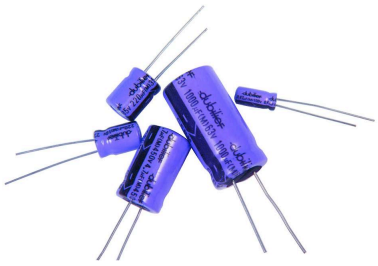
Craig's Guide to Capacitors

See p812 of catalogue 2011/12 – Here you will find explanations of the different types of capacitor, along with their characteristics and typical applications.

The unit of capacitance is the 'Farad', with most capacitors having values a tiny fraction of this — the largest of which you are likely to encounter having a value of just one Farad.
You *really* should go and have a look at the one Maplin stock `[A07GU]` over with the car stereos, to see how ginormous it is in comparison to the ones we sell over the service counter!

NOTE: There are many different kinds of capacitor, as explained in the catalogue, but it is the electrolytic type that is most often requested.

Electrolytic Capacitors



Of all the components in a device, these are probably the most prone to failure. Their construction renders them susceptible to damage from overheating and reverse polarity. Customers often bring in circuit boards on which can be seen an electrolytic capacitor which has swollen and/or leaked.

To find a replacement we need to know:

1. The value of capacitance, which for electrolytic capacitors is almost always in µF (microfarads, or $x10^{-6}F$)
2. Its maximum operating voltage (higher replacement is ok)
3. Its maximum operating temperature (higher replacement is ok)

General-use electrolytic capacitors are rated at 85ºC, but some applications require high-temperature capacitors, which are rated at 105ºC — **so always check**!

SALES

Does the customer require a soldering iron?
The Antex irons are excellent quality (Craig's personal recommendation!) and the 18W variant [FY62] is a great all-rounder for small electronic jobs.
The soldering iron stand FR20 is very sturdy and comes with a sponge for cleaning the tip too.

(Tip packs N14FR & N15FR fit the above-mentioned iron)

What about solder?

A de-soldering pump to help remove the faulty component? [N40CH]

If the customer has never soldered before, we sell a small book called 'The Art of Soldering' [CJ23] for just £3.99

APPENDIX

The following table shows how picofarads, nanofarads and microfarads all compare in magnitude to values in Farads:

Farads	Microfarads **µF** (10^{-6})	Nanofarads **nF** (10^{-9})	Picofarads **pF** (10^{-12})
0.001	1000		
0.000 1	100		
0.000 01	10		
0.000 001	1.0	1000	
0.000 000 1	0.1	100	
0.000 000 01	0.01	10	
0.000 000 001	0.001	1.0	1000
0.000 000 000 1	0.000 1	0.1	100
0.000 000 000 01	0.000 01	0.01	10
0.000 000 000 001	0.000 001	0.001	1.0
0.000 000 000 000 1	0.000 000 1	0.000 1	0.1
0.000 000 000 000 01		0.000 01	0.01
0.000 000 000 000 001			0.001

A capacitor is a device for storing ***charge***, usually for a few fractions of a second. The electrons are able to enter and exit the capacitor almost instantaneously (in human terms), unlike a typical battery. For example, the common AA cell produces electricity by means of a chemical reaction, and with a rechargeable cell this reaction is reversible. (It is also reversible with a normal alkaline cell, but that's another story that the Duracell Bunny doesn't want you to know!)

Larger capacitors are often used as an electrical reservoir in DC power supplies to meet brief surges in demand without the voltage dropping. In the same manner, they can help to smooth the ripple in a power line — this is where the voltage fluctuates up and down after being converted from AC to DC.

Smaller capacitors are used in "tuned circuits" to create oscillators (e.g. a circuit which oscillates between positive and negative) which are used in devices from sound generators, clocks / timers, radio equipment etc.

The principle behind a capacitor's construction is very simple. It usually comprises two conductive plates which are in very close proximity to each other yet are electrically insulated via something called a dielectric. The materials for the dielectric can be different kinds of plastics, or even air in the case of variable capacitors.
Electrolytic capacitors are built from two sheets of foil sandwiching a sheet of paper-like material soaked in electrolyte (which is the dielectric), and then rolled up tightly. Except for special versions, electrolytic capacitors are polarised in that the charge can only flow in one direction without causing damage to the electrolyte.

Because capacitors do take a finite time to charge and discharge: as you would expect, the larger ones take longer. At higher frequencies smaller capacitors are required to the point where at the frequencies of modern communications equipment, the values used are measured in picofarads. Where 1 picofarad (pF) = one trillionth (10^{-12}) of a farad.
With values this small in use throughout the electronics, conductive materials in close proximity to one another can cause unwanted capacitance that can have adverse effects.

The capacitive touchscreens of smartphones and tablets employ the conductivity of human skin to vary the capacitance at the points on the screen where it is being touched!

Bibliography

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