ON DYNAMIC RANGE

Dynamic range is defined by the ratio of the largest to the smallest signal that can be reliably transmitted by a particular system, measured in decibels. The dynamic range is limited upward by the system full scale, above which the signal is clipped, and downward by the noise of the system. 20 dB represents a factor of 10, so 120 dB represents a factor of 10^6 = 1,000,000. For an Analog-to-Digital Converter, the dynamic range decreases with increasing sampling rate, because of higher noise floor at higher sampling rates.

Kinemetrics (KMI) used and continue to use a traditional calculation method of the dynamic range: the full scale RMS divided by the noise RMS, where RMS stands for Root Mean Square. This definition is in itself consistent (ratio of two RMS levels), generic (can be applied to any type signal) and repeatable (will give the same result for the same system under the same conditions).

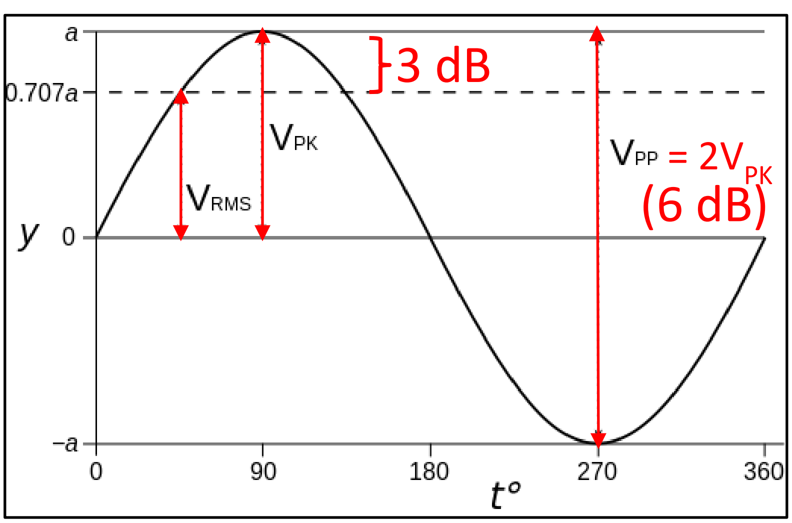
The picture below shows that for a sine wave with zero-to-peak amplitude $a = V_{PK}$, its RMS value is $V_{RMS} = 0.707a$ or 3 dB less than a. The noise RMS N_{RMS} is, let's say, within the thickness of the baseline (zero line) in the picture below. The dynamic range DR is given by the logarithm of the ratio of two RMS values:

$$DR_{KMI} = 20 \log(V_{RMS} / N_{RMS})$$

However, some manufacturers use, without specifying or mentioning only in small print, a different definition to calculate the dynamic range meant to yield higher numbers: instead of V_{RMS}, they use

$$V_{PP} = 2V_{PK} = (2 / 0.707)\, V_{RMS} = 2.83\, V_{RMS}$$

Therefore, their dynamic range is $20 \log(2.83) = 9\text{dB}$ numerically higher than Kinemetrics' DR_{KMI}. When making comparisons, the user is advised to verify whether the 9dB increase comes into play.



Graph showing how using V_{PP} instead of V_{RMS} (an arbitrary calculation method) adds artificially 9 dB to the actual dynamic range (modified from www.wikipedia.com).