

VX-54WH
Hand-Arm Vibration

VX-54WB
Whole-Body Vibration

VX-54WS
Habitability on Ships



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



VX-54WS

Marine Vibration Card



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.



**Accelerometer (tri-axial)
(for floor positioning)**

PV-83CW

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.

System Configuration

OP =Option for VM-54

Marine Vibration Card VX-54WS



3-Axis Vibration Meter VM-54



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

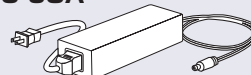
Supplied

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

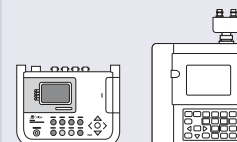
OP FFT Analysis Card VX-54FT



OP AC Adapter NC-98A



OP Accelerometer PV-57A (for wall positioning)



OP

Data Recorder DA-20

OP

FFT Analyzer SA-78

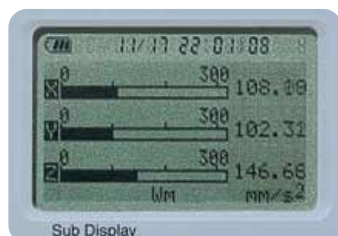
OP Extension Cable EC-04 series

OP Carl Cable VP-51K

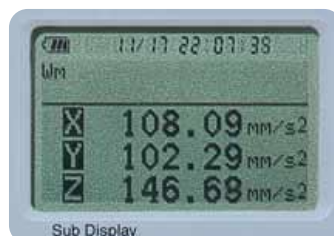
OP Magnet Attachment VP-53S

Display screen examples

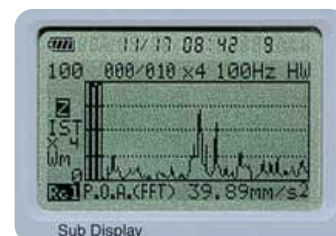
Sub display



Graphic screen

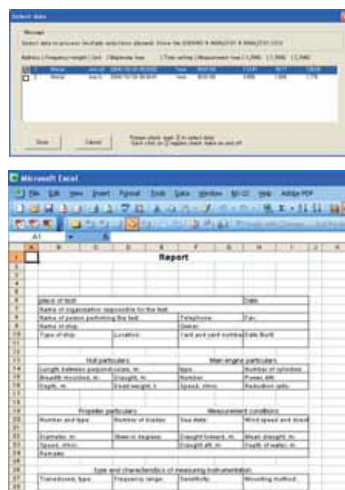


Numeric screen

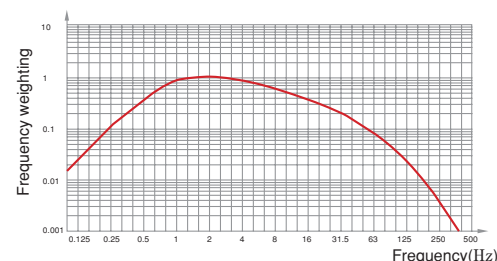


FFT screen (using VX-54FT)

■ Unit inserted in soft protection case ■ Excel macro



■ Frequency weighting curve W_m



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	W_m (ISO 2631-2: 2003), bandwidth limiting
Measurement modes	Acceleration, velocity
Measurement range	
[With PV-83CW]	Acceleration (mm/s^2): 30, 100, 300, 1000, 3000, 10000 Velocity (mm/s): 1, 3, 10, 30, 100, 300
[With PV-57A]	Acceleration (mm/s^2): 0.3, 1, 3, 10, 30, 100, 300, 1000 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



VX-54WB

Whole Body Vibration Card



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.

3-Axis Vibration Meter
VM-54



Seat Measurement
Accelerometer (tri-axial)

PV-62 Option

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.

Whole Body Vibration Card
VX-54WB3-Axis Vibration Meter
VM-54

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



OP 3-ch Preamplifier
VP-80

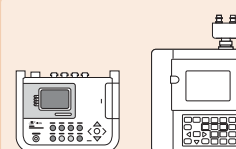
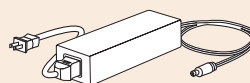
OP FFT Analysis Card
VX-54FT



