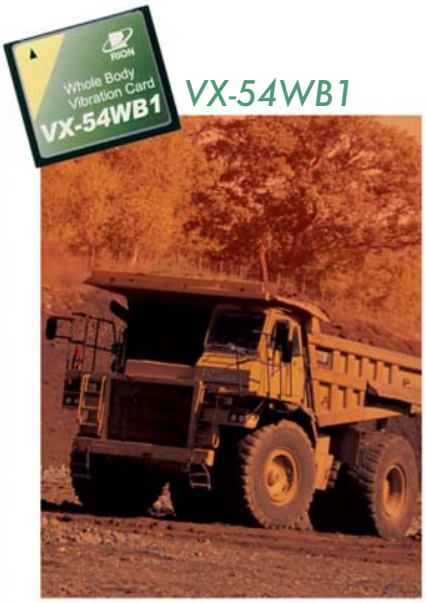
CE

RION

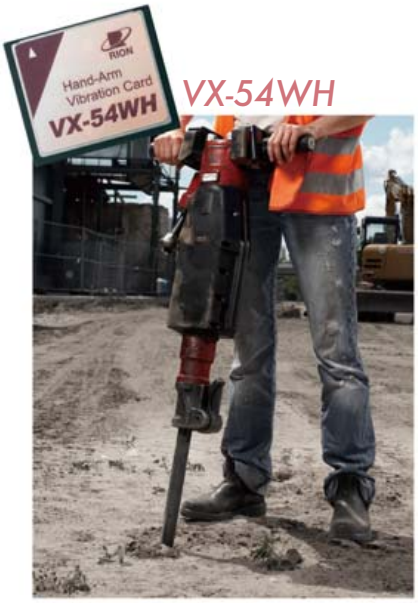
VX-54WS

Habitability on Ships



VX-54WB1

Whole-Body Vibration



VX-54WH

Hand-Arm Vibration

System for human related vibration measurements
All-round instrument

3-Axis Vibration Meter

VM-54

Optional program card line-up

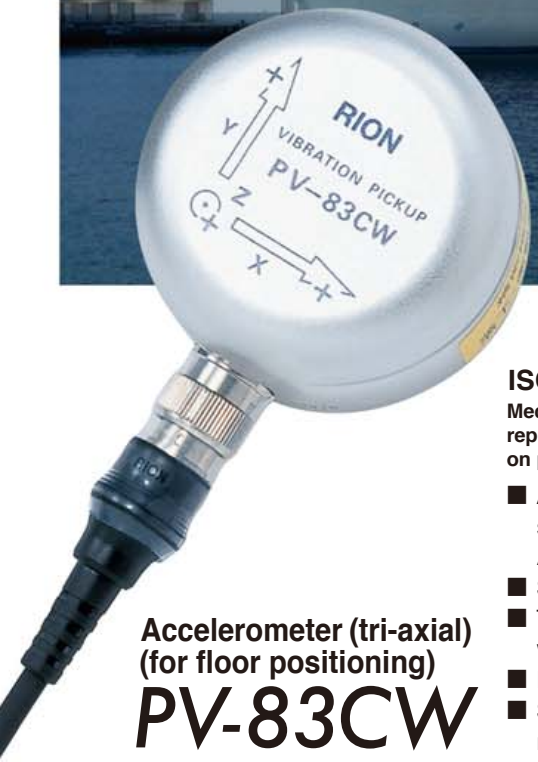
VX-54WS/VX-54WB1/VX-54WH/VX-54FT

3-Axis Vibration Meter VM-54
+
Marine Vibration Card
VX-54WS

Vibration measurement system for evaluating comfort in passenger and merchant ships

ISO 6954:2000 provides the framework for measuring and recording vibrations that occur in the crew and passenger accommodation sections of ships, to evaluate suitability and comfort.
The present measurement system for marine vibrations consists of the Accelerometer (tri-axial) PV-83CW (for floor positioning), the 3-Axis Vibration Meter VM-54, and the Marine Vibration Card VX-54WS.
The system allows measurement and evaluation compliant to the relevant standards.

