

Mains UK



If the current constantly changes direction it is called alternating current, or ac. Mains electricity is an alternating supply. The UK mains supply is about **230V**. (RMS)

It has a frequency of 50 cycles per second or 50 Hertz, which means that it changes direction 50 times a second.

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Frequency Calculations



If Mains frequency is **50 Hz** one cycle lasts **1/50 sec**

Hence we can say that

$$\begin{aligned} 0.02s &= \text{time period } T \\ 1/T &= f = 1/ 0.02s = 50s^{-1} \\ 50s^{-1} &= 50\text{Hz} \end{aligned}$$

Easy way to think is more cycles per second is a higher frequency. Use the X-Scale for time and add it up to form a complete cycle. i.e. 1ms/div is $1 \times 10^{-3}s$ per 1cm block.

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Peak to RMS



When we talk about AC Voltage or Current it changes as a sinewave. This means that it is not steady and you cannot use normal $V=IR$ equations. So we convert it from that to the "rms" or "DC" equivalent in terms of power or energy delivery.

This means we can compare the two and then do normal circuit calcs.

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Mains Peak and RMS



The AC supply goes from $\pm 325V$ as a peak but we class this as only 230V D.C or RMS equivalent as there is a conversion formulae.

RMS voltage or Current = Peak voltage or Current / $\sqrt{2}$
You can think of it as being scaled down as RMS is always less than Peak.

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Circuit Calculations



If you have the peak voltage you must convert to RMS before you use the normal equations i.e.
Peak Voltage (V_o) = **5V**
so RMS Voltage = **$5V/\sqrt{2} = 3.5V$** .

Then if we put 5V peak across a 4W resistor the RMS current would be
 $3.5V / 4W = 0.88A$ (RMS Current)

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Power and AC



We can also see from the idea that RMS voltage or Current = Peak voltage or Current / $\sqrt{2}$ so if Power = Voltage x Current...

$$\begin{aligned} P_{\text{rms}} &= V_{\text{rms}} \times I_{\text{rms}} \\ &= V_o/\sqrt{2} \times I_o/\sqrt{2} \\ &= P_o/2 \end{aligned}$$

So the RMS power is half that of the Peak power. Which also makes sense as V and I are lower!

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Timebase



On an oscilloscope the time base is a scale for the voltmeter. It means that when switched on you can see changes to V with time.

This allows us to see a sinewave or decay of a capacitor. If turned off you only see a dot with DC or a vertical line with AC.

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Voltage Scale



The vertical axis on an oscilloscope shows you the PD across whatever you connect it to.

It is a simple way of comparing traces and can be scaled to enable you to better see a result. We can also use an oscilloscope to see peaks of sound which arrive a distance or time apart and work out their speed.

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AS Chapter 6



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