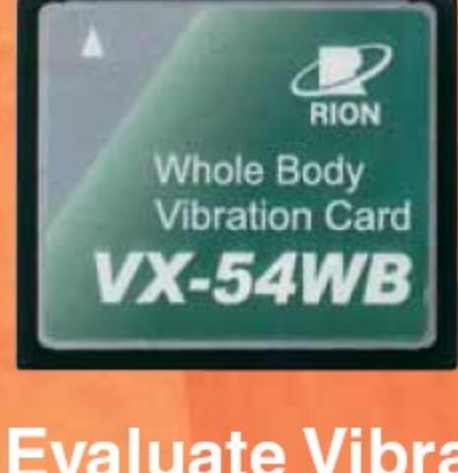




VX-54WB

Whole Body Vibration Card



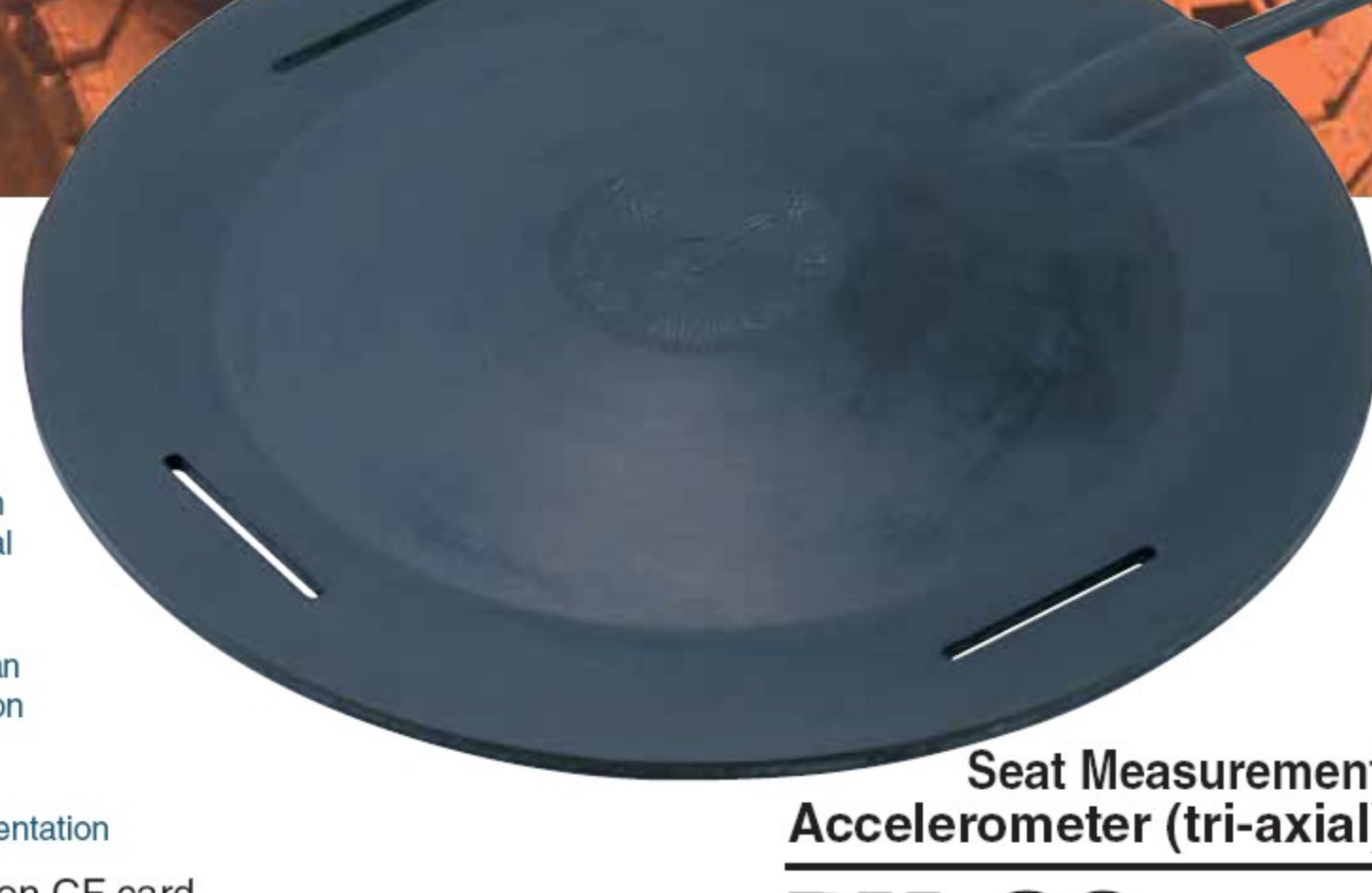
Evaluate Vibrations Affecting the Whole Body

