Vibration Displacement, Velocity and Acceleration Conversion

Convert a sinusoidal vibration between displacement, velocity and acceleration at a frequency, in peak, peak-to-peak and RMS values, and in g.

Method: Sinusoidal motion: v = ω x; a = ω v; RMS = peak/√2

Input parameters

Unit system: SI

Parameter	Value	Unit
Velocity (RMS) From a peak reading divide by √2; from a peak displacement x_p use 2πf·x_p/√2.	4.5000	mm/s
Frequency	24.667	Hz

Calculated results

Parameter	Value	Unit
Velocity (peak)	6.3640	mm/s
Displacement (peak)	41.062	µm
Displacement (peak to peak)	82.123	µm
Acceleration (RMS)	0.69743	m/s²
Acceleration (peak) in g	0.10058	

Notes for this case

- Exact for a single frequency; for a mixed signal convert each spectral line separately. Acceleration (RMS) is in m/s².

Formula and method

$$v_p = \sqrt{2}\, v_{rms}, \quad x_p = \frac{v_p}{2\pi f}, \quad x_{pp} = 2x_p$$

$$a_{rms} = 2\pi f\, v_{rms}, \quad a_g = \frac{2\pi f\, v_p}{g}$$

Variables

v_{rms}	Velocity (RMS)	m/s
f	Frequency	1/s
v_p	Velocity (peak)	m/s
x_p	Displacement (peak)	m
x_{pp}	Displacement (peak to peak)	m
a_{rms}	Acceleration (RMS)	m/s²
a_g	Acceleration (peak) in g	-
g	Standard gravity, 9.80665	m/s²

Method and standards

Derivatives of a sinusoid.

Assumptions and limits

- The input is RMS velocity. A peak velocity reading is divided by √2 first; a peak displacement x_p converts as v_rms = 2πf x_p/√2.
- RMS acceleration is in m/s² in every unit system (there is no acceleration unit to convert it to).
- Single sinusoid.

References

- Sinusoidal motion: v = ω x
- a = ω v; RMS = peak/√2

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/vibration-noise/vibration-unit-conversion

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.