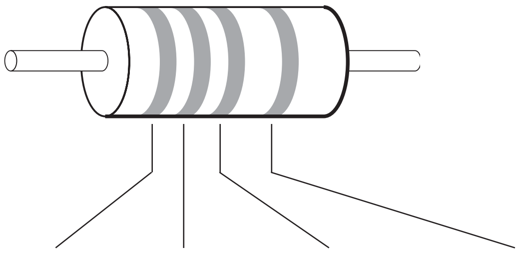
RESISTOR VALUES

COLOUR CODE

The value of a resistor can be worked out from a colour code which consists of a number of coloured bands. The bands are 'read' from left to right and give the resistance value in ohms (Ω). The first two bands state the first two digits of the value and the third band, the number of zeros.



Colour	Band 1	Band 2	Band 3	Tolerance
Black	0	0	x1	
Brown	1	1	x10	
Red	2	2	x100	
Orange	3	3	x1000	
Yellow	4	4	x10,000	
Green	5	5	x100,000	
Blue	6	6	x1,000,000	
Violet	7	7		
Grey	8	8		
White	9	9		
Silver				±10%
Gold				±5%

For example: yellow, violet, red = 4700 ohms
brown, black, brown = 100 ohms

WRITTEN VALUES

Instead of writing out several zeros for high value resistors, we use larger units of resistance:

1 kilohm (kΩ) = 1000 Ω
1 megohm = 1 000 000 Ω
so 4 700 Ω = 4.7 kΩ and 2 200 000 Ω = 2.2 MΩ

The 'k' can be thought of as a multiplier i.e. × 1000
and the M as × 1 000 000.

This is the most commonly used method of writing resistor values and the most easily understood.

PRINTED CODE

This code gives the value of a resistor by using letters and numbers. Manufacturers print the code on fixed and variable resistors where it would be difficult to use the colour code. Sometimes it is also used in circuit diagrams and books.

'R' stand for 1
'K' stands for 1,000
'M' stands for 1 000 000 and the position of the letter gives the decimal point.

For example:
A 10 Ω resistor is written as 10R.

A 2 000 Ω resistor is written as 2K0 (sometimes the 0 is left out so this becomes 2K).

A 4.7 MΩ resistor is written as 4M7.

Letters are added to the end of this code to give the manufacturers tolerance on the value.

J = ± 5%
K = ± 10%

For example:

6K8K = 6.8 kΩ ± 10%

WHICH K

Remember that lower case k's are used in written values to mean × 1000 **but** capital K's are used in the printed code to mean both × 1000 and a tolerance of ± 20%.

Tolerances on Resistors

Electronic components are not manufactured to have an exact value. For example, a resistor can have a stated resistance of 1 kΩ and a tolerance of ±5%. This means that the value quoted is not exact. It could be 5% more or 5% less than 1 kΩ. The tolerance is the accuracy to which the resistor has been made. The tolerance is given by the coloured band on the end of the resistor.

Gold band = 5% tolerance.
Silver band = 10% tolerance.

Here is an extract from a catalogue.

Tolerance ±5%
10 Ω
15 Ω
22 Ω
33 Ω
47 Ω
68 Ω
100 Ω

If you use a 47 Ω resistor, what is the greatest resistance this could have?

The catalogue says there is a 5% tolerance on these, so we need to find 47 + 5% of 47 Ω.

5% of 47 Ω = 2.35 Ω.

So the greatest value is

47 + 2.35 = 49.35 Ω.

Preferred Values

Manufacturers of resistors cannot supply every possible value of resistor, so they make available preferred values only.

The E12 and E24 series of preferred values start as follows:

E12	E24
10R	10R
	11R
12R	12R
	13R
15R	15R
	16R
18R	18R
	20R
22R	22R
	24R
27R	27R
	30R
33R	33R
	36R
39R	39R
	43R
47R	47R
	51R
56R	56R
	62R
68R	68R
	75R
82R	82R
	91R
100R	100R
	110R
120R	120R
	130R
150R	150R
	160R
180R	180R
	200R
220R	220R
	240R
270R	270R
	300R
330R	330R
	360R
390R	390R
	430R
470R	470R
	510R

E12	E24
560R	560R
	620R
680R	680R
	750R
820R	820R
	910R
1K	1K
	1K1
1K2	1K2
	1K3
1K5	1K5
	1K6
1K8	1K8
	2K0
2K2	2K2
	2K4
2K7	2K7
	3K0
3K3	3K3
	3K6
3K9	3K9
	4K3
4K7	4K7
	5K1
5K6	5K6
	6K2
6K8	6K8
	7K5
8K2	8K2
	9K1
etc	etc

Power Rating

Resistors heat up when they pass current. If they get too hot, they burn out. All resistors are given a power rating in watts (W). Higher wattage resistors are physically larger and can dissipate or get rid of more heat. The normal size resistor used in electronics work is rated at 0.25 W.