours or more, constant operation ＊Battery life will differ depending on settings

-AC adapter
NC-98 series

Specifications

■Available options

Waveform rec program VX-56WR

1/3 oct band analysis program VX-56RT

Waveform Analysis Software   AS-70GV

SD card (512MB, 2 GB and 32 GB)

AC adapter NC-98 Dseries

Extension Cable EC-04 series

BNC to RCA Cable CC-24

Comparator Cable CC-42C

RS-232 Serial I/O Cable CC-42R

L-bracket VP-54L

DIN plate VP-54D

THANK YOU!

ANY QUESTIONS?