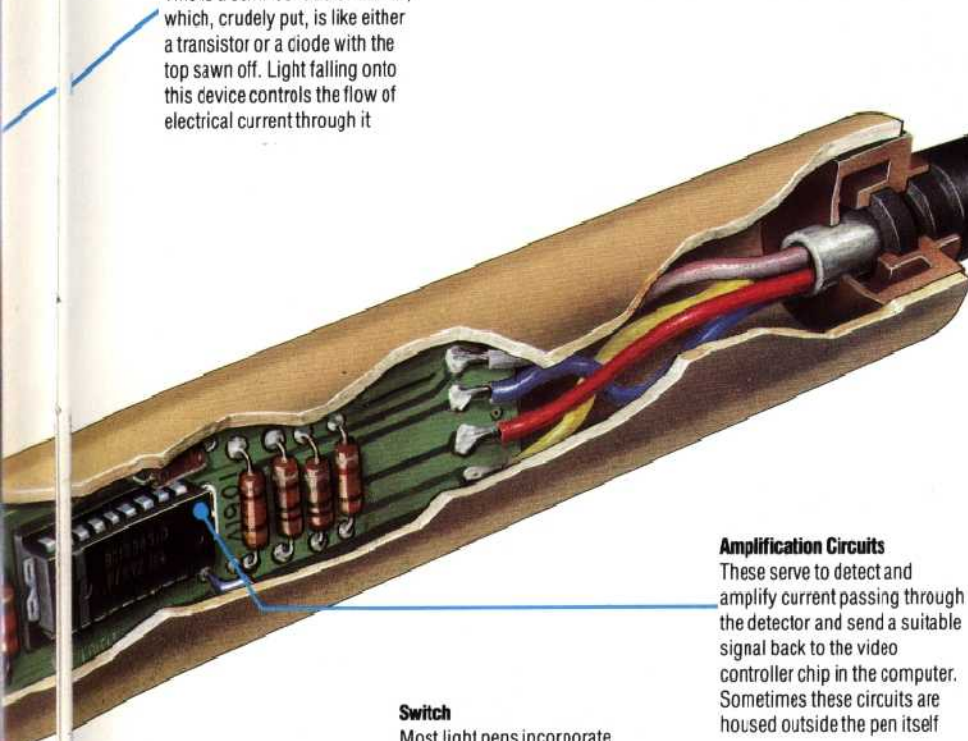


**Photo Detector**

This is a semi-conductor device, which, crudely put, is like either a transistor or a diode with the top sawn off. Light falling onto this device controls the flow of electrical current through it



**Amplification Circuits**

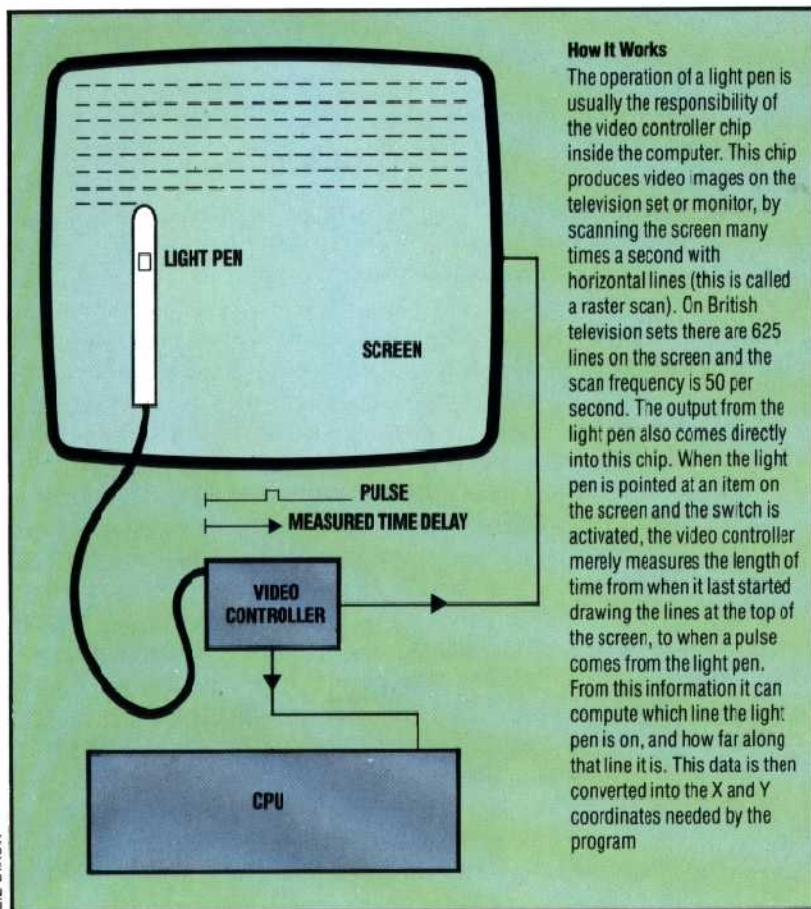
These serve to detect and amplify current passing through the detector and send a suitable signal back to the video controller chip in the computer. Sometimes these circuits are housed outside the pen itself

**Switch**

Most light pens incorporate some sort of a switch, either operated by finger pressure or, in some cases, activated by pressing the light pen onto the screen. The switch is needed so that the light pen doesn't react to light (such as room lights) when it is not being used to select an item on the screen

**Lead**

This telephone-style coiled cable leads directly into the back of the computer, and from there to the video controller chip



**How It Works**

The operation of a light pen is usually the responsibility of the video controller chip inside the computer. This chip produces video images on the television set or monitor, by scanning the screen many times a second with horizontal lines (this is called a raster scan). On British television sets there are 625 lines on the screen and the scan frequency is 50 per second. The output from the light pen also comes directly into this chip. When the light pen is pointed at an item on the screen and the switch is activated, the video controller merely measures the length of time from when it last started drawing the lines at the top of the screen, to when a pulse comes from the light pen. From this information it can compute which line the light pen is on, and how far along that line it is. This data is then converted into the X and Y coordinates needed by the program

the main screen, it leaves a line in that colour.

The user can also select different line widths or textures from the bottom of the screen to paint with, and has the ability to draw circles and squares. In short, everything that we discussed in 'The Electronic Artist' (see page 26) can be achieved with a light pen and probably a great deal faster than with a keyboard.

Games that make use of light pens are starting to appear on the scene, too. Zapping alien monsters is a great deal easier with a light pen than through the keyboard, so the games have to be made considerably harder. Rather more sedate games such as computerised chess can benefit — point to where you want the knight to move and the computer looks after the rest.

Perhaps the largest group of light pen users, however, is in engineering and design offices. Computer Aided Design (CAD) systems are featured widely in advertisements for new cars — in fact they are just like other computer systems, but with specialised software, and high-quality graphics. If a CAD system is being used to design a new electronic device, then the screen will feature representations of all the components that the designer may want access to, and these can be 'picked up' by the designer and placed where they are required anywhere on the screen.

The light pen is one of the best examples of a computer add-on that is both fun to use and of great practical value.

LIZ DIXON