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 the vibration perception, comfort levels, and the 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: Human in buildings (1 Hz to 80 Hz)

ISO/DIS 8041 : 2003
Human response to vibration — Measuring Instrumentation

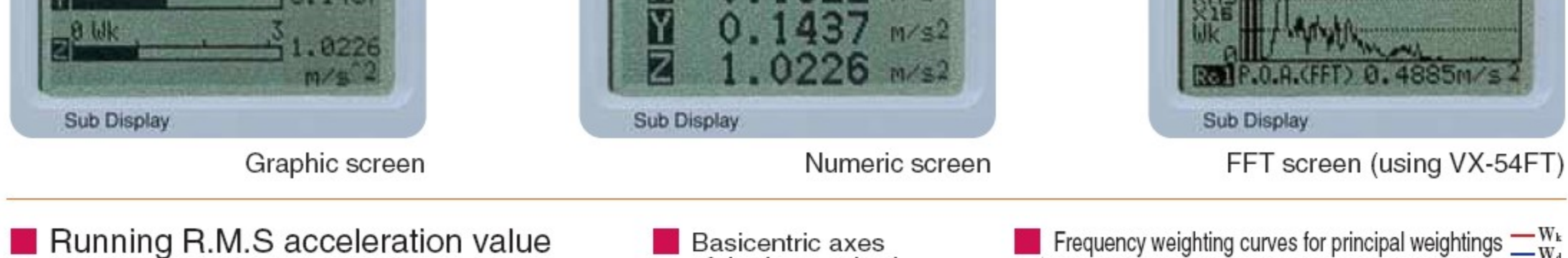
- Measurement result data can be stored on CF card.
- 3-axis output signal for connection to frequency analyzer, data recorder, or other waveform recording device.

System Configuration

OP =Option for VM-54



Display screen examples



Running R.M.S acceleration value

$$a_w(t_0) = \sqrt{\frac{1}{T} \int_{t_0-T}^{t_0} a_w^2(t) dt}$$

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

Maximum Transient Vibration Value (MTVV)

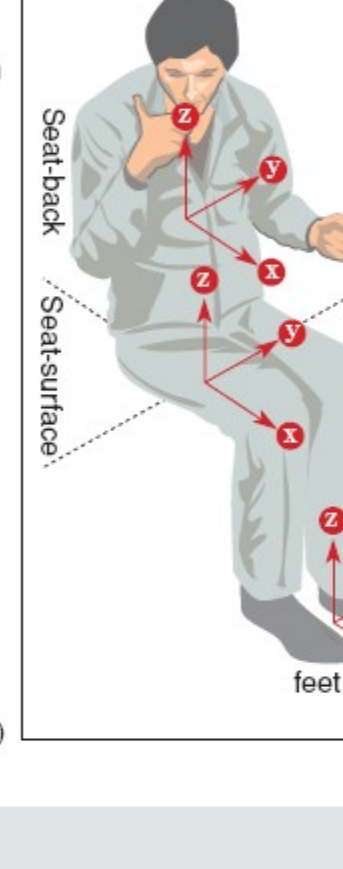
$$MTVV = \max[a_w(t_0)]$$

Vibration Dose Value (VDV)

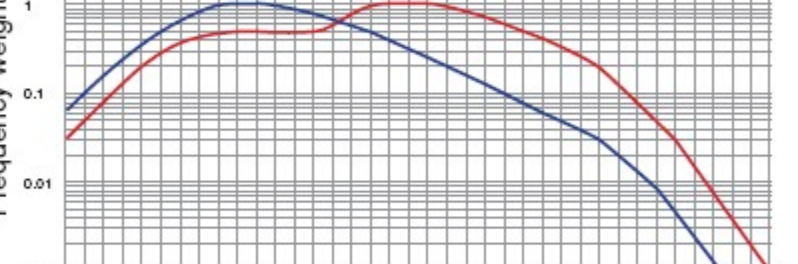
$$VDV = \left[\int_0^T a_w^4(t) dt \right]^{1/4}$$

