# Investigating fuses: What happens to the current flowing through a fuse as it is overloaded and 'blows'? – Teachers' Guide

This activity is one in which the students produce and analyse graphs of Current against Time for two different types of fuse – Fasting acting/Quickblow and Time delay/Slowblow.

Very often students do not realise what the fuse rating means. Many think that a 100mA fuse will 'blow' at a current of 100mA, when it is actually the current that could pass indefinitely. Reference to datasheets on fuses (see weblinks) show well how the length of time before a fuse 'blows' depends on the overload current being passed.

Although there is a little in the students' notes on the purpose of a fuse, it is always useful to emphasise that they do not just protect devices from overload. Should there be a short-circuit between the Live and an Earthed chassis of an appliance, a fuse would 'blow', switching off the electricity, and so protect the user from an electric shock.

A brief comment has been made in the students' activity notes of how the current is sensed and calculated when dataloggers can only accept voltages as inputs. This can give you extra opportunities to deal with the relationships between current, voltage and resistance.

The *PASPort* Voltage/Current sensor can sample at a rate up to 1000 samples per second and this rate is needed here to show the fast changes that take place.

## Typical results

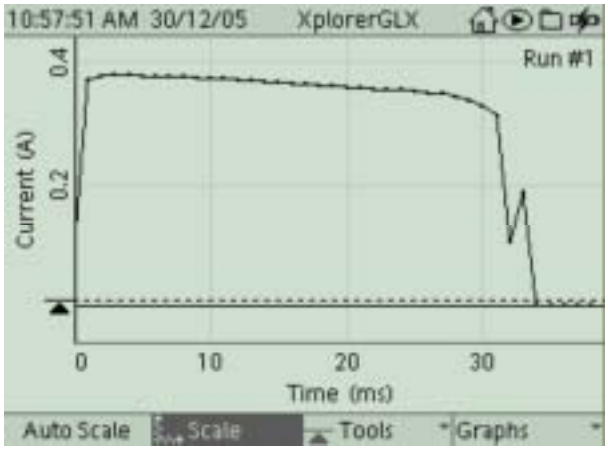


**Figure 1 Current-time graph for a 100mA 'Quickblow' fuse**

As you will note, the current passed by this 100mA actually rose to nearly 400mA before 'blowing' and lasted just over 30ms. If the overload had been smaller it would have lasted for rather longer.

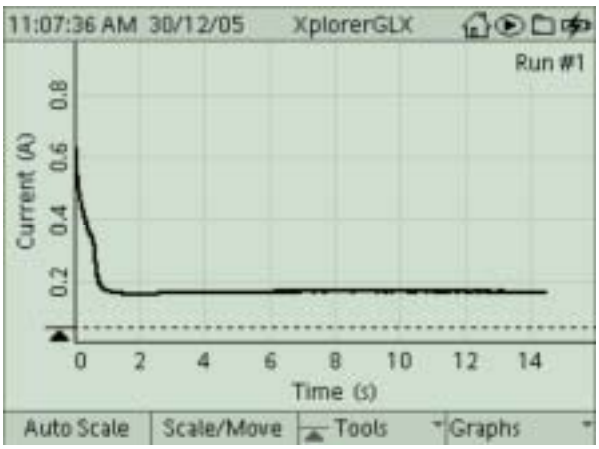


**Figure 2 Current-time graph for the 100mA 'Slowblow' fuse**

Here you can see that this fuse is lasting a lot longer despite the current initially rising to just over 800mA. I stopped datalogging after 14 seconds as memory would soon get filled up, but it would no doubt have lasted quite a lot longer. A greatly expanded version of the very start of Figure 2 is shown below.

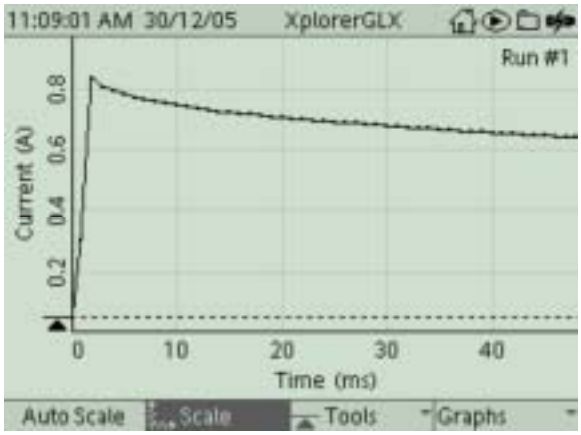


**Figure 3 Greatly expanded beginning section of Current-time graph for the 100mA 'Slowblow' fuse**

## Answers to questions

**Q1** Slowblow – just over 800mA, Quickblow – a little under 400mA.
These may vary with the fuses obtained and the state of the battery.

**Q2** Slowblow – around 2ms, Quickblow – also around 2ms.
Again these may vary with the fuses obtained and the state of the battery.

**Q3** The Slowblow had not 'blown' even after 14 seconds. The Quickblow had 'blown' after around 34ms. Again these may vary with the fuses obtained and the state of the battery.

**Q4** Quickblow - the current rose sharply, appeared to almost level off for a while before falling sharply to zero. (As you will note on Figure 1 there was an odd 'spike' just before the fuse melted.) Slowblow – the current rose sharply and there was then a steady 'decay' to a levelled off value which continued until datalogging was stopped.

## Useful weblinks

### Focusing on fuses
http://www.nmsu.edu/Research/tdi/public_html/pdf-resources/cc67.pdf
This is an article by John Wiles on fuses from *Home Power* Magazine October/November 1998. It contains a lot of information on why to use a fuse, fuse ratings, the differences between ac and dc fuses, what current-limiting fuses are, automobile fuses, who makes fuses and more.

### Fuse (electrical)
http://en.wikipedia.org/wiki/Fuse_(electrical)
This Wikipedia, the free encyclopaedia, site provides lots of information on fuses, their characteristics, types of package, circuit breakers and much more. Excellent.

### Fuse Terminology
http://www.belfuse.com/Data/DBObject/fuseterm.pdf
A useful set of information sheets from a manufacturer of electronic devices including fuses on the terminology used about fuses. Bel is an American company that employs over 5000 people across the world.

### Littelfuse datasheet
http://www.littelfuse.com/data/en/Time_Curve/218-228.tc.pdf
This datasheet on a Time Lag fuse shows clearly how fusing timing depends on the overload current.