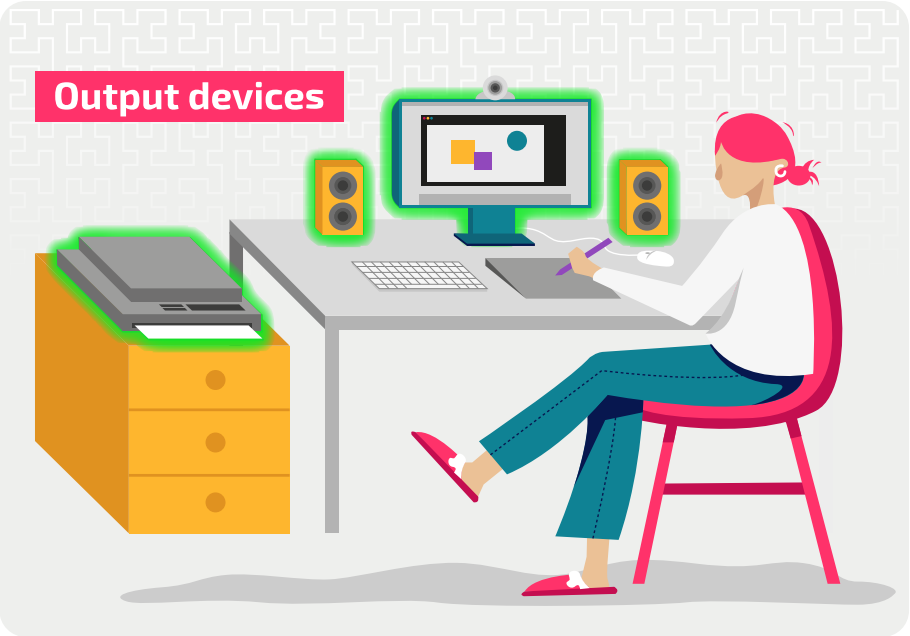
isaac computer science



# Output devices




Output devices

**Output devices** are peripherals that produce or display data and information from a computer system. Information is data that has been processed and formatted in a way that is useful for the end user.

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## Common output devices

There are many different devices that output data in different ways. Some of the more common devices, and their primary purpose, are listed below.

| Device | Purpose |
|---|---|
| Speakers | A speaker connected to a computer is a device that generates sound waves from data being received from a sound card. Speakers are often built into devices but can also be connected as external peripherals. |
| Inkjet printers | Inkjet printers use liquid ink to produce black-and-white or colour prints. High-end inkjet printers can often handle specialist paper and print at very high resolutions (with the ability to show a large amount of detail).<br><br>Liquid ink produces rich colours, making this type of printer the most suitable for printing photographs.<br><br>The cost of ink is a key factor to take into account. Printer ink is often cited as being one of the most expensive commodities in the world, with small cartridges being the most expensive.<br><br>Inkjet printers are usually the printer of choice in the home because of their low upfront cost. They are also preferred by photographers and for print studios because of their superior colour production. |
| Laser printers | Laser printers are frequently used in the workplace. They print a whole page at a time, so are usually faster than inkjet printers. High-specification laser printers are capable of producing 200 pages per minute.<br><br>Laser printers do not use liquid ink. Instead, they use powdered ink called **toner**.<br><br>The quality produced by a laser printer is generally very good for text, but not so good for photo-quality images, as it is difficult to produce deep, rich colours. |
| Plotters | A plotter is a device that uses one or more pens to draw an image. Pens are lifted or applied to the paper as required, to produce very precise drawings. Plotters are often large devices that can handle very wide paper, sometimes on a drum to allow repeated layers to be printed.<br><br>Plotters are commonplace in engineering and architectural practices. |
| 3D printers | 3D printing allows for three-dimensional designs on a computer to be printed in solid form.<br><br>3D printers use **filament**, usually in the form of plastic-based resin, which is heated and printed layer (slice) by layer to form a solid object.<br><br>The potential for 3D printing is very exciting. Scientists are already exploring the use of special 3D printers — bioprinters — to make living body parts. |
| Display screens | Most computers have some form of display, often either a stand-alone monitor or a built-in screen.<br><br>**LCD screens** (liquid crystal display) are low cost, and are the most common display found in offices and on standard desktop and laptop computers. They are rapidly being superseded by **LED displays**. LED (light-emitting diode) technology uses less power than LCD, so LED displays are cheaper and more environmentally friendly to run.<br><br>A variant on traditional LED displays is **OLED screens** (organic light-emitting diode), which are currently being developed. OLEDs are lighter and more flexible than LED displays, which means that OLEDs are a good option for mobile devices such as phones and tablets. |

Which of the output devices from the table above would be most suitable for an architect to produce a scale model of a building they have designed?