Where $a_w(t)$: Instantaneous value of translational 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	Wb
Health	z-axis, Seat-surface	x,y-z-axis, Seat-surface	z-axis, Seat-surface
Comfort	z-axis, Seat-surface	x,y-axis, Standing vertical/rearback (expect head)	x,y-axis, Standing horizontal/rearback
Perception	z-axis, Seat-surface	x,y-axis, Standing vertical/rearback (expect head)	x,y-axis, Standing horizontal/rearback

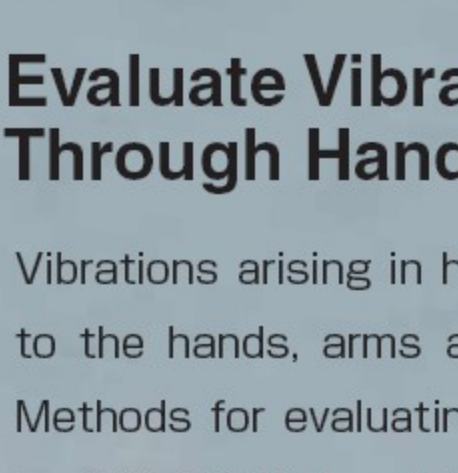
Specifications

Applicable standards : ISO 2631-1: 1997, ISO 2631-2: 2003, ISO/DIS 8041: 2003.	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)
Input : Seat Measurement Accelerometer (tri-axial) PV-62, or Accelerometer (tri-axial) PV-83CW	Display : LCD X 2 (main and sub)
Measurement : 0.5 to 80 Hz	Data store function : Auto store, Manual store
Frequency range : 0.3, 1, 3, 10, 30, 100, 300, 1000	Recording media interface : CompactFlash memory card (64 MB)
Frequency weighting : Wk, Wd, Wb, Wc, Wj, Wm, Wn, bandwidth limiting	Output connectors : Connectors for 3-axis signals (AC)
Measurement mode : Acceleration	Ambient conditions for use : -10 to +50 °C, max. 90 % RH
Measurement range : [With PV-62] Acceleration (mm/s ²): 0.3, 1, 3, 10, 30, 100, 300, 1000	Power supply : Four IEC R14 (size 'C') batteries, 16 hours continuous operation with alkaline batteries
[With PV-83CW] Acceleration (mm/s ²): 0.03, 0.1, 0.3, 1, 3, 10	Dimensions and weight : Approx. 56 (H) x 200 (W) x 175 (D) mm; approx. 1 kg (including batteries)
Processing functions : RMS, MTVV, VDV, Synthesized Value, Peak, Crest Factor	



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

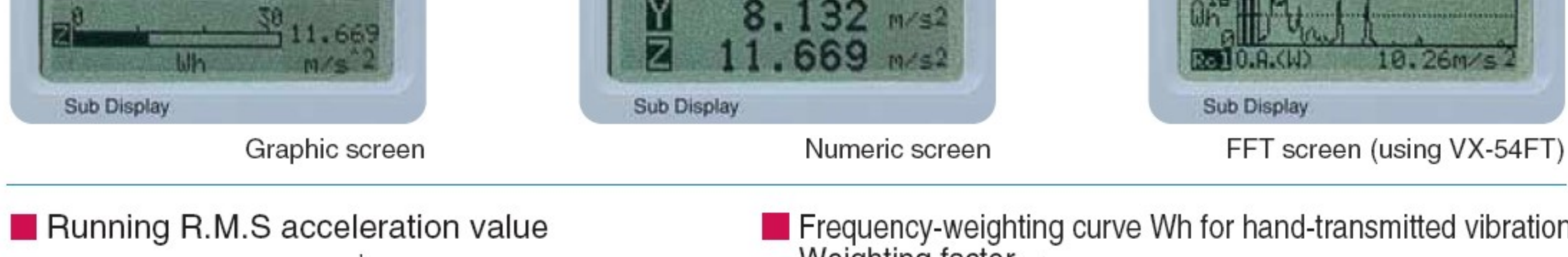
- Measurement result data can be stored on CF card.
- 3-axis output signal for connection to frequency analyzer, data recorder, or other waveform recording device.

