4 Output Devices

Topic

Various types of output devices and their use

Learning objectives

Students will be able:

- to explain what an output device is
- to list the main types of output devices and their uses: monitors, printers, plotters
- to understand the technical features of display screens
- to understand how the computer display works
- to recommend the most suitable monitor for particular users
- to understand the technical features of printers
- co compare different types of printers,
- to recommend the most suitable printer for particular users
- to use technical vocabulary associated with output devices

Key words

Pixel, resolution, dot pitch, flicker, electron beam, ergonomics, aspect ratio, colour depth, brightness, refresh rate, video adapter, plasma, plasma screen, noble gases, inch

Dot-matrix printer, inkjet printer, laser printer, thermal printer, imagesetter, platesetter (CTP), multi-function printer, plotter

Resolution, dots per inch, ink cartridge, toner, PictBridge, page description language

Abbreviations: CRT, LCD, TFT, OLED, cd/m^2, cps, dpi, USB, CTP, PDL

Output devices

Output devices are pieces of hardware which provide information and results of data processing in an accessible form. The most common output devices are monitors and printers of various kinds.

The display screens

The screen is also known as a monitor or VDU (visual display unit). Inside a computer there is a video adapter, or a graphics card which processes images and sends signals to the monitor. Advantages of this kind of an output device is that they provide high speed change of display including text, graphics and colour, make no noise and do not waste paper, the disadvantage is that they do not provide a permanent copy.

The basic characteristics of display screens

- **Screen size** – the viewing area, measured diagonally in inches.
- **Resolution** – the clarity of the image depending on the number of pixels (separate units of light) on a display across and down the screen. The sharpness of an image is affected by **dot pitch** – the distance between the pixels. Most monitors offer 0.25 mm dot pitch. The higher the resolution the more pixels are used which takes up more storage space in the computer. A typical resolution is 1024x768.
- **Brightness** – the amount of light the monitor produces, measured in cd/m^2 (candela per square metre).
- **Aspect ratio** – the width of the screen to the height (4:3, 16:9).
- **Colour depth** – the number of colours which a monitor can display.
- **Refresh rate** – the number of times that the image is drawn each second. If the rate is low, you can notice a flicker. The refresh rate should be at least 72 Hz.

Display technologies

- **A Cathode Ray Tube (CRT)** is a monitor similar to a traditional TV set. It contains millions of tiny red, green and blue phosphor dots that glow when they are struck by an electron beam travelling across the screen, and thus create a visible image. CRTs are cheap, but they are heavy, can flicker and emit radiation.
- **A Liquid Crystal Display (LCD)** is made of two glass plates with a liquid crystal material between them. The crystals block the light in different quantities to create the image. Active –matrix LCDs use TFT (thin film transistor) technology, in which each pixel has its own transistor switch. They offer better quality with less flicker and take up less space. The disadvantage is that the screens can be viewed only from a limited angle.
- **A plasma screen** - images are created by a plasma discharge which contains noble gases. Plasma screens allow larger screens and wide viewing angles.
- **Organic Light-Emitting Diodes (OLEDs)** – are thin-film LED displays that do not require a backlight to function. The material emits light when it is stimulated by an electrical current, which is known as electroluminescence. They consume less energy, produce brighter colours and are flexible – can be bent or rolled up when they are not being used

The printers

Printers provide output in the form of permanent copy, normally on paper or acetate sheets.

A program called the printer driver converts data into a form that the printer can understand. The output quality – resolution – is measured in dpi (dots per inch). The speed of the printer is measured in pages per minute (ppm).

Printers vary in cost, speed, print quality, noise or printing method.

Dot-matrix printers

are impact printers, which use a matrix of pins. A print head containing tiny pins strikes an inked ribbon to make letters or graphics. The ribbon impregnated with ink transfers the image or text on paper. The ribbon needs changing when the ink is used up or dries out.

Advantages/disadvantages

- They have relatively low resolution
- They are quite noisy
- Cheap.

Ink-jet printers

Operate by spraying small ink droplets onto paper to form the required image. A standard ink-jet has a three colour cartridge and a black cartridge. Professional ink-jets have five-colour cartridges plus black. They work well on ordinary paper. They are suitable for small quantities or home use.