3-Axis Vibration Meter
VM-54



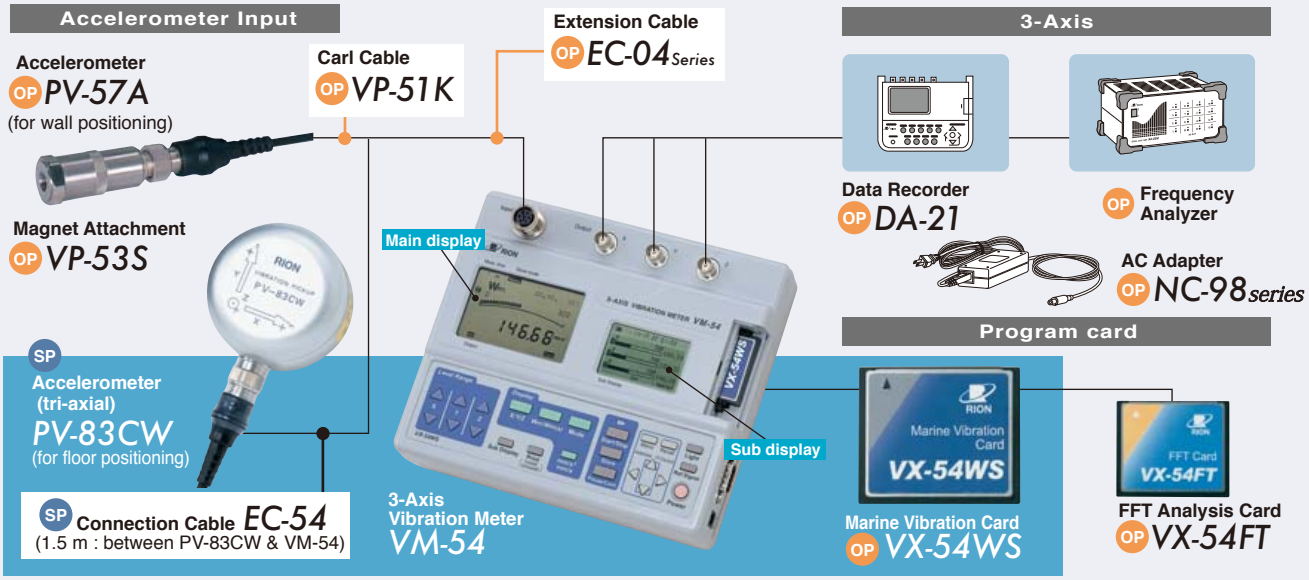
Accelerometer (tri-axial)
(for floor positioning)
PV-83CW

ISO 6954:2000
Mechanical vibrations - Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships

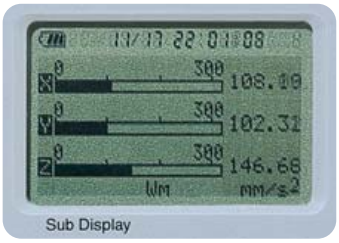
- Accelerometer PV-83CW (tri-axial) (for floor positioning) is supplied as standard accessory of VX-54WS.
  Accelerometer PV-57A (for wall positioning) available as optional accessory.
- Storing of measurement data on CompactFlash™ memory card.
- Tri-axial analogue AC outputs for connection to frequency analyzer, data recorder, or other waveform recording device.
- Excel macro for creating reports is supplied accessory.
- Soft protection case with shoulder strap is supplied accessory for VX-54WS. This facilitates measurement in the marine environment and protects the unit from water and oil.

System Configuration

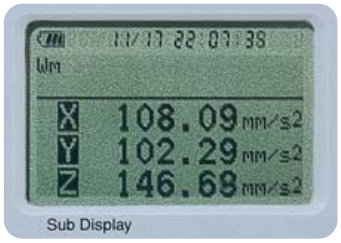
SP =Supplied for VX-54WS OP =Option for VM-54



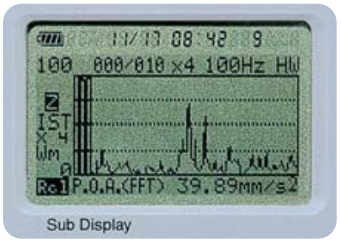
Display screen examples Sub display



Graphic screen



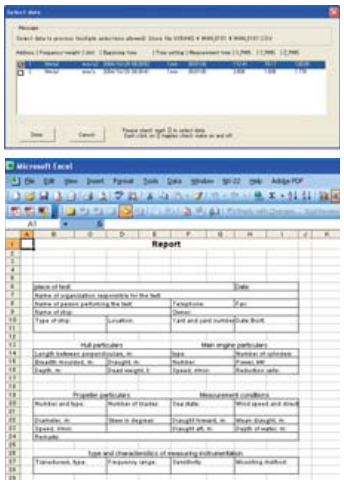
Numeric screen



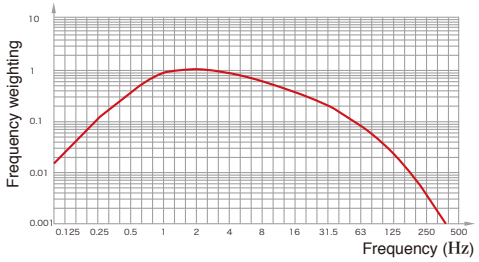
FFT screen (using VX-54FT)

