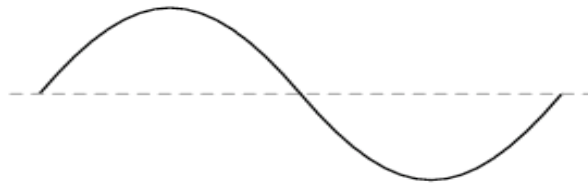


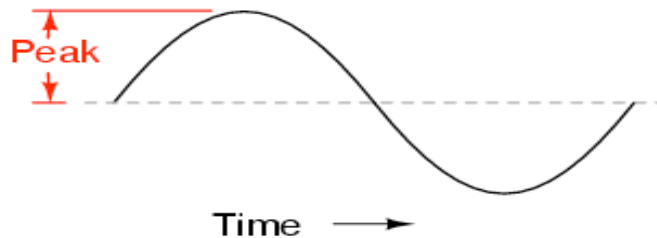
Measuring Amplitude – Peak and RMS

One of the most important and common things an engineer has to do is watch out for levels. Too little amplitude and you might hear more noise, and fail to take advantage of the dynamic range of your equipment. Too much amplitude and you'll be clipping, going into the 'red'.



But how do you measure the amplitude of something that changes constantly, like the sinewave shown above?

One way is to measure its maximum amplitude. This is a **peak** measurement, the difference between 0 volts (the centre line) and the maximum positive peak.



Peak measurements tell you how loud the sound gets at its loudest moment. But they don't tell you how loud the mix sounds on average.

The **average** amplitude is a better indicator than the peak of how loud the mix sounds. For example, let's say we take three random measurements of the amplitude of a waveform. The measurements are 2, 3 and 7. The peak is 7, but the average level, the perceived loudness, is only 4.

$$2+3+7 = 12$$

$$12 / 3 = 4$$

TO CALCULATE AVERAGE:

1. ADD all the values
2. Divide the total by how many values there are.

In electronics, there's a special kind of average called **RMS**, which stands for **Root Mean Square**. A mix may have loud peaks, but if its RMS level is low, it won't sound as loud as it could.

RMS is a kind of averaging that involves squares and square roots. You square the values before you average them. Then calculate the square root of the average to get the RMS. The RMS of 2, 3, and 7 would be 4.5:

$$2^2 + 3^2 + 7^2 = 4 + 9 + 49 = 62$$

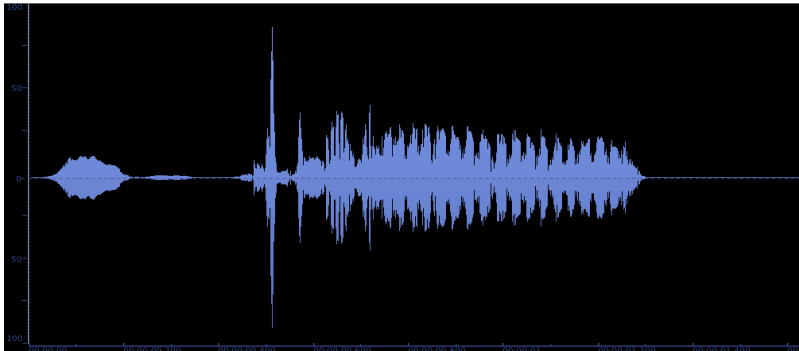
$$62 / 3 = 20.6$$

$$\text{square root of } 20.6 = 4.5$$

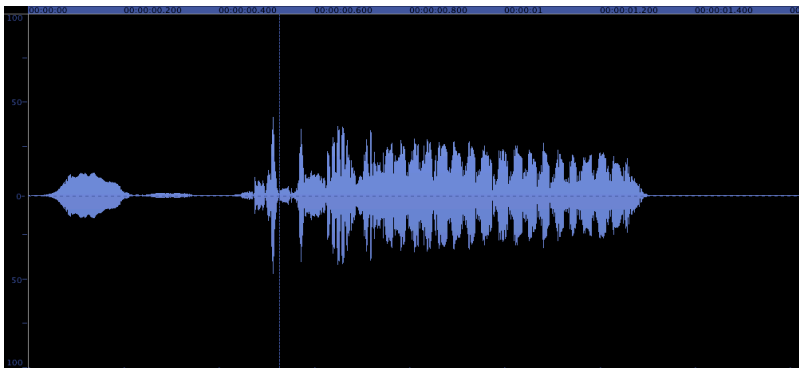
TO CALCULATE RMS:

1. SQUARE all the values
2. Take the average of the squares
3. Take the square root of the average

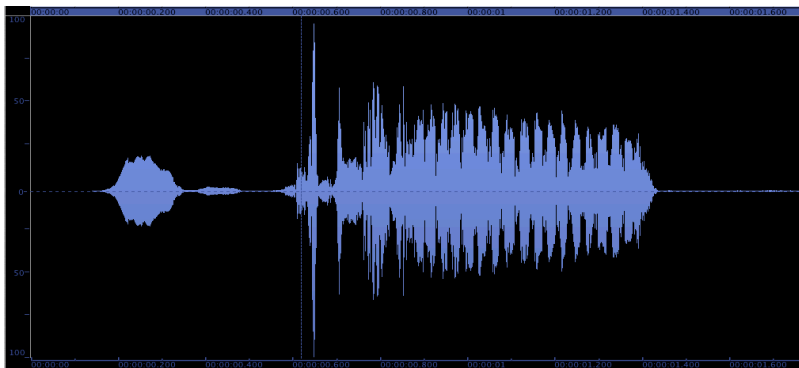
A **compressor** makes a louder mix possible by reducing the peaks. Then you can increase the volume of the mix without clipping.



Original sound, with a noticeable peak.



Peak is reduced by compression.



Sound can be turned up until peak reaches its previous level.

Compressors can be set to respond to peak levels, or to RMS levels. Peak compression is useful during the recording process, or on individual tracks in a mix. RMS compression is useful on the whole mix, to gently narrow the dynamic range of the mix, allowing it to be turned up.