System Configuration

OP =Option for VM-54



Display screen examples



Running R.M.S acceleration value

$$a_w(t_0) = \sqrt{\frac{1}{T} \int_{t_0-T}^{t_0} a_w^2(t) dt}$$

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

Maximum Transient Vibration Value (MTVV)

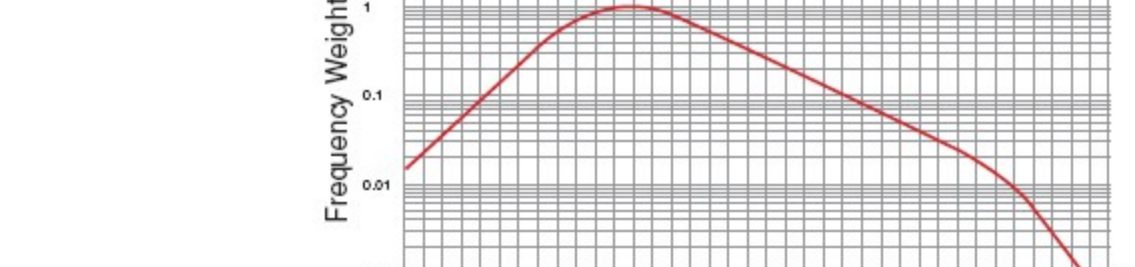
$$MTVV = \max[a_w(t_0)]$$

Vibration Dose Value (VDV)

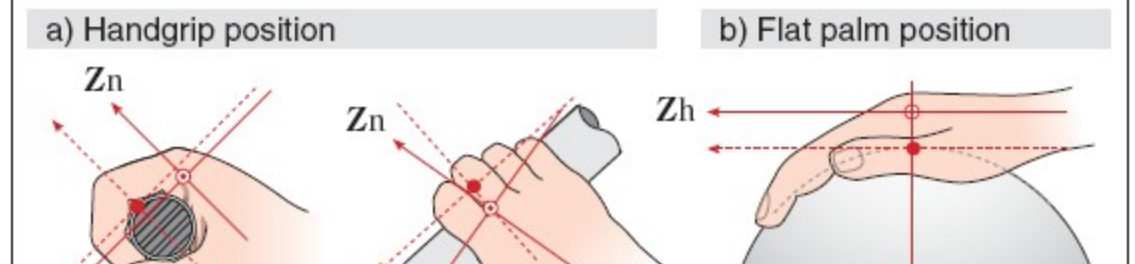
$$VDV = \left[\int_0^T a_w^4(t) dt \right]^{1/4}$$

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



Coordinate systems for the hand



Specifications

Applicable standards : ISO 5349-1: 2001, ISO 5349-2:2001.	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)
Input : Piezoelectric Accelerometer PV-97C (tri-axial) or equivalent	Display : LCD X 2 (main and sub)
Measurement : 8 to 1000 Hz	Data store function : Auto store, Manual store
Frequency range : 0.5 to 5 000 Hz	Recording media interface : CompactFlash memory card (64 MB)
Frequency weighting : Wh	Output connectors : Connectors for 3-axis signals (AC)
Measurement mode : Acceleration	Ambient conditions for use : -10 to +50 °C, max. 90 % RH
Measurement range : [With PV-97C] Acceleration (mm/s ²): 30, 100, 300, 1 000, 3 000, 10 000	Power supply : Four IEC R14 (size 'C') batteries, 16 hours continuous operation with alkaline batteries
(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	Dimensions and weight : Approx. 56 (H) x 200 (W) x 175 (D) mm; approx. 1 kg (including batteries)
(VP-80 charge amplifier gain set to x 1) Acceleration (mm/s ²): 0.3, 1, 3, 10, 30, 100, 300, 1 000	
Processing functions : RMS, MTVV, VDV, Synthesized Value, Peak, Crest Factor	

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.

