RION

VX-54WH
Hand-Arm Vibration
VX-54WB
Whole-Body Vibration
VX-54WS
Habitability on Ships
Input
Output
X
Y
Z
RION
3-AXIS VIBRATION METER VM-54
5.622
Sub Display
Level Range
Display
X/Y/Z
Mode
Sub Display
Install / Uninstall
Max Hold Reset
(Start/Stop)
(Store)
(Pause/Cont)
Menu
(Recall)
(Y-Zoom)
Light
Cal
Power

System for human related vibration measurements
All–round instrument

3-Axis Vibration Meter

VM-54

Optional program card line-up
VX-54WS/VX-54WB/VX-54WH/VX-54FT

3-Axis
Vibration Meter
VM-54 +

VX-54WS
Marine Vibration Card

RION
Marine Vibration Card
VX-54WS

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

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.

RION
VIBRATION PICKUP
PV-83CW
+Y
+Z
+X
P&O
SUN PRINCESS
146.68
3-AXIS VIBRATION METER VM-54
VX-54WS

3-Axis Vibration Meter
VM-54

ISO 6954 : 2000

Mechanical vibrations — Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships

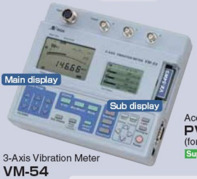
- Accelerometer PV-83CW (tri-axial) (for floor positioning) is supplied as standard accessory of VX-54WS.
  Accelerometer PV-57A (for wall positioning) available as optional accessory.
- Storing of measurement data on CompactFlash™ memory card.
- Tri-axial analogue AC outputs for connection to frequency 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.

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

System Configuration

OP =Option for VM-54

Marine Vibration Card
VX-54WS


Main display
Sub display

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

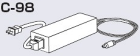
3-Axis Vibration Meter
VM-54

Supplied Connection Cable **EC-54**
(1.5 m : between PV-83CW & VM-54)

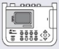
OP FFT Analysis Card
VX-54FT

FFT Card
VX-54FT

OP AC Adapter
NC-98



OP Accelerometer
PV-57A (for wall positioning)



OP Data Recorder
DA-20

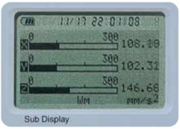
OP FFT Analyzer
SA-78

OP Extension Cable
EC-04 series

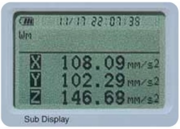
OP Carl Cable
VP-51K

OP Magnet Attachment
VP-53S

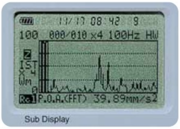
Display screen examples **Sub display**


13/13 22:01:08
0
300
X
108.10
0
300
Y
102.31
0
300
Z
146.68
Wm
mm/s2
Sub Display

Graphic screen


13/13 22:07:38
Wm
X 108.09 mm/s2
Y 102.29 mm/s2
Z 146.68 mm/s2
Sub Display

Numeric screen

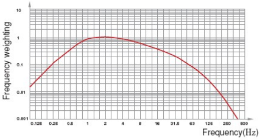

13/13 08:42 9
100 000/010 x4 100Hz HW
Z
IST
X 4
Wm
0
Rel P.O.A.(FFT) 39.89mm/s2
Sub Display

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/s^2):
30, 100, 300, 1 000, 3 000, 10 000
Velocity (mm/s):1, 3, 10, 30, 100, 300
【With PV-57A】 Acceleration (mm/s^2): 0.3, 1, 3, 10, 30, 100, 300, 1 000
Velocity (mm/s): 10, 30, 100, 300, 1000, 3000
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 200 000 data can be stored on VX-54WS)
Recording media : CompactFlash memory card (64 MB)
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+

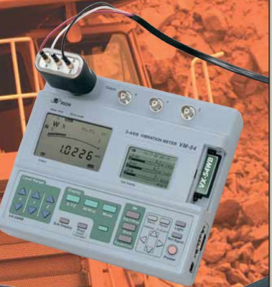
VX-54WB

Whole Body Vibration Card

RION
Whole Body Vibration Card
VX-54WB

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-54WB.
The system allows measurement and evaluation compliant to the relevant standards.


