A quick look at electrical units and symbols

You will find that a number of units and symbols are commonly encountered in electrical and electronic circuits. If you have already studied Module 3 you will already know all about them but if not the following notes should quickly get you up to speed!

Unit	Abbrev.	Symbol	Notes
Ampere	A	*I*	Unit of electric current (a current of 1A flows in a conductor when a charge of 1C is transported in a time interval of 1s).
Coulomb	C	*Q*	Unit of electric charge or quantity of electricity (a *fundamental unit*)
Farad	F	*C*	Unit of capacitance (a capacitor has a capacitance of 1F when a charge of 1C results in a potential difference of 1V across its plates).
Henry	H	*L*	Unit of inductance (an inductor has an inductance of 1H when an applied current changing uniformly at a rate of 1A/s produces a potential difference of 1V across its terminals).
Hertz	Hz	*f*	Unit of frequency (a signal has a frequency of 1Hz if one complete cycle occurs in a time interval of 1s).
Joule	J	*E*	Unit of energy (a *fundamental unit*)
Ohm	Ω	*R*	Unit of resistance (a *fundamental unit*)
Second	s	*t*	Unit of time (a *fundamental unit*)
Siemen	S	*G*	Unit of conductance (the reciprocal of resistance).
Tesla	T	*B*	Unit of magnetic flux density (a flux density of 1T is produced when a flux of 1Wb is present over an area of 1 square metre).
Volt	V	*V*	Unit of electric potential (we sometimes refer to this as *EMF* or *PD*).
Watt	W	*P*	Unit of power (equal to 1J of energy consumed in a time of 1s).
Weber	Wb	*Φ*	Unit of magnetic flux (a *fundamental unit*)

Multiples and sub-multiples

Unfortunately, because the numbers can be very large or very small, many of the electrical units can be cumbersome for everyday use. For example, the voltage present at the antenna input of a VHF radio could be as little as 0.0000015 V. At the same time, the resistance present in an amplifier stage could be as high as 10,000,000 Ω! Clearly we need to make life a little easier. We can do this by using a standard range of multiples and sub-multiples. These use a *prefix* letter in order to add a *multiplier* to the quoted value, as follows:

Prefix	Abbrev.	Multiplier
tera	T	10^{12} (=1,000,000,000,000)
giga	G	10^{9} (=1,000,000,000)
mega	M	10^{6} (=1,000,000)
kilo	k	10^{3} (=1,000)
(none)	(none)	10^{0} (=1)
centi	c	10^{-2} (=0.01)
milli	m	10^{-3} (=0.001)
micro	μ	10^{-6} (=0.000,001)
nano	n	10^{-9} (=0.000,000,001)
pico	p	10^{-12} (=0.000,000,000,001)

Example 1

An indicator lamp requires a current of 0.15 A. Express this in mA.

Solution

To convert A to mA, we apply a multiplier of 10^3 or 1,000. Thus to convert 0.15 A to mA we multiply 0.15 by 1,000, as follows:

$0.15\text{A} = 0.15 \times 1{,}000 = 150\ \text{mA}$

Key point

Multiplying by 1,000 is equivalent to moving the decimal point *three* places to the *right* whilst dividing by 1,000 is equivalent to moving the decimal point *three* places to the *left*. Similarly, multiplying by 1,000,000 is equivalent to moving the decimal point *six* places to the *right* whilst dividing by 1,000,000 is equivalent to moving the decimal point *six* places to the *left*.

Example 2

An insulation tester produces a voltage of 2,750V. Express this in kV.

Solution

To convert V to kV we apply a multiplier of 10^{-3} or 0.001. Thus we can convert 2,750V to kV as follows:

2,750V = 2,750 × 0.001 = 2.75kV

Here, multiplying by 0.001 is equivalent to moving the decimal point three places to the *left*.

Example 3

A capacitor has a value of 27000pF. Express this in μF.

Solution

There are 1,000,000 pF in 1 μF. Thus, to express the value in 27,000pF in μF we need to multiply by 0.000,001. The easiest way of doing this is simply to move the decimal point six places to the left. Hence 27,000pF is equivalent to 0.027μF (note that we have had to introduce an extra zero before the 2 and after the decimal point).

Test your knowledge!

1. State the units for electric current.
2. State the units for frequency.
3. State the symbol used for capacitance.
4. State the symbol used for conductance.
5. A pulse has a duration of 0.0075 s. Express this time in s.
6. A generator produces a voltage of 440V. Express this in kV.
7. A signal has a frequency of 15.62 MHz. Express this in kHz.
8. A current of 570μA flows in a resistor. Express this current in mA.
9. A capacitor has a value of 0.22μF. Express this capacitance in nF.
10. A resistor has a value of 470 kΩ. Express this resistance in MΩ.