Advantages/disadvantages

- The printers themselves are relatively cheap to buy.
- They produce images that are almost as good as photographs if they are printed on high quality paper
- They take up less space than laser printers
- They are almost silent in operation
- The wet ink droplets tend to spread before they dry
- Are slower than laser printers
- Running costs are usually higher than for lasers because inkjet cartridges do not last long and have to be replaced. For a high quality printout special paper is required.

Laser printers

Scan the image with a laser beam and transfer it to paper with a special ink powder called toner. The toner is attracted to paper by an electrostatic charge and then fixed by a hot roller. Lasers use a Page Description Language (PDL) which describes how to print the text and draw images on the page. The most common languages are Adobe PostScript and HP Printer Control Language.

Laser printers are fast and produce a high resolution, so they are ideal for businesses and professional graphics work.

Advantages/disadvantages

- They are fast
- They have high resolution
- They are expensive, particularly colour laser printers
- They are quite cheap to run because toner cartridges don´t have to be replaced so often

Thermal transfer printers

produce colour images by transferring a wax-based ink onto the paper. They are used for printing bar codes, labels and medium-resolution graphics.

Multi-function printers

Are devices that can work as a printer, scanner, photocopier and a fax. Some of them accept memory cards and print photos directly from the camera using the PictBridge technology.

Imagesetters and platesetter

Imagesetters produce very high resolution output on paper or microfilm. They are most often used in desktop publishing (DTP). They produce the highest quality output, but are very expensive.

In modern lithographic printing, images are created on a DTP computer and then output directly to the printing plates, without a film as an intermediate step. This technology is called computer to plate – CTP, and the machine is called platesetter.

Plotters

are devices for producing high quality graphical output on paper. They can produce construction plans, engineering drawings, maps, diagrams and three dimensional drawings. There two main types of plotters – pen plotters and penless plotters. Pen plotters use pens containing different colour inks to produce images. The pens can reach any point on the piece of paper. The lines drawn are continuous, not made of dots and the drawing is very accurate. Penless plotters use various technologies. High quality output is produced by electrostatic plotters. Plotters are slow but very accurate.

Vocabulary

	Definition	Translation
aspect ratio	the width of the screen divided by its height	poměr stran
brightness	the amount of light produced by a monitor	jas
candela	the SI base unit of luminous intensity	kandela
colour depth	the number of bits used to hold a colour pixel, it determines the number of colours the monitor can display	barevná hloubka
contrast ratio	a property of a display system, defined as the ratio of the luminance of the brightest color (white) to that of the darkest color (black) that the system is capable of producing	
CRT	Cathode Ray Tube	katodová trubice
CTP	computer to plate= an imaging technology in which DTP files are output directly to the printing plates	
dot pitch	the distance between dots on a monitor screen	rozteč bodů
dot-matrix printer	a printer that uses pins to print an array of dots	jehličková tiskárna
electron beam	a group of nearly parallel lines of electromagnetic radiation	elektronový svazek
ergonomics	the branch of engineering science which studies the relation between workers and their environments	ergonomie
flicker	intermittent flashing	blikání, kmitání
imagesetter	a professional printer that generates a high-resolution output	
inch	a unit of length equal to 2.54 cm	palec
ink cartridge	a replaceable container that holds ink in an inkjet printer	inkoustová náplň
inkjet printer	a printer that generates an image by spraying tiny drops of ink at the paper	inkoustová tiskárna
laser beam	a beam of monochromatic coherent light	laserový paprsek
laser printer	a printer that uses a laser beam to fix the ink toner to the paper	laserová tiskárna
LCD	Liquid Crystal Display	displej s tekutými krystaly, LCD
multi-function printer	an all-in-one device that can function as a printer, scanner, photocopier and a fax	multifunkční tiskárna
noble gases	chemically inert gaseous elements of the helium group in the periodic table	vzácné, inertní plyny
OLED	Organic Light-Emitting Diodes	

page description language (PDL)	a computer language that describes how to print the text and images on each page of the document	jazyk pro popis stránky
PictBridge	a technology developed by Canon that lets you print images from a memory card in a digital camera directly to the printer (without using a computer)	PictBridge
pixel	short for Picture Element, the smallest individual dot that can be displayed on a computer monitor	obrazový bod, pixel
plasma	an electrically charged gas that emits light	plazma
plasma screen	a display that generates images by a plasma discharge	plazmová obrazovka
platesetter	a machine creating the printing plates	
plotter	a graphics output device used to make engineering drawings	plotr, kreslicí zařízení
printer driver	a program installed to control a particular type of printer	ovladač tiskárny
refresh rate	the frequency at which the image is re-drawn on a display screen	obnovovací frekvence
resolution	the maximum number of pixels in the horizontal and vertical directions of the screen, number of pixels per inch	rozlišení
thermal printer	a printer that produces colour images by adhering wax-based ink onto the paper	tepelná tiskárna
toner	a special ink powder used in laser printers	toner
video adapter	an expansion card that processes images and sends the video signals to a monitor,	video adaptér

