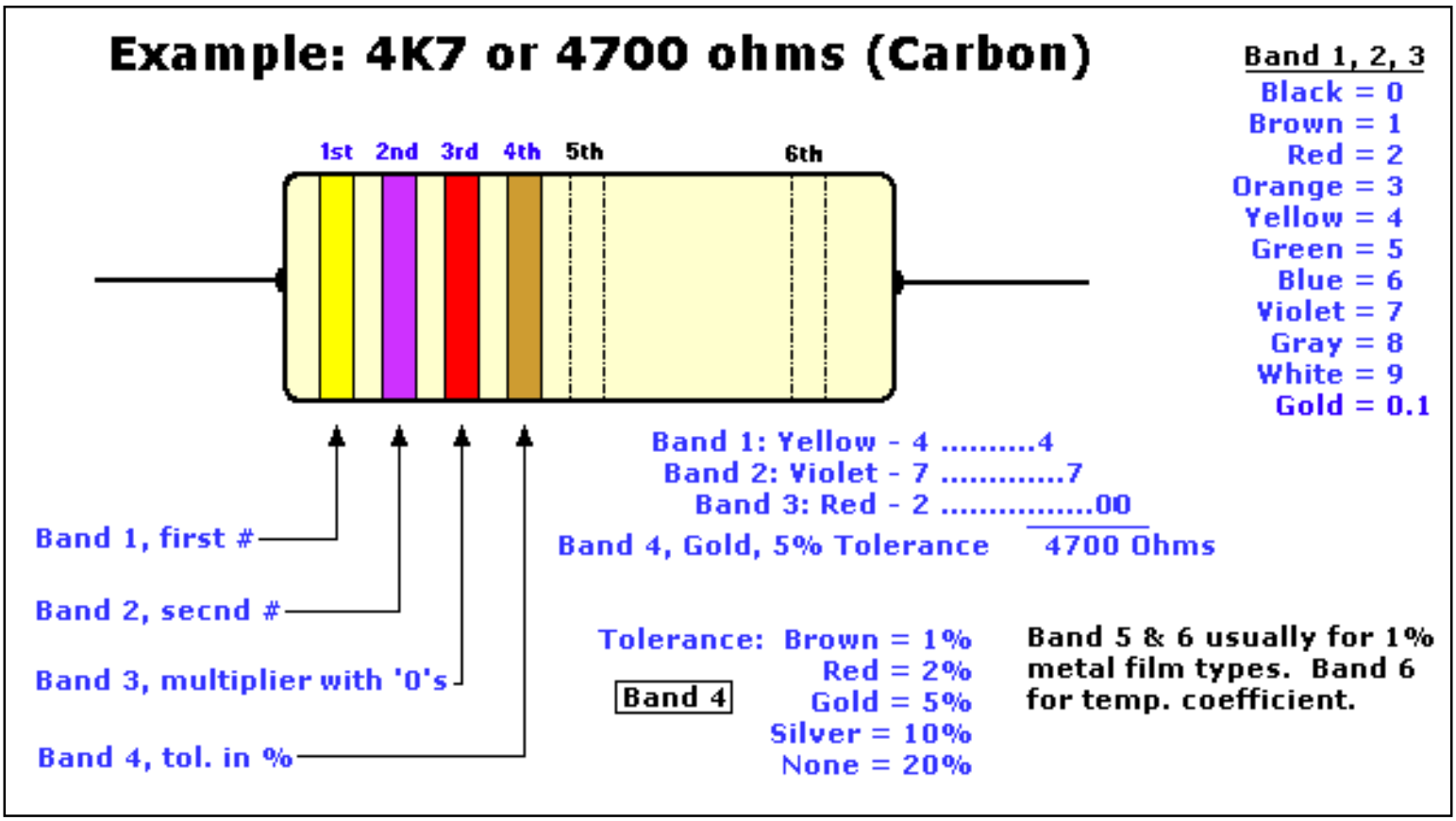
Resistor Color Code, Tutorial



Another example for a Carbon 22000 Ohms or 22 KiloOhms also known as 22K at 5% tolerance:

Band 1 = Red, 1st digit
Band 2 = Red, 2nd digit
Band 3 = Orange, 3rd digit, multiply with zeros, in this case 3 zero's
Band 4 = Gold, Tolerance, 5%

Example for a Precision Metal Film 19200 Ohms or 19.2 KiloOhms also known as 19K2 at 1% tolerance:

Band 1 = Brown, 1st digit
Band 2 = White, 2nd digit
Band 3 = Red, 3rd digit
Band 4 = Red, 4th digit, multiply with zeros, in this case 2 zero's
Band 5 = Brown, Tolerance, 1%
Band 6 = Blue, Temperature Coefficient, 6