■ Unit inserted in soft protection case

■ Excel macro



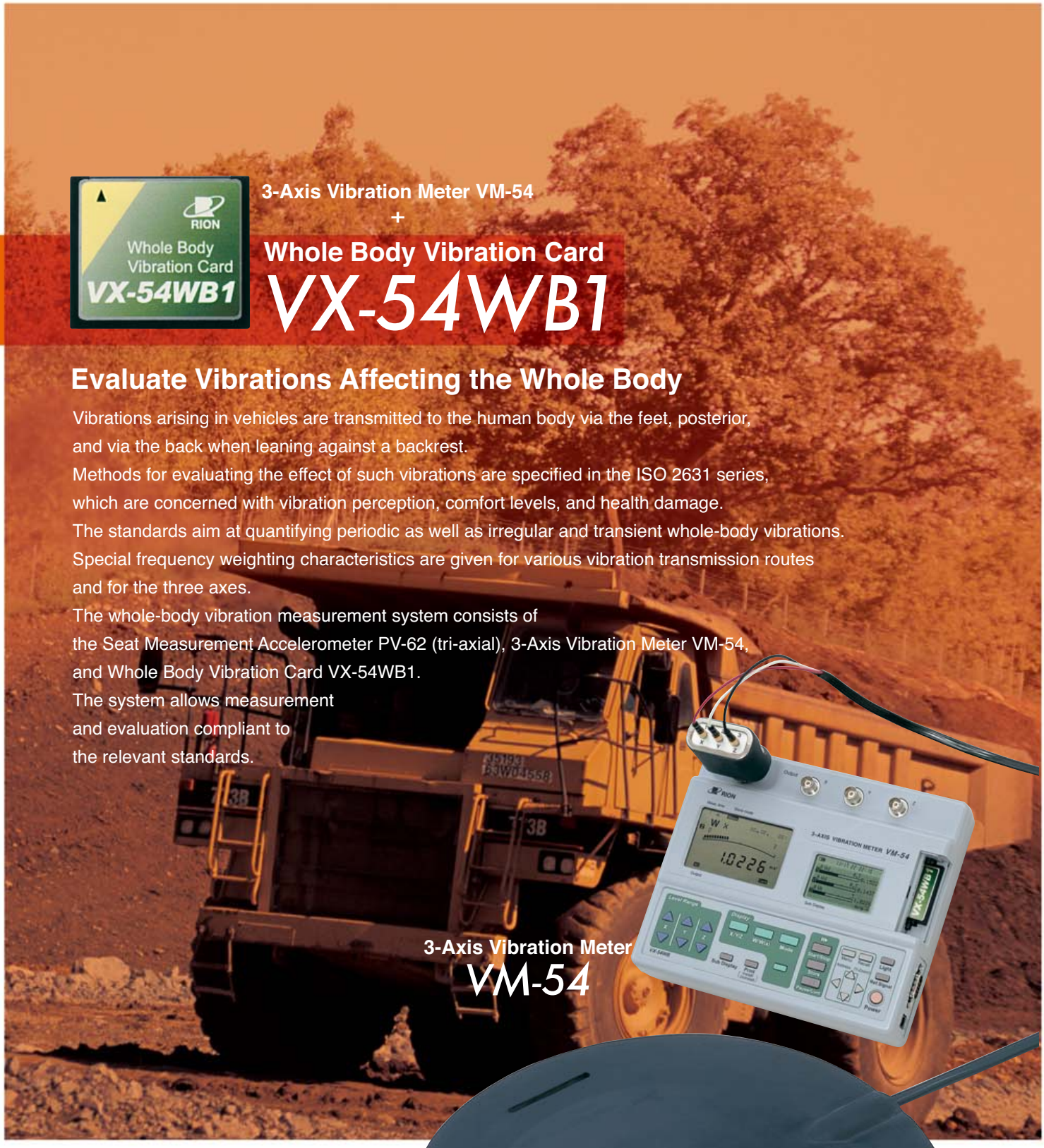
■ Frequency weighting curve Wm



Specifications

Applicable standards : ISO 6954: 2000
Input : Accelerometer (tri-axial) PV-83CW, or Accelerometer PV-57A (option)
Measurement frequency range : 1 to 80 Hz(Up to 1 kHz with flat characteristics, when using PV-57A)
Frequency weighting : Wm (ISO 2631-2: 2003), bandwidth limiting
Measurement modes : Acceleration, velocity
Measurement range :
【With PV-83CW】 Acceleration (mm/s²): 30, 100, 300, 1000, 3 000, 10 000
Velocity (mm/s):1, 3, 10, 30, 100, 300
【With PV-57A】 Acceleration (m/s²): 0.3, 1, 3, 10, 30, 100, 300, 1000
Velocity (mm/s): 10, 30, 100, 300, 1000, 3 000
Processing functions : RMS, max (MTVV), min
Measurement time settings : 10 sec, 1 min, 2 min, 10 min