Summary

Output devices are pieces of hardware which provide information and results of data processing in an accessible form. The most common output devices are monitors and printers of various kinds.

The screen is an output device that provides high speed change of display including text, graphics and colour, but does not provide a permanent copy. There are various display technologies – CRT, LCD, plasma screen, OLEDs.

Printers provide output in the form of permanent copy, normally on paper or acetate sheets. There are many types of printers, for example dot-matrix printers, inkjet printers, laser printers, thermal printers, imagesetters, platesetters (CTP), multi-function printers, plotters. They vary in cost, speed, print quality, noise or printing method.

Tasks

1. **Study the following monitor ads; complete the table below and compare the characteristics of the monitors. Discuss pros and cons and tell the class which display screen you would most like to own. Give reasons for your choice.**

A) HP Compaq LE2002X 20" Class Widescreen LED Monitor

16:9 - Maximum Resolution 1600 x 900 - 50 to 76 Hz - LED Backlight – Brightness 250 cd/m² - Response time 5ms - •Pixel Pitch: 0.277 mm x 0.277 mm –Contrast Ratio 3,000,000:1 – Power consumption 26W
$129.99

B) Acer G215HV 22" Class Widescreen LCD Monitor

16:9 - Maximum Resolution 1920 x 1080 - 55 - 75Hz – Brightness 200 cd/m² - Response time 5ms - Pixel Pitch 0.248mm –Contrast Ratio 20,000:1– Power consumption 33W
$119.99

C) Dell ST2321L 23" Class Widescreen LED Monitor

16:9 - Maximum Resolution 1920 x 1080- 50 - 76 Hz - Active matrix TFT - LED Backlight – Brightness 250 cd/m² - Response time 5ms - •Pixel Pitch: 0.265mm –Contrast Ratio 7,000,000:1– Power consumption 26W
$179.99

	HP Compaq LE2002X	**Acer G215HV**	**Dell ST2321L**
Price			
Aspect ratio			
Resolution			
Display technology			
Pixel pitch			
Refresh rate			
Brightness			
Response time			
Contrast ratio			
Power consumption			

2. **Complete the definitions with the words from the vocabulary section.**
    a) The number of pixels contained in a display, horizontally and vertically
    b) An expansion card generating the video signal sent to a computer display
    c) The smallest unit on a display screen (usually a coloured dot)
    d) the number of times that the image is drawn each second
    e) an electrically charged gas that emits light
    f) the distance between dots on a monitor screen
    g) a replaceable container that holds ink in an inkjet printer
    h) The width of the screen in proportion to its height
    i) the amount of light produced by a monitor
    j) a graphics output device used to make engineering drawings
    k) Also called gas discharge display
    l) Small needles that press on the inked ribbon to make the characters on paper
    m) A language that tells the printer how to print the document
    n) an imaging technology in which DTP files are output directly to the printing plates
    o) impact printers, which use a matrix of pins
    p) a special ink powder used in laser printers

3. **Listening Intertech p 34, 35 – monitors, ergonomics.**

4. **Read the printer adverts and answer the questions:**

a) How many laser printers are advertised?
b) Which printer is the fastest one?
c) Which printer offers the most quality output?
d) Which printer would you recommend to someone who prints large quantities of standard quality documents?
e) Which printer is able to print not only on the paper?
f) Which printer would you recommend to a company which not only standard documents but also greeting cards, labels, brochures, etc.?
g) What types of ink cartridges do the inkjet printers use?
h) What software allows you to create albums, calendars and stickers easily using photos taken with digital cameras?
i) What operating systems are compatible with Canon PIXMA iP2702 Inkjet Photo Printer?
j) What features enable the Canon PIXMA iP2702 Inkjet Photo Printer to reach the outstanding print quality?

