# Math, Scientific Notation and terms.

Scientific notation is used throughout electronics and it is important that you become comfortable with writing it and calculating with it. We will not try to teach scientific notation in depth in this book; but we will emphasize that it is a *fundamental* of serious importance in electronics and you will need to learn it just about now if you want to fully understand even how to identify electronic parts. Any book teaching electronics theory will get to it in early chapters. You will need to understand a bit of it immediately simply to understand the next section about markings on capacitors.

We know that some of the beginner's books that teach theory can be tough to follow and for learning the terminology that you will need. So, we'll try to help with some terminology. (You may have selected a book that made all of this very clear in which case you'll want to skip on ahead.) Once you understand Ohm's law and scientific notation, you have the beginning of a good handle on electronics and other formulae and math won't seem very mysterious.

You will hear the terms millivolts, milliamps and other "milli's" quite often. From way back in grade school, you'll remember that the first place behind the decimal is the tens column. Then the second column is the hundreds column and finally the third column is thousands. In Electronics, values that you find in these three columns are usually referred to as milli-something. For example, instead of saying "one one-thousandths of a volt", an engineer will say "one millivolt". And 0.100 volts is clearly one tenth of a volt, but engineers usually say 100 millivolts. And one one-hundredths of an amp is 10 milliamps. You can see that 50 milliamps has to be .050 amp, right? Remember that mil is one thousand from the Latin word *mille*. When you learn scientific notation, you'll also know that one mil can also be written $1 \times 10^{-3}$ and it is not uncommon to write 1mV.

Milli-
.000,000,000,000

Next, we look at *micro*. One microvolt is just exactly one one-thousandths of a millivolt and it could be written .000,001 volts or $1 \times 10^{-6}$ in scientific notation. When you assemble small circuits, the term microfarad will become very familiar to you. It can be written 1 ufd. The little 'u' indicates micro. Which is also 'millionths'.

Micro-
.000,000,000,000

And next there is *nano* and a nanovolt is one one-thousandths of a microvolt just as a nanofarad is one one-thousandths of microfarad. If you have a four nanofarad capacitor it could be written .000,000,004 farad or, much easier $4 \times 10^{-9}$ and so on.

Nano-
.000,000,000,000

Finally, there is pico which is sometimes also called micro-micro. This is about as small a number as you'll need in electronics. One picofarad can be written as .000,000,000,001 or $1 \times 10^{-12}$ farad and is often written 1uufd and pronounced as micro-microfarad. (But "one picofarad" is in fashion today; micro-micro will be heard mostly from your elders.)

Pico-
.000,000,000,000

Keep these relationships well in mind as they are absolutely necessary to your understanding of electronics. Scientific Notation is behind some of the markings of parts, so be sure that you understand it as you move on to learn more about identifying parts.

**Terms you will see in text and on electronic parts.**

.000 = milli - m (example 16mV is sixteen millivolts is .016 volts)

.000,000 = micro = u (example 2ufd. is two microfarad is .000,002 farad)

.000,000,000 = nano = n (example 3nfd. is three nanofarad or .000,000.003 farad.)

.000,000,000,000 = pico = P or uu (example 4P on a capacitor is four picofarad, or four micromicrofarad)

If someone told you that a light emitting diode is drawing 20 milliamps of current at 1300 millivolts, would you understand what he is saying? If not, it is a good time to read the early chapters in a beginner's book about electronics theory. But they are telling you that the current the light "pulls" (or uses) .020 amperes when operated at 1.3 volts. Soon, this kind of language will be familiar to you and you'll realize that you speak 'electronics".