Display : LCD x 2 (main and sub)
Data store function : Manual store (up to 400 000 data can be stored on VX-54WS [128 MB CFCard])
Recording media : CompactFlash memory card
Interface : For dedicated printer only (allows measurement data printout on dedicated printer)
Output connectors : Connectors for 3 axis signals (AC)
Ambient conditions : -10 to +50 °C, max. 90 % RH
Power supply : Four IEC R14 (size "C") batteries, 16 hours continuous operation with alkaline batteries
Dimensions and weight : Approx. 56 (H) x 200 (W) x 175 (D) mm; approx. 1 kg (including batteries)
Supplied accessories : Accelerometer (tri-axial) PV-83CW
Connection Cable EC-54 (1.5 m)
Soft protection case



3-Axis Vibration Meter VM-54
+
Whole Body Vibration Card
VX-54WB1

Evaluate Vibrations Affecting the Whole Body

Vibrations arising in vehicles are transmitted to the human body via the feet, posterior, and via the back when leaning against a backrest.
Methods for evaluating the effect of such vibrations are specified in the ISO 2631 series, which are concerned with vibration perception, comfort levels, and health damage.
The standards aim at quantifying periodic as well as irregular and transient whole-body vibrations.
Special frequency weighting characteristics are given for various vibration transmission routes and for the three axes.
The whole-body vibration measurement system consists of the Seat Measurement Accelerometer PV-62 (tri-axial), 3-Axis Vibration Meter VM-54, and Whole Body Vibration Card VX-54WB1.
The system allows measurement and evaluation compliant to the relevant standards.

3-Axis Vibration Meter
VM-54

ISO 2631-1 : 1997
Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1 : General requirements

ISO 2631-2 : 2003
Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2 : Vibration in buildings (1 Hz to 80 Hz)

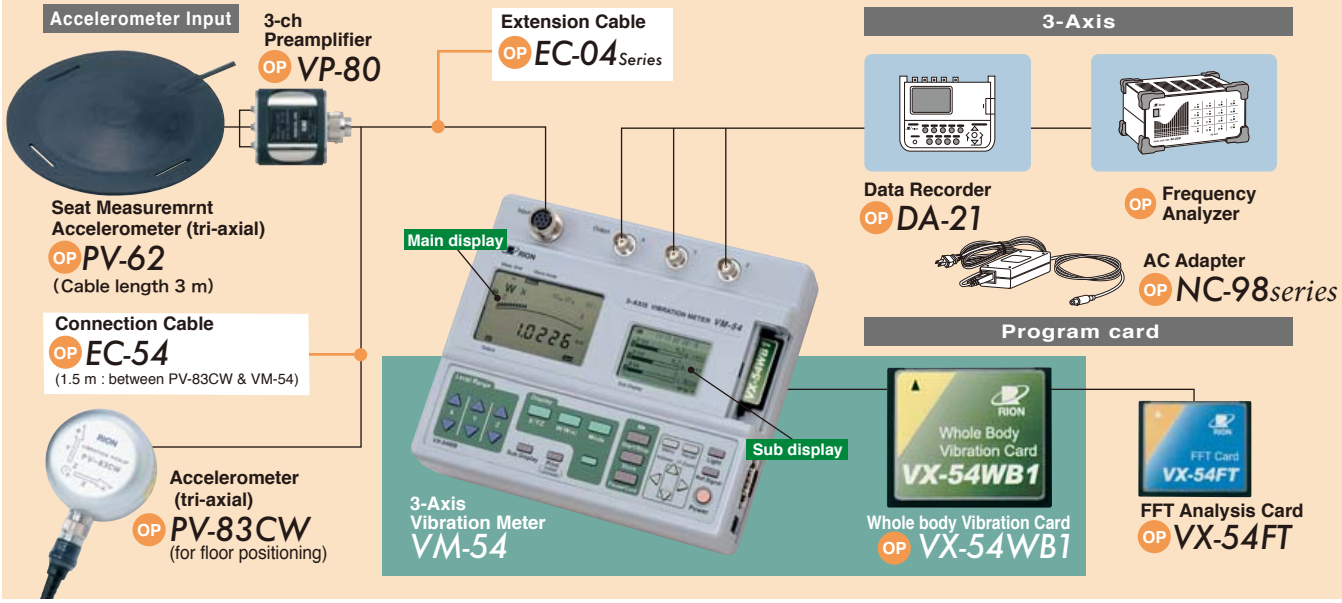
ISO 8041 : 2005
Human response to vibration — Measuring instrumentation

- Measurement result data can be stored on CF card.
- 3-axis output signal for connection to frequency analyzer, data recorder, or other waveform recording device.