5. **Choose one of the adverts and recommend it to your friend. Use the technical specs to persuade him to buy it.**

HP Thermal Inkjet Deskjet 1000 Printer:

Key Features:

- Print Speed
  Black: Up to 16 ppm; Colour: Up to 12 ppm
- Print Resolution
  Up to 4800 x 1200 dpi
- Replacement Ink
  HP 61, HP 61XL Black Ink Cartridges, HP 61, HP 61XL Tri-colour Ink Cartridges

Additional Specifications

- 1 x USB 2.0 port
- Paper & Media Compatibility: 60-sheet input tray, 25-sheet output tray
  Media Types: Paper (brochure, inkjet, plain), Photo Paper, Envelopes, Labels, Cards (greeting), Transparencies

System Requirements

- Compatible Operating Systems: Microsoft Windows XP (32-bit only), Vista, 7, Mac OS X (v 10.5 or 10.6)

What's Included

- HP 61 Black Ink Cartridge, HP 61 Tri-colour Ink Cartridge
- Software CD and setup guide
- Power Supply and power cord

Lexmark 26A0000 C540N Laser Printer

Ultra-compact and exceptionally quiet, the offers you true 1200 x 1200 dpi colour printing to liven up your business documents, plus rapid print speeds as fast as 21ppm in both black and colour.

- Prints 21 monochrome pages per minute
- Prints 21 colour pages per minute
- 1200 x 1200 maximum print resolution
- 128 MB standard memory
- Mac and PC platform support

Canon PIXMA iP2702 Inkjet Photo Printer

Are you looking for a product with a sophisticated look and compact design that can print photo lab quality at a great value? This stylish machine fits almost anywhere while you easily print beautiful, borderless photos up to 8.5" x 11", pages off the web through Easy-WebPrint EX or documents all with amazing quality. This is made possible thanks to its FINE Cartridges which contain pigment black ink for laser-quality text and dye ink for smooth, natural photos. The ChromaLife100+ system enables your photos to last up to 300 years when using genuine Canon ink and paper and stored in archival-quality photo album. Printing and automatically correcting your photos has never been easier thanks to Auto Photo Fix II, which can be accessed through the popular EasyPhoto-Print EX software.

Key Features:

- Print Speed
  Black: Up to 7 ipm; Colour: Up to 4.8 ipm; Photo: 4" x 6" approximately 55 seconds
- Print Resolution
  Black: Up to 600 x 600 dpi, Colour: Up to 4800 x 1200 dpi
- Replacement Ink
  PG-210, PD-210 XL Black Ink Cartridges, CL-211, CL-211XL Color Ink Cartridges

Additional Specifications

- USB 2.0 interface

System Requirements

- Compatible Operating Systems: Windows 7, Windows Vista, Windows XP/2000 and Mac OS X v. 10.4.11 to 10.6.x

What's Included

PG-210 black and CL-211 colour cartridges , User's Guide and Setup Software CD-ROMs , Power supply and power cord

6. **Choose the most appropriate type of printer for the following users.**
    a) A company that needs to print in a large quantities at high quality
    b) An engineer creating detailed precise engineering drawings
    c) A graphic arts business team producing catalogues, brochures and other publications
    d) A translator working at home
    e) A family printing occasional text documents and photographs
    f) A company that wants to print carbon copies of bills and receipts
    g) A magazine publisher

Questions

1. What is an output device?
2. What are the advantages and disadvantages of screens as output devices?
3. What do CRT and LCD stand for?
4. How is the screen size measured?
5. What technology is used by active-matrix LCDs?
6. What unit is used to measure the brightness of a display?
7. What unit is used to measure the refresh rate?
8. What unit is used to measure the screen size?
9. What unit is used to measure the resolution?
10. What substance produces light and colour when hit by electrons in a CRT monitor?
11. What are advantages of OLED displays?
12. What types of printers do you know?
13. How is the quality and speed of a printer measured?
14. What types of printers are used in DTP?
15. How is the image in dot-matrix printers created?
16. What are the advantages and disadvantages of Inkjet printers?
17. What technology lets you print directly from your digital camera without needing a computer?
18. What are plotters?
19. What language describes how to print text and pictures on the page?
20. What do the abbreviations **PDL, dpi, CTP** and **ppm** stand for?

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