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## **A LOOK BACK AT COMPUTER MONITORS**

The first monitors used CRT(cathode ray tube) technology and appeared in 1922. However, for computers this technology began to be used only in 1950. Until the 50s, computers displayed information only onto printing devices.

The cathode-ray tube (CRT) is a vacuum tube that contains one or more electron guns and a phosphorescent screen and is used to display images. It modulates, accelerates, and deflects electron beam(s) onto the screen to create the images. The images may represent electrical waveforms (oscilloscope), pictures (television, computer monitor), radar targets, or other phenomena. In television sets and computer monitors, the entire front area of the tube is scanned repetitively and systematically in a fixed pattern called a raster. In color devices, an image is produced by controlling the intensity of each of the three electron beams, one for each additive primary color (red, green, and blue) with a video signal as a reference. In all modern CRT monitors and televisions, the beams are bent by magnetic deflection, a varying magnetic field generated by coils and driven by electronic circuits around the neck of the tube, although electrostatic deflection is commonly used in oscilloscopes, a type of electronic test instrument.

For the first time in 1950 at Cambridge university, the cathode ray tube of an oscilloscope was used to output graphical information on an EDSAC (Electronic Delay Storage Automatic Computer). About a year and a half later, the English scientist Christopher Stretch wrote for the computer “Mk. 1” a program that played

checkers and displayed information onto the screen. However, a breakthrough in the field of graphic output devices was the American military project based on the "Whirlwind" computer. The objective of this project was to output data from radars to a CRT display (this means that the radar transmits to the display information about the location of objects in the "field of view" of the radar). This project was first demonstrated on April 20, 1951. This type of monitors continues to be used and improved to this day.

Although CRT displays began to be used only in the 1950s, already in 1960s RCA Company began researching liquid crystal materials for using it in imaging devices. The operation principle of any liquid crystal screen is based on the property of liquid crystals to change (rotate) the plane of polarization of the light passing through them in proportion to the voltage applied to them. Thus, using liquid crystals, it is possible to produce optical elements with a variable degree of transparency. Any LCD screen on a computer monitor, laptop, tablet or TV contains from several hundred thousand to several million such cells, a fraction of a millimeter in size. They are combined into an LCD matrix and with their help we can form an image on the surface of a liquid crystal screen.

In 1964, George Heilmeyer created the first liquid crystal display based on the dynamic scattering effect (DSM). In 1968 RCA introduced a liquid crystal monochrome screen. In 1973 Sharp released the first DSM-LCD-based LCD calculator. Liquid crystal displays began to be used in electronic watches, calculators, and measuring devices. Then matrix displays began to appear, reproducing a black and white image. In 1987 Sharp developed the first 3-inch color LCD, and in 1988 the world's first 14-inch color TFT LCD. In 1983 Casio released the first portable black-and-white TV with a TV-10 LCD screen, in 1984 - the first color portable TV with an LCD TV-1000, in 1992 - the first video camera with an LCD QV-10.