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



OP AC Adapter
NC-98A

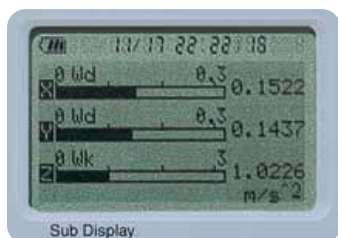


OP Data Recorder
DA-20

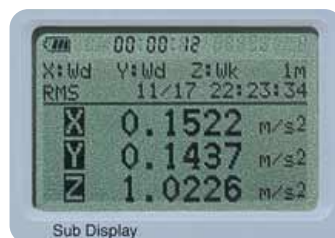
OP FFT Analyzer
SA-78

OP Extension Cable
EC-04 series

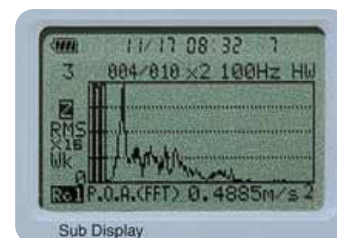
OP Connection Cable
EC-54
(1.5m : between PV-83CW & VM-54)

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)

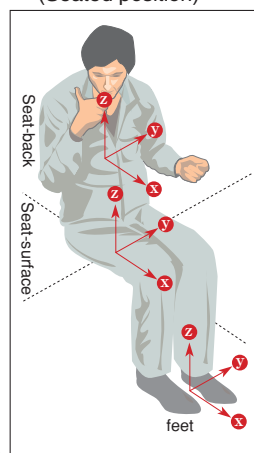
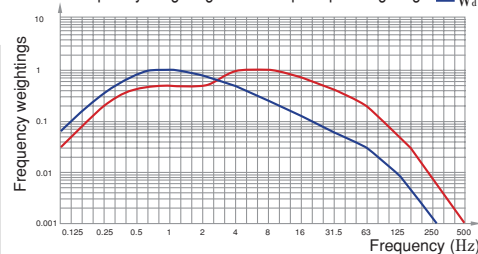
$$MTVV = \max[a_w(t_0)]$$

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 W_k W_d 

Guide for application of frequency-weighting curves for principal weightings

Frequency weighting	W _k	W _d
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 : W_k, W_d, W_b, W_c, W_j, W_m, bandwidth limiting

Measurement mode : Acceleration

Measurement range :
 [With PV-62] Acceleration (mm/s²): 0.3, 1, 3, 10, 30, 100, 300, 1000
 [With PV-83CW] Acceleration (mm/s²): 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)



VX-54WH

Hand-Arm Vibration Card



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 5349-1 and 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



Accelerometer (tri-axial)

PV-97C

Option

ISO 5349-1: 2001

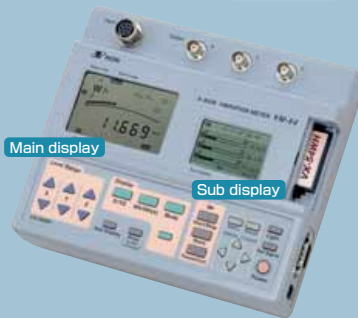
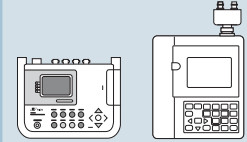
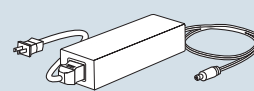
Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements

ISO 5349-2: 2001

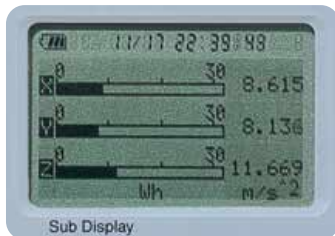
Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 2: Practical guidance for measurement at the workplace

- 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.

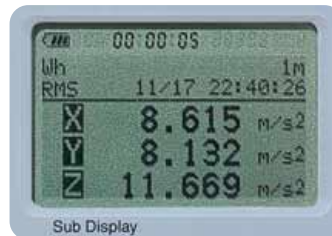


Hand-Arm Vibration Card
VX-54WH3-Axis Vibration Meter
VM-54OP Accelerometer (tri-axial)
PV-97COP Accelerometer
PV-90I
single axis : preamplifier incorporatedOP FFT Analysis Card
VX-54FTOP Accelerometer (single axis)
PV-90BOP 3-ch Preamplifier
VP-80OP AC Adapter
NC-98AOP Data Recorder
DA-20OP FFT Analyzer
SA-78OP Extension Cable
EC-04 series

