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CRT Basics

Color CRTs - shadow masks and aperture grills

All color CRTs utilize a shadow mask or aperture grill a fraction of an inch (1/2" typical) behind the phosphor screen to direct the electron beams for the red, green, and blue video signals to the proper phosphor dots. Since the electron beams for the R, G, and B phosphors originate from slightly different positions (individual electron guns for each) and thus arrive at slightly different angles, only the proper phosphors are excited when the purity is properly adjusted and the necessary magnetic field free region is maintained inside the CRT. Note that purity determines that the correct video signal excites the proper color while convergence determines the geometric alignment of the 3 colors. Both are affected by magnetic fields. Bad purity results in mottled or incorrect colors. Bad convergence results in color fringing at edges of characters or graphics.

The shadow mask consists of a thin steel or InVar (a ferrous alloy) with a fine array of holes - one for each trio of phosphor dots - positioned about 1/2 inch behind the surface of the phosphor screen. With most CRTs, the phosphors are arranged in triangular formations called triads with each of the color dots at the apex of the triangle. With many TVs and some monitors, they are arranged as vertical slots with the phosphors for the 3 colors next to one another.

An aperture grille, used exclusively in Sony Trinitrons (and now their clones as well), replaces the shadow mask with an array of finely tensioned vertical wires. Along with other characteristics of the aperture grille approach, this permits a somewhat higher possible brightness to be achieved and is more immune to other problems like line induced moire and purity changes due to local heating causing distortion of the shadow mask.

However, there are some disadvantages of the aperture grille design:

- weight - a heavy support structure must be provided for the tensioned wires