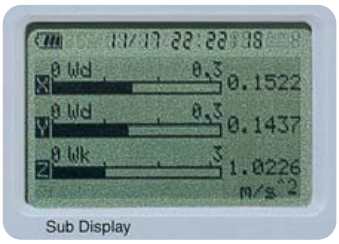
Seat Measurement Accelerometer (tri-axial)
PV-62 Option

System Configuration

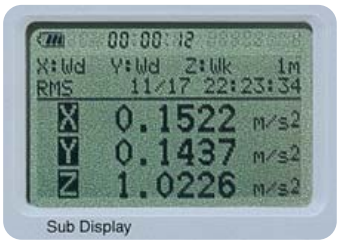
OP =Option for VM-54



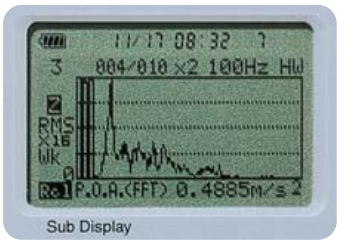
Display screen examples Sub display



Graphic screen



Numeric screen



FFT screen (using VX-54FT)

■ Running R.M.S acceleration value

$$a_w(t_0) = \left[\frac{1}{\tau} \int_{t_0-\tau}^{t_0} a_w^2(t)\,dt \right]^{\frac{1}{2}}$$

Where
$a_w(t)$: Instantaneous value of vibration acceleration to which frequency weighting was applied
t : Moving average integral time (s)
τ : Time (integral variable)
t_0 : Observation time point (instantaneous time)

■ Maximum Transient Vibration Value (*MTVV*)

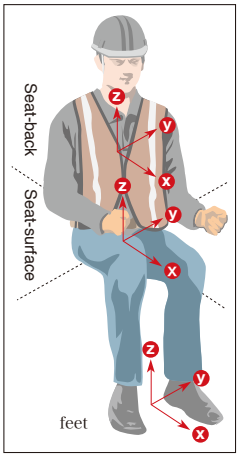
$$MTVV = \max[a_w(t_0)]$$

■ Vibration Dose Value (*VDV*)

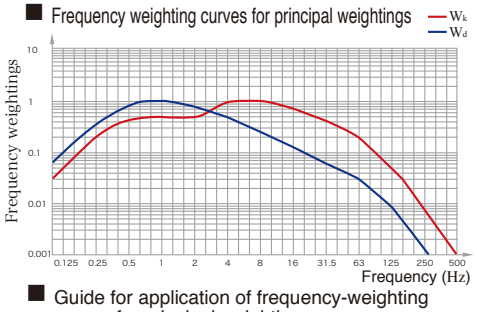
$$VDV = \left[\int_0^T a_w^4(t)\,dt \right]^{\frac{1}{4}}$$

Where
$a_w(t)$: Instantaneous value of translational or rotary vibration acceleration to which frequency weighting was applied
T : Continuous measurement time (s)

■ Basicentric axes of the human body (Seated position)



■ Frequency weighting curves for principal weightings



■ Guide for application of frequency-weighting curves for principal weightings

Frequency weighting	Wk	Wd
Health	z-axis Seat-surface	x,y-axis Seat-surface
Comfort	z-axis, Seat-surface z-axis, Standing vertical recumbent (expect head) x,y,z-axis, Feet	x,y-axis, Seat-surface x,y-axis, Standing horizontal recumbent y,z-axis, Seat-back
Perception	z-axis, Seat-surface z-axis, Standing vertical recumbent (expect head)	x,y-axis, Seat-surface x,y-axis, Standing horizontal recumbent

Specifications

Applicable standards : ISO 2631-1: 1997, ISO 2631-2: 2003, ISO 8041: 2005.
Input : Seat Measurement Accelerometer (tri-axial) PV-62, or Accelerometer (tri-axial) PV-83CW
Measurement frequency range : 0.5 to 80 Hz
Frequency weighting : Wk, Wd, Wb, Wc, Wj, Wm, Wg, bandwidth limiting
Measurement mode : Acceleration, Velocity (in case of Wm)
Measurement range :
[With PV-62] Acceleration (m/s²): 0.3, 1, 3, 10, 30, 100, 300, 1 000
[With PV-83CW] Acceleration (m/s²): 0.03, 0.1, 0.3, 1, 3, 10
Velocity (mm/s): 1, 3, 10, 30, 100, 300
Processing functions : RMS, MTVV, VDV, Synthesized Value, PEAK, Crest Factor
Measurement time settings : 1 to 30 sec in 1-sec units
1 min, 10 min, 30 min, 1 hour, 4 hours, 8 hours, 12 hours (max. 12 hours)
Display : LCD x 2 (main and sub)
Data store function : Auto store1, Auto store2, Manual store
Recording media : CompactFlash memory card
Interface : For dedicated printer only (allows measurement data printout on dedicated printer)
Output connectors : Connectors for 3-axis signals (AC)
Ambient conditions for use : -10 to +50 °C, max. 90 % RH
Power supply : Four IEC R14 (size "C") batteries, 16 hours continuous operation with alkaline batteries
Dimensions and weight : Approx. 56 (H) x 200 (W) x 175 (D) mm; approx. 1 kg (including batteries)