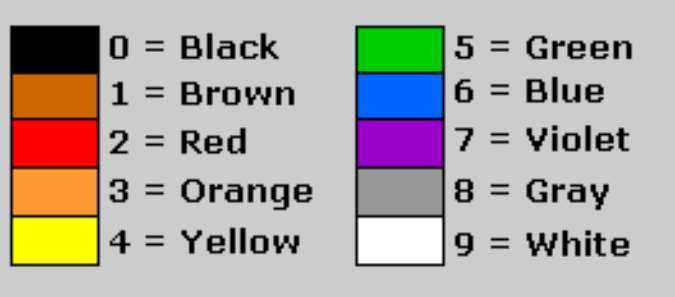
If you are a bit serious about the electronics hobby I recommend learning the "Color-Code". It makes life a lot easier. The same color code is used for everything else, like coils, capacitors, rf-chokes, etc. Again, just the color code associated with a number, like: black=0 brown=1 red=2, etc, etc.

If you are interested in learning the code by memory, try the steps below to help you 'Learn the Color-code'.
Make sure you add the number to the color, like: 0 is black, 1 is brown, 2 is red, etc. etc.
Do not proceed to step **3** until you know the color-code backwards, forwards, and inside-and-out (trust

me!)

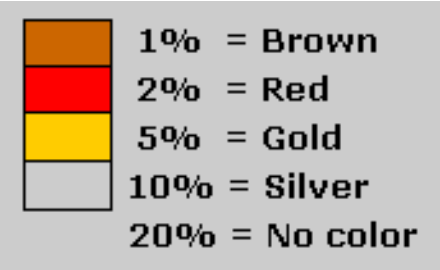
Can you *'create'* your own resistors? Sure thing, and not difficult. Here is how to do it: Draw a line on a piece of paper with a soft pencil, HB or 2HB will do fine. Make the line thick and about 2 inches (5cm) long. With your multimeter, measure the ohm's value of this line by putting a probe on each side of the line, make sure the probes are touching the carbon from the pencil. The value would probably be around the 800K to 1.5M depending on your thickness of the line and what type of pencil lead is used. If you double the line the resistance will drop considerably, if you erase some of it (length-wise obviously!) the resistance will increase. You can also use carbon with silicon glue and when it dries measure the resistance, or gypsum with carbon mixed, etc. The reason for mentioning these homebrew resistors is that this method was used in World War II to fix equipment when no spare parts were available. My father, who was with the Dutch resistance during WWII, at that time made repairs like this on many occasion.

Step 1: Learn the colors.

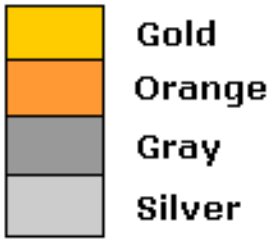


The color 'Gold' is not featured in the above table. If the 3rd band is gold it means multiplying by 0.1. Example, 1.2 ohm @ 5% would be brown-red-gold-gold. 12 multiplied by 0.1 gives 1.2 Don't get confused by gold as a resistance or a tolerance value. Just watch the location/posistion of the band.

Step 2: Learn the tolerances.



Step 3: Do the exercises below. (Cheating gets you nowhere :-))