RION
3-AXIS VIBRATION METER VM-54
VX-54WB

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/DIS 8041 : 2003
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

Whole Body Vibration Card
VX-54WB

Whole Body Vibration Card
VX-54WB

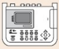
Main display
Sub display

3-Axis Vibration Meter
VM-54

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

OP 3-ch Preamplifier
VP-80

OP Seat Measurement Accelerometer (tri-axial)
PV-62(cable length 3 m)



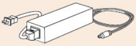
OP Data Recorder
DA-20

OP FFT Analyzer
SA-78

OP FFT Analysis Card
VX-54FT

FFT Card
VX-54FT

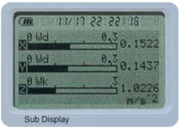
OP AC Adapter
NC-98



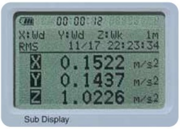
OP Extension Cable
EC-04 series

OP Connection Cable
EC-54
(1.5m : between
PV-83CW & VM-54)

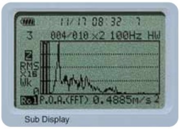
Display screen examples Sub display


13/ 17 22:22 18
X 0 Wd 0.3 0.1522
Y 0 Wd 0.3 0.1437
Z 0 Wk 3 1.0226
m/s^2
Sub Display

Graphic screen


00:00:12
X:Wd Y:Wd Z:Wk 1m
RMS 11/17 22:23:34
X 0.1522 m/s2
Y 0.1437 m/s2
Z 1.0226 m/s2
Sub Display

Numeric screen


11/ 17 08:32 7
3 004/010 ×2 100Hz HW
Z
RMS
X16
Wk
0
Rel P.O.A.(FFT) 0.4885m/s^2
Sub Display

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*)

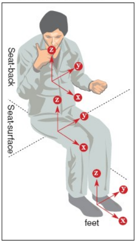
$$MTVV = \max[a_w(t_0)]$$

Vibration Dose Value (*VDV*)

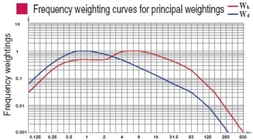
$$VDV = \left[\int_0^T a_w^4(t)\,dt \right]^{\frac{1}{4}}$$

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)


Seat-back
Seat-surface
z
y
x
z
y
x
z
y
x
feet

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/DIS 8041: 2003.
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, bandwidth limiting
Measurement mode : Acceleration
Measurement range :
【With PV-62】 Acceleration (m/s^2): 0.3, 1, 3, 10, 30, 100, 300, 1000
【With PV-83CW】 Acceleration (m/s^2): 0.03, 0.1, 0.3, 1, 3, 10
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 (64 MB)
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 +

VX-54WH

Hand-Arm Vibration Card

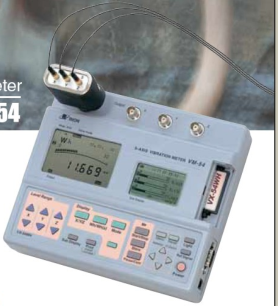
RION
Hand-Arm
Vibration Card
VX-54WH

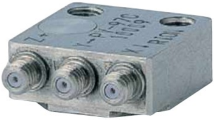
Evaluate Vibrations Transmitted Through Hands and Arms

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


RION
3-AXIS VIBRATION METER VM-54
11.669
VX-54WH



Accelerometer (tri-axial)
PV-97C Option

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.

System Configuration

OP =Option for VM-54

Hand-Arm Vibration Card
VX-54WH

Hand-Arm Vibration Card
VX-54WH

Main display
Sub display

3-Axis Vibration Meter
VM-54

OP Accelerometer (tri-axial)
PV-97C

OP Accelerometer (single axis)
PV-90B

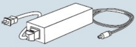
OP Accelerometer
PV-90I
single axis : preamplifier incorporated

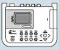
OP 3-ch Preamplifier
VP-80

OP FFT Analysis Card
VX-54FT

FFT Card
VX-54FT

OP AC Adapter
NC-98



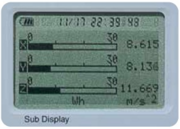


OP
Data Recorder
DA-20

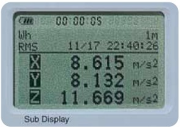
OP
FFT Analyzer
SA-78

OP Extension Cable
EC-04 series

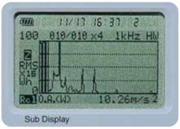
Display screen examples **Sub display**


11/17 22:39:88
X 0 30 8.615
Y 0 30 8.136
Z 0 30 11.669
Wh m/s^2
Sub Display

Graphic screen


00:00:05
Wh 1m
RMS 11/17 22:40:26
X 8.615 m/s2
Y 8.132 m/s2
Z 11.669 m/s2
Sub Display