3-Axis Vibration Meter VM-54
+
Hand-Arm Vibration Card
VX-54WH

Evaluate Vibrations Transmitted Through Hands and Arms

Vibrations arising in hand-held tools are transmitted to the hands, arms and shoulders of the operator. Methods for evaluating such vibrations are covered by ISO 5349-1and ISO 5349-2. These standards not only specify frequency weighting characteristics and evaluation factors, they also contain detailed information about how to mount accelerometers.
The hand-arm vibration measurement system consists of the Accelerometer PV-97C (tri-axial), 3-Axis Vibration Meter VM-54, and Hand-Arm Vibration Card VX-54WH. The system allows measurement and evaluation compliant to the relevant standards.

3-Axis Vibration Meter
VM-54

ISO 5349-1: 2001
Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements

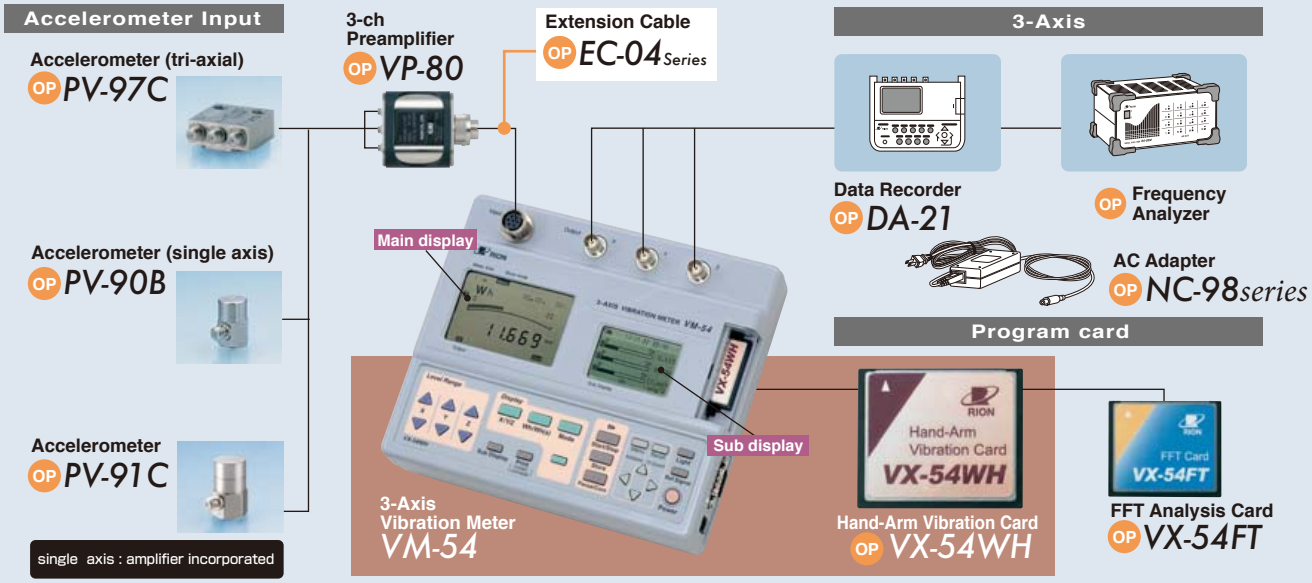
ISO 5349-2 : 2001
Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 2: Practical guidance for measurement at the workplace

- Measurement result data can be stored on CF card.
- 3-axis output signal for connection to frequency analyzer, data recorder, or other waveform recording device.