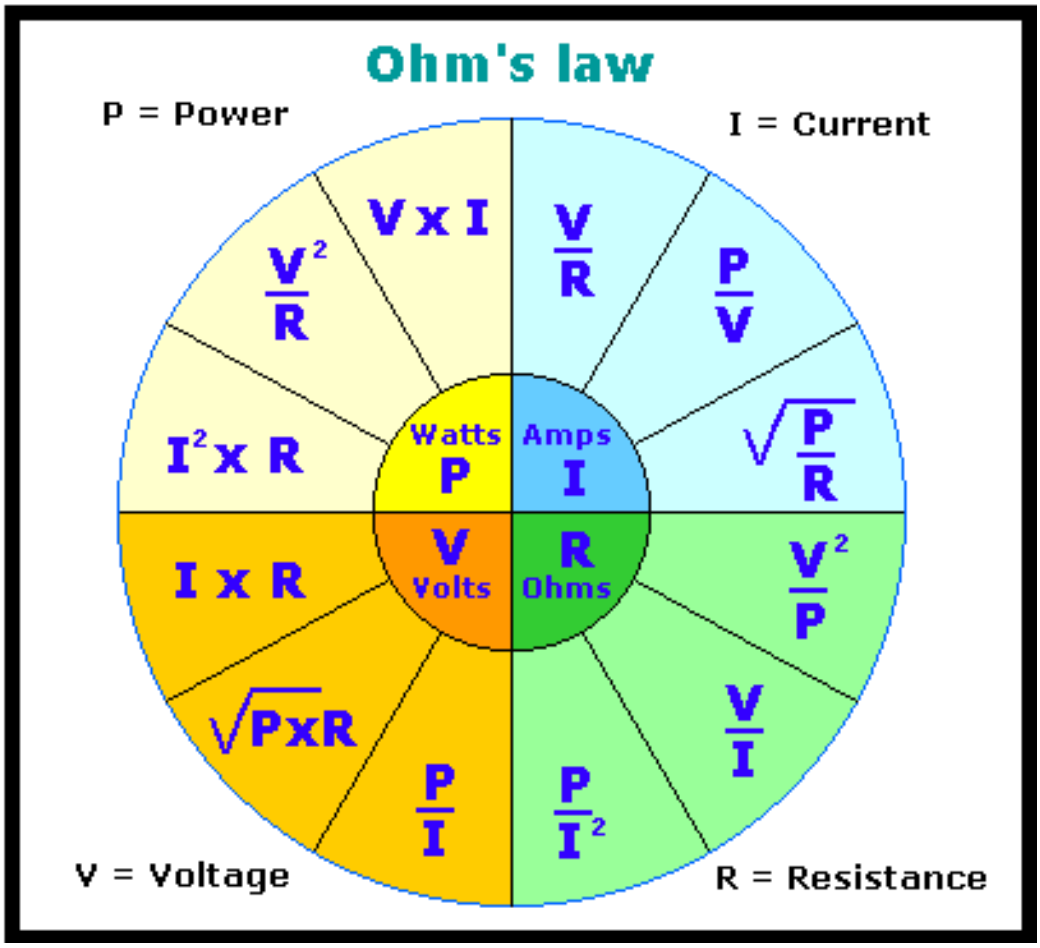


Colors I used for 'Gold, Orange, Gray, and Silver'

To get familiarized with abreviations in values, I used below 4700 or 4K7, 1000 or 1K, which is all the same. Every thousand (1000) is called a 'K' which stands for 'Kilo'. The 'M' stands for 'Mega' (million). 1 Mega is 1000K or 1000 000 ohms. So 4K7 means 4 thousand and 7 hundred or 4700 ohms. 6K8 means 6 thousand and 8 hundred or 6800 ohm. One more example, 1M2 means 1million and 200.000 or 1.200000 ohms. These abreviations you find everywhere in the industry, schematics, diagrams and whatever. It is normal and takes a bit of time to get used to.

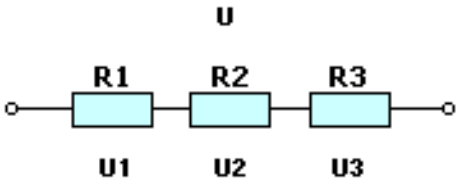
This should get you started. If it looks difficult to you, don't worry. It is easy. Whenever you have a spare moment practise the color code in your head. It's like learning to ride a bicycle, once you know how to do it you never forget (like riding a bicycle). Good luck my friends!

Resistor Formulas



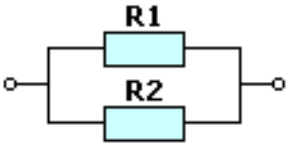
$R = \frac{V}{I}$ **Ohm's Law. R is Resistance, V is Volt, I is Current.**

$R = \rho \frac{1}{A}$ $(\rho = \frac{1}{4} \pi d^2)$ ρ **is called 'Rho'**



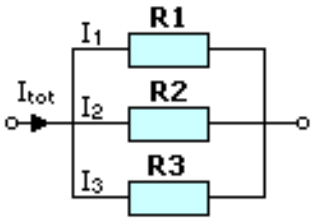
$$R_s = R_1 + R_2 + R_3$$

Resistors in series; just count them up!



$$R_p = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

Two resistors in parallel



$$I_{tot} = I_1 + I_2 + I_3$$

$$I_{tot} = I_1 + I_2 + I_3 = \frac{1}{R_p} : \frac{1}{R_1} : \frac{1}{R_2} : \frac{1}{R_3}$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Multiple resistors in parallel

I forgot to mention a very important thing, there are two resistor *body* colors which you should know what they are if you are thinking of repairing electronic circuits. These body colors are white, and blue (and sometimes composite green depending on where you live) and are used to indicate non-flammable and/or fusible resistor types. It is important to know **NOT** to replace these with ordinairy type resistors. The non-flamable types are there for a reason (they don't burn when overheated) and just replacing it with a normal type resistor may create a fire-hazard or worse. The fusible types are usually white with one black band in the middle of the body. So if you ever are looking for the 'fuses' check these out. They are less than 0.1 ohm, carbon.
In the case of surface mount resistors; since they are so tiny they feature the same coding as on capacitors. For example, if it says 103 this means 10 Kilo-ohm (10 + 3 zeros), 104 means 10 + 4 zeros (100K), 222 means 22 + 2 zeros (2K2). Easy huh?