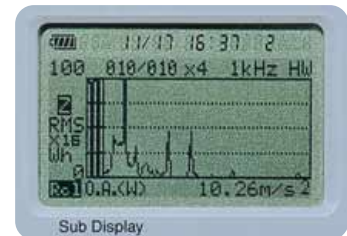
Display screen examples Sub display



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)

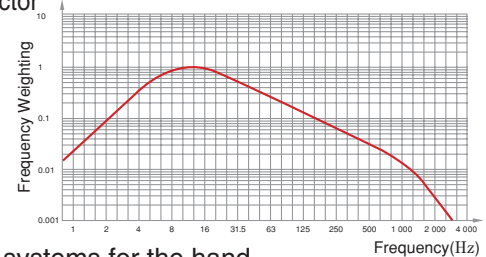
$$MTVV = \max[a_w(t_0)]$$

Vibration Dose Value (VDV)

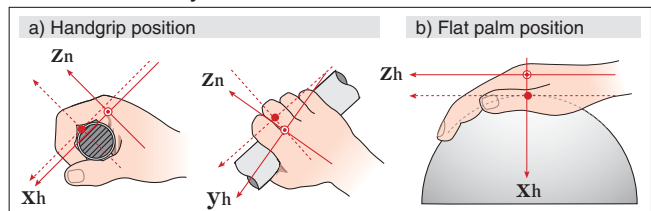
$$VDV = \left[\int_0^T a_w^4(t) dt \right]^{\frac{1}{4}}$$

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



Specifications

Applicable standards : ISO 5349-1: 2001, ISO 5349-2:2001,
 Input : Piezoelectric Accelerometer

PV-97C (tri-axial) or equivalent
 Measurement : 8 to 1000 Hz

frequency range

Frequency weighting : Wh

Measurement mode : Acceleration

Measurement range :

[With PV-97C] Acceleration (mm/s²):
 30, 100, 300, 1000, 3 000, 10 000
 (VP-80 charge amplifier gain set to x 0.1)
 Acceleration (mm/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 (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 (Acceleration rms value) : Instantaneous value, maximum hold
Measurement range:
With piezoelectric accelerometer

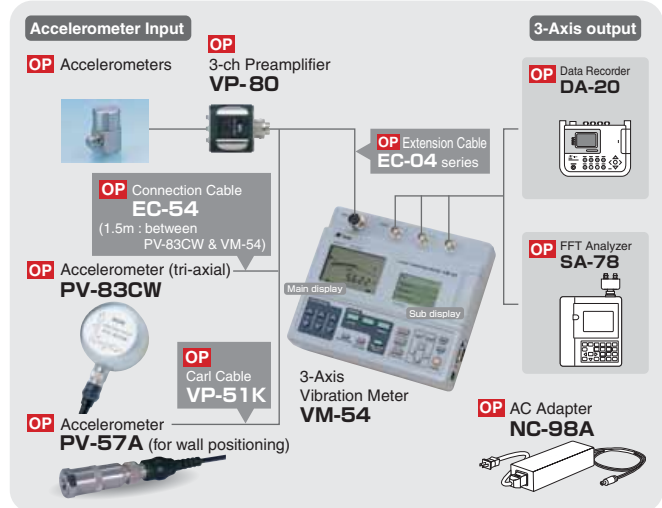
Sensitivity setting	0.1 to 0.999	3, 10, 30, 100, 300, 1000, 3 000, 10 000
	1.00 to 9.99	0.3, 1, 3, 10, 30, 100, 300, 1000
	10 to 99.9	0.03, 0.1, 0.3, 1, 3, 10, 30, 100

With PV-83CW

With PV-57A

Acceleration	0.03, 0.1, 0.3, 1, 3, 10	Acceleration(m/s ²)	0.3, 1, 3, 10, 30, 100, 300, 1000
--------------	--------------------------	---------------------------------	-----------------------------------

System Configuration (Vibration pickup input / 3-axis Output) **OP** =Option



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)

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 Pre-amplifier	VP-80
Accelerometer (tri-axial) *1	PV-83CW
Accelerometer	PV-57A
Carl Cable (for PV-57A)	VP-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-90I
Connection Cable *1	EC-54
Extension Cable (2 m)	EC-04
AC Adapter (100 to 240 V AC)	NC-98A

*1 Supplied only with VX-54WS

* Specification subject to change without notice.



3-20-41, Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan
Tel: +81-42-359-7888 Fax: +81-42-359-7442
<http://www.rion.co.jp/english/>

Distributed by:

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