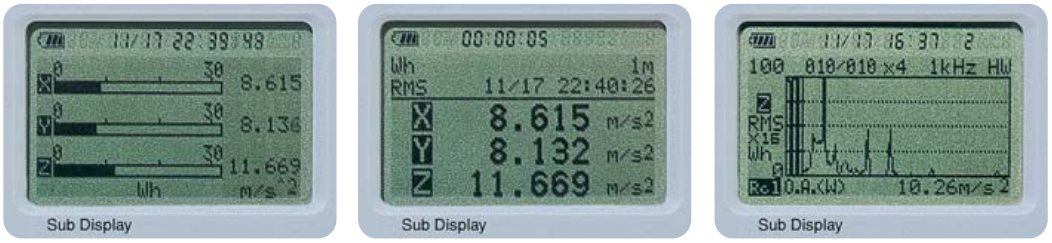
Accelerometer (tri-axial)
PV-97C Option

System Configuration

OP =Option for VM-54



Display screen examples Sub display



Graphic screen | Numeric screen | FFT screen (using VX-54FT)

■ Running R.M.S acceleration value

$$a_w(t_0) = \left| \frac{1}{\tau} \int_{t_0-\tau}^{t_0} a_w^2(t)\,dt \right|^{\frac{1}{2}}$$

Where
$a_w(t)$: Instantaneous value of vibration acceleration to which frequency weighting was applied
t : Moving average integral time (s)
τ : Time (integral variable)
t_0 : Observation time point (instantaneous time)

■ Maximum Transient Vibration Value (*MTVV*)

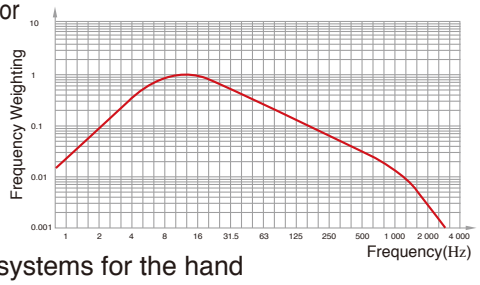
$$MTVV = \max[a_w(t_0)]$$

■ Vibration Dose Value (*VDV*)

$$VDV = \left| \int_0^T a_w^4(t)\,dt \right|^{\frac{1}{4}}$$

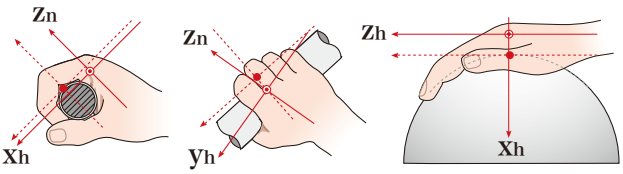
Where
$a_w(t)$: Instantaneous value of translational or rotary vibration acceleration to which frequency weighting was applied
T : Continuous measurement time (s)

■ Frequency-weighting curve Wh for hand-transmitted vibration Weighting factor



■ Coordinate systems for the hand

a) Handgrip position | b) Flat palm position



Specifications

Applicable standards : ISO 5349-1: 2001, ISO 5349-2:2001,
Input : Piezoelectric Accelerometer PV-97C (tri-axial) or equivalent
Measurement frequency range : 8 to 1 000 Hz
Frequency weighting : Wh
Measurement mode : Acceleration
Measurement range :
[With PV-97C] Acceleration (m/s²):
30, 100, 300, 1000, 3 000, 10 000
(VP-80 charge amplifier gain set to x 0.1)
Acceleration (m/s²):
3, 10, 30, 100, 300, 1000, 3 000, 10 000
(VP-80 charge amplifier gain set to x 1)
Processing functions : RMS, MTVV, VDV, Synthesized Value, PEAK, Crest Factor

Measurement time settings : 1 to 30 sec in 1-sec units
1 min, 10 min, 30 min, 1 hour, 4 hours, 8 hours, 12 hours (max. 12 hours)
Display : LCD x 2 (main and sub)
Data store function : Auto store, Manual store
Recording media : CompactFlash memory card
Interface : For dedicated printer only
(allows measurement data printout on dedicated printer)
Output connectors : Connectors for 3-axis signals (AC)
Ambient conditions : -10 to +50 °C, max. 90 % RH
Power supply : Four IEC R14 (size "C") batteries,
16 hours continuous operation with alkaline batteries
Dimensions and weight : Approx. 56 (H) x 200 (W) x 175 (D) mm;
approx. 1 kg (including batteries)

3-Axis Vibration Meter

VM-54

The 3-Axis Vibration Meter VM-54 can be used with PV-83CW and various other accelerometers.

- 3-axis output signal for connection to frequency analyzer, data recorder, or other waveform recording device.
- Microphone extension cable (EC-04 series) can be used to extend accelerometer connection.