Numeric screen


11/17 16:37 2
100 010/010 x4 1kHz HW
Z
RMS
X16
Wh
0
Rc1 O.A.(W) 10.26m/s 2
Sub Display

FFT screen (using VX-54FT)

Running R.M.S acceleration value

$$a_{\mathrm{w}}(t_0) = \left[\frac{1}{\tau} \int_{t_0-\tau}^{t_0} a_{\mathrm{w}}^{2}(t)\mathrm{d}t \right]^{\frac{1}{2}}$$

Where
$a_{\mathrm{w}}(t)$: 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*)

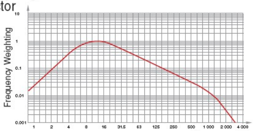
$$MTVV = \max[a_{\mathrm{w}}(t_0)]$$

Vibration Dose Value (*VDV*)

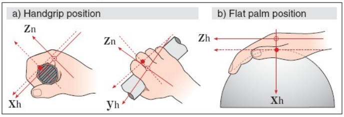
$$VDV = \left[\int_{0}^{T} a_{\mathrm{w}}^{4}(t)\mathrm{d}t \right]^{\frac{1}{4}}$$

Where
$a_{\mathrm{w}}(t)$: 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



Coordinate systems for the hand


a) Handgrip position
b) Flat palm position
Zn
Xh
Zn
Yh
Zh
Xh

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 (mm/s^2): 30, 100, 300, 1 000, 3 000, 10 000 (VP-80 charge amplifier gain set to x 0.1) Acceleration (mm/s^2): 3, 10, 30, 100, 300, 1 000, 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 (64 MB)
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 combined with a variety of accelerometers or vibration pickups designed for vibration level meters.

- 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 (instantaneous value in 3 axes) : Acceleration m/s^2
Measurement range:
With piezoelectric accelerometer

Sensitivity setting	0.1 to 0.999	3, 10, 30, 100, 300, 1000, 3 000, 10 000
	1.00 to 9.99	0.3, 1, 3, 10, 30, 100, 300, 1000
	10 to 99.9	0.03, 0.1, 0.3, 1, 3, 10, 30, 100

With PV-83C/CW

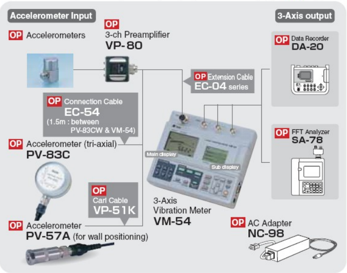
Acceleration	0.03, 0.1, 0.3, 1, 3, 10

With PV-57A

Acceleration(m/s^2)	0.3, 1, 3, 10, 30, 100, 300, 1000

System Configuration (Vibration pickup input / 3-axis Output)

OP =Option


Accelerometer Input
OP Accelerometers
OP 3-ch Preamplifier VP-80
OP Extension Cable EC-04 series
OP Connection Cable EC-54 (1.5m : between PV-83CW & VM-54)
OP Accelerometer (tri-axial) PV-83C
Main display
Sub display
OP Carl Cable VP-51K
3-Axis Vibration Meter VM-54
OP Accelerometer PV-57A (for wall positioning)
3-Axis output
OP Data Recorder DA-20
OP FFT Analyzer SA-78
OP AC Adapter NC-98

Display	: LCD x 2 (main and sub)
Interface	: For dedicated printer only (allows measurement data printout on dedicated printer)
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)

RION
FFT Card
VX-54FT

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
1 kHz	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)	PV-83C
Accelerometer (tri-axial)*1	PV-83CW
Accelerometer	PV-57A

Product name	Model
Carl Cable (for PV-57A)	VP-51K
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-90I
Connection Cable*1	EC-54
Extension Cable (2 m)	EC-04
AC Adapter (100 to 240 V AC)	NC-98

*1 Supplied only with VX-54WS