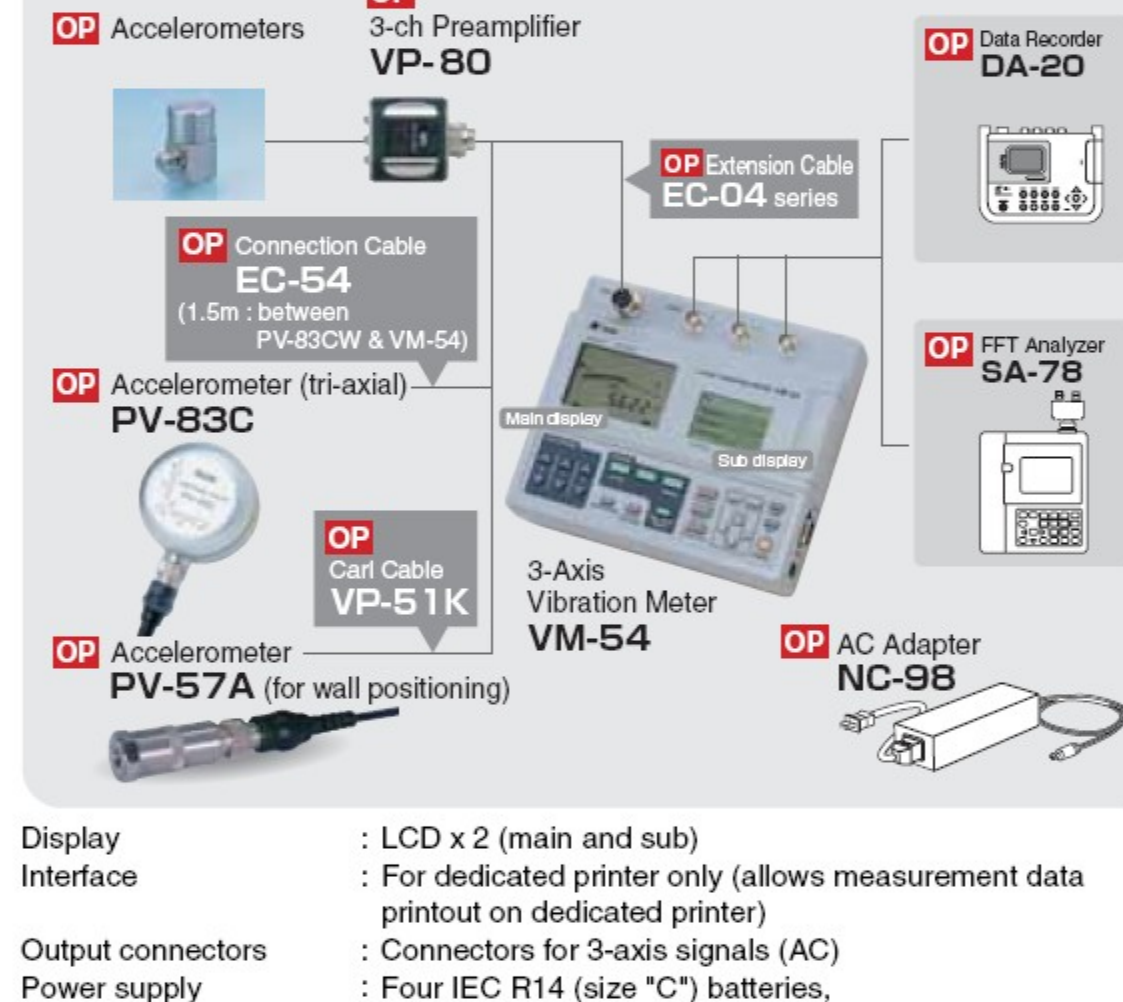
Inputs : 3-channel input (using 3-Channel Input adapter VP-80)
 Measurement frequency range : 0.5 to 5 000 Hz
 Measurement mode (instantaneous value in 3 axes) : Acceleration m/s²
 Measurement range : With piezoelectric accelerometer

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/W	With PV-57A
Acceleration [0.03, 0.1, 0.3, 1, 3, 10]	Acceleration [mm/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 mode : Acceleration
 Measurement channels : X, Y, Z (3 channel simultaneous analysis)
 Frequency range settings : 50 Hz, 100 Hz, 500 Hz, 1 kHz

Frequency span	Sampling frequency	Sampling interval	Frame time	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)
 Level range : 50 % (no overlap at 1 kHz)
 Data store function : Dependent on respective program card
 Manual store : 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
 Data stored on VX-54FT card can be recalled on sub display
 Interface : Available
 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	Product name	Model	Product name	Model
FFT Analysis Card	VX-54FT	Carl Cable (for PV-57A)	VP-51K	Accelerometer (single axis)	PV-90I
3-ch Pre-amplifier	VP-80	Magnet Attachment (for PV-57A)	VP-53S	Connection Cable #1	EC-54
Accelerometer (tri-axial)	PV-83C	Seat Measurement Accelerometer (tri-axial)	PV-62	Extension Cable (2 m)	EC-04
Accelerometer (tri-axial)*1	PV-83CW	Accelerometer (tri-axial)	PV-97C	AC Adapter (100 to 240 V AC)	NC-98
Accelerometer	PV-57A	Accelerometer (single axis)	PV-90B		

*1 Supplied only with VX-54WB