Habitability on Ships  Whole-Body Vibration  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
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.

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.
Specifications

Applicable standards: ISO 6954: 2000
Input:
- Accelerometer (tri-axial) PV-83CW, or Accelerometer PV-57A (option)
Measurement:
- 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, 3000, 10000
  - Velocity (mm/s): 1, 3, 10, 30, 100, 300
- [With PV-57A]
  - Acceleration (mm/s²): 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 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

Excel macro

Frequency weighting curve Wm

Display screen examples: Sub display

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

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.
Specifications


Input: Seat Measurement Accelerometer (tri-axial) PV-62, Accelerometer (tri-axial) PV-83CW

Measurement: 0.5 to 80 Hz frequency range

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, 1000
- [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)
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.

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.
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, 3000, 10 000
(VP-80 charge amplifier gain set to x 0.1)
Acceleraion (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 settings:
- Time settings: 1 to 30 sec in 1-sec units
- Recording time settings: 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 storage function: Auto store, Manual store
- Recording media: CompactFlash memory card
- Interface: For dedicated printer only
- 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)
FFT Analysis card VX-54FT

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
- Processing frames
- Level range
- Data store function
- Frequency weighting characteristics
- Processing frames
- Overlap
- Level range
- Dependent on respective program card
- Manual store on VX-54FT card
- Max. 100 data sets per file (3-channel data format 1 set)
- Max. 50 files
- Data stored on VX-54FT card can be recalled on sub display
- Available
- For dedicated printer only (hard copy of sub display contents can be produced on dedicated printer)
- AC output according to selected frequency weighting characteristics (O.A.)
- 16 hours continuous operation (using PV-83CW, at room temperature, with alkaline batteries)
- -10 to +50 ºC, max. 90 % RH

**Options**

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