Inputs: 3-channel input (using 3-Channel Input adapter VP-80)
Measurement frequency range: 0.5 to 5 000 Hz
Measurement mode: Acceleration rms value, Instantaneous value and maximum hold
Measurement range: With piezoelectric accelerometer

Sensitivity setting	0.1 to 0.999	3, 10, 30, 100, 300, 1 000, 3 000, 10 000
	1.00 to 9.99	0.3, 1, 3, 10, 30, 100, 300, 1 000
	10 to 99.9	0.03, 0.1, 0.3, 1, 3, 10, 30, 100

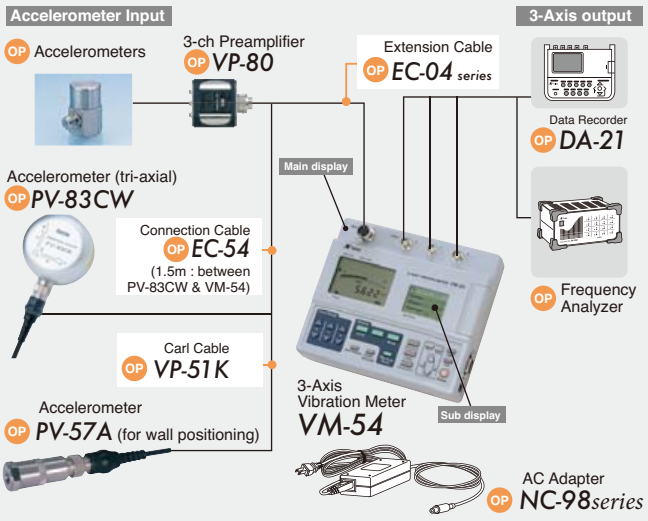
With PV-83CW

Acceleration	0.03, 0.1, 0.3, 1, 3, 10

With PV-57A

Acceleration(m/s²)	0.3, 1, 3, 10, 30, 100, 300, 1 000

System Configuration (Accelerometer input / 3-axis Output)



Display : LCD x 2 (main and sub)
Output connectors : Connectors for 3-axis signals (AC)
Power supply : Four IEC R14 (size "C") batteries, 16 hours continuous operation with alkaline batteries
Ambient conditions : -10 to +50 ◦C, max. 90 % RH
Dimensions and weight : 56 (H) x 200 (W) x 175 (D) mm; approx. 1 kg (including batteries)

FFT Analysis card

VX-54FT Option

The VX-54FT functions as a memory card and allows storing FFT analysis result data in CSV format. The supplied Excel macro makes it easy to generate a graph display from the stored data.

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 channel simultaneous analysis)
Frequency range settings : 50 Hz, 100 Hz, 200 Hz, 500 Hz, 1 kHz

Frequency span	Sampling frequency	Sampling interval	Frame time	Frequency resolution
50 Hz	128 Hz	7.8125 ms	8 s	0.125 Hz
100 Hz	256 Hz	3.90625 ms	4 s	0.25 Hz
200 Hz	512 Hz	1.953125 ms	2 s	0.5 Hz
500 Hz	1.28 kHz	0.78125 ms	0.8 s	1.25 Hz
1kHz	2.56 kHz	0.390625 ms	0.4 s	2.5 Hz

Window types : Hanning, Rectangular
Analysis lines : 400
Processing : Instantaneous value, RMS method, maximum value
Display (VM-54) : Main display : Shows instantaneous value in specified channel (rms with 1 second integration time)
Sub display : Shows FFT analysis result in specified channel and overall value simultaneously
X axis : Frequency (Hz)
Y axis : Linear
Menu screen
Recall screen
Zoom ratio [X axis] : x1, x2, x4
[Y axis] : x1, x4, x16, x64, x256
Frequency weighting characteristics : Dependent on respective program card
Processing frames : max. 999 (selectable in 1-frame steps)
Overlap : 50 % (no overlap at 1 kHz)
Level range : Dependent on respective program card
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
Recall function : Data stored on VX-54FT card can be recalled on sub display
Resume function : Available
Interface : For dedicated printer only (hard copy of sub display contents can be produced on dedicated printer)
Outputs : AC output according to selected frequency weighting characteristics (O.A.)
Battery life (using VX-54FT) : 16 hours continuous operation (using PV-83CW, at room temperature, with alkaline batteries)
Ambient conditions : -10 to +50 ◦C, max. 90 % RH

OP Options

Product name	Model
FFT Analysis Card	VX-54FT
3-ch Preamplifier	VP-80
Accelerometer (tri-axial)*1	PV-83CW
Accelerometer	PV-57A
Carl Cable (for PV-57A)	PV-51K

Product name	Model
Magnet Attachment (for PV-57A)	VP-53S
Seat Measurement Accelerometer (tri-axial)	PV-62
Accelerometer (tri-axial)	PV-97C
Accelerometer (single axis)	PV-90B

Product name	Model
Accelerometer (single axis)	PV-91C
Connection Cable*1	EC-54
Extension Cable (2 m)	EC-04
AC Adapter (100 to 240 V AC)	NC-98series

*1 Supplied only with VX-54WS

ilac-MRA IA Japan Accredited Calibration JCSS JCSS 0197

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

* Specifications subject to change without notice.

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