**Click a button to show the answer**

What is your level of confidence that your own answer is correct?

Low Medium High

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## Specialist devices for people with a physical disability

Although not a specialist device, **speakers** are an important peripheral for people with visual impairments, to allow them to access content through **screen readers** and **text-to-speech utilities**. A screen reader is a software application that can support people with visual impairments to use a computer. A screen reader will read the contents of the screen to the user. It is important when designing applications to ensure that they are able to facilitate screen reading. An example of this is when using an image in an application, you are able to add a meaningful written description of what appears in the image, know as an **alt text**. This is text that appears on the screen as an 'alternative' if the image can't be displayed, but it is also an accessibility feature as it is the text that is used by a screen reader.

If the user can read Braille, a device known as a **refreshable Braille display** could be used. The device displays characters as a series of dots formed by pins that protrude through the flat surface of the device. As the information on the computer screen changes, so do the Braille characters on the display, allowing the user to read what is on the screen.

A Level **Printers**

The criteria that you may want to consider when choosing a suitable printer include speed, print resolution, the quality of colour reproduction, paper handling, and the cost of consumables.

Print resolution is measured in dots per inch (dpi), and a resolution of at least 300 dpi is needed for photo-quality images.

Most printers will handle sheets of A4 paper, but some users need smaller or larger printouts. Some situations require specialist paper.

Impact printers produce characters by striking the paper. They were once commonplace and useful for printing on multipart stationery (where the sheets are carbonated to produce two or more copies). Impact printers are noisy, and it is quite rare to find them in today's office environments. Faster, cheaper printers make it easy to produce multiple copies by selecting more than one copy, or by photocopying an original.

## Inkjet printers

Inkjet printers are non-impact printers that use liquid ink to produce black-and-white or colour prints. This type of printer can cost anything from tens to hundreds of pounds depending on factors such as speed, quality, and paper handling capability. High-end inkjet printers can often handle specialist paper and print at very high resolutions. Liquid ink produces richer colours, making this type of printer the most suitable for printing photo-quality images.

The cost of ink is a key factor to take into account. Printer ink is often cited as being one of the most expensive commodities in the world, with small cartridges being the most expensive.

Inkjet printers are usually the printer of choice in the home because of their low upfront cost. They are also preferred by photographers and for print studios because of their superior colour production and paper handling capabilities.

## Laser printers

Laser printers are frequently used in the workplace. They print a whole page at a time, so are usually faster than inkjet printers. High-specification laser printers are capable of producing 200 pages per minute.

Laser printers do not use liquid ink. Instead, they use powdered ink called 'toner'. The toner cartridges are quite large and colour printers (which have four separate toner cartridges) can be bulky and take up a lot of room.

Powdered ink is cheaper than liquid ink, and lasts longer. However, other laser printer consumables such as the drum will need to be replaced from time to time, and this must be factored in to the overall cost of ownership. Comparison sites often quote a cost per page to allow disparate printers to be compared.

The quality of laser-printed output is generally very good for text, but not so good for photo-quality images, as it is difficult to produce deep, rich colours.

## Plotters

A plotter is a device that uses one or more pens to draw an image. Pens are lifted or applied to the paper as required, to produce a very precise drawing. Plotters are often large devices that can handle very wide paper, sometimes on a drum to allow repeated layers to be printed.

Plotters are commonplace in engineering and architectural practices.

## 3D printers

3D printing technology has developed rapidly over recent years, and costs have fallen to the point where many schools have them for use in art and product design. The printers work by interpreting a set of instructions that model an object in 3D space. Filament, usually in the form of plastic-based resin, is extruded at heat and applied to precise dimensions and location. Commercial 3D printers are able to create larger-scale and more robust objects.

The potential for 3D printing is very exciting. Scientists are already exploring the use of special 3D printers — bioprinters — to make living body parts.

## Laser printers: principles of operation

A laser printer operates as follows:

1. To print a page, a bitmap image of the page is created.

2. A negative charge is applied to the print drum and then the laser is used to change the polarity on the drum, in line with the bitmap image.
3. When this stage is complete, the drum is exposed to positively charged toner, which is attracted to the negatively charged areas on the drum.
4. A sheet of paper is passed under the drum and the toner is transferred onto the paper.
5. When the toner application process is complete, it passes to a fusing (heating) stage to ensure that the toner sticks to the paper.

If the laser can produce colour printouts, it will have four different toner cartridges: Cyan, Magenta, Yellow, and Black. Each toner is applied in turn to achieve the correct colour print.



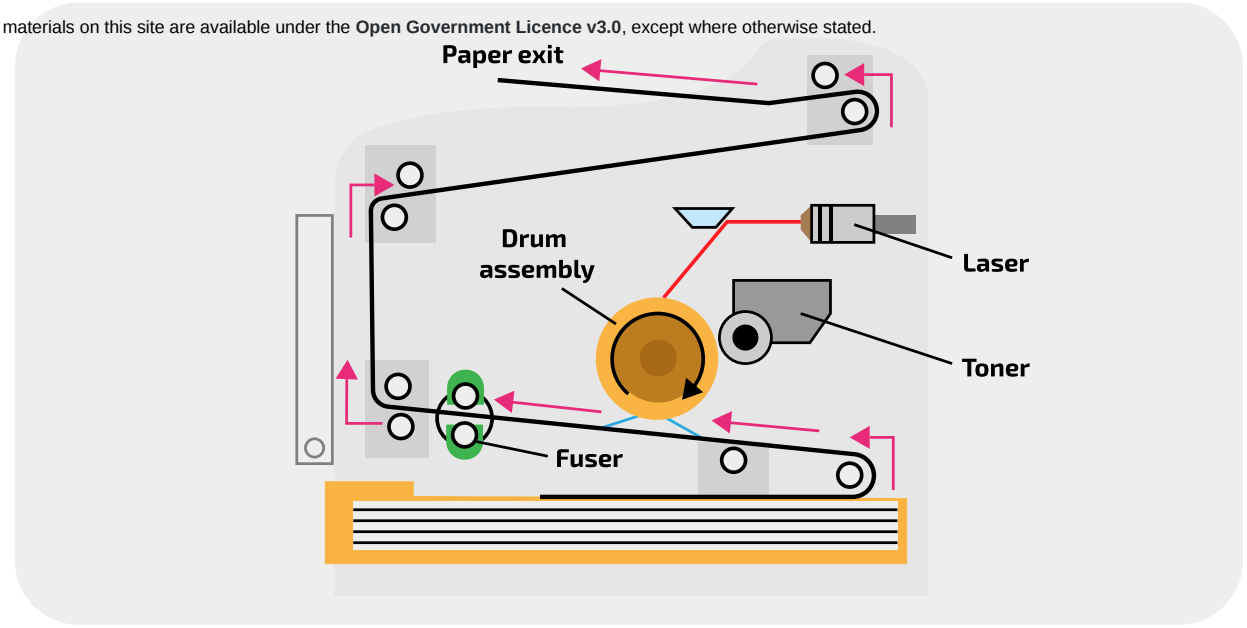


**Figure 1:** Laser printer
Derivative work based on original Welleman via Wikimedia Commons ( https://commons.wikimedia.org/wiki/File:Laser_printer_(cutaway_diagram).jpg), [Public Domain]

A Level

## Display devices

Most computers have some form of display, often either a stand-alone monitor or a built-in screen. When choosing a monitor, you will probably wish to consider screen size and resolution. Resolution for displays is usually measured in ppi or pixels per inch. Colour reproduction can be a factor for some users. For example, photographers, graphic designers, and artists will want the colours on the screen to be precisely calibrated.

**LCD displays** are low cost, and are the most common display found in offices and on standard desktop and laptop computers. They are rapidly being superseded by **LED displays**. LED technology uses less power than LCD, so it is cheaper and more environmentally friendly to run LED displays.

A variant on traditional LED displays is **OLED screens**, which are currently being developed. OLEDs do not require a backlight, but are instead activated using an electric current. Traditional displays use glass at the front of the screen, whereas OLEDs use a thin film of transparent plastic. This means that OLEDs are lighter and more flexible. The benefits of OLEDs mean that they are a good option for mobile devices such as phones and tablets.

A Level

## Motors and actuators

There is a wide range of control systems in which sensors act as analogue inputs. Outputs can also be analogue, and are usually controlled by motors or actuators. Digital signals are converted to analogue by a digital to analogue converter (DAC).

Automated systems can bring about massive cost savings for businesses. Automation is cheaper, safer, and more efficient. Robots can operate 24 hours a day, 7 days a week.

Individuals can also make use of control systems. For example, a gardener could control their greenhouse windows using a computer with a temperature probe to monitor heat. Once a set temperature is reached, the computer system will send a signal to a set of motors or actuators to open or close the windows.

A Level

## How to choose an appropriate method/device

Output devices can be quite specialised and, as well as the generic issues of cost and compatibility, there are specific criteria that need to be considered for certain categories of device. For example, print resolution may be important when selecting a printer, whereas maximum voltage would be an important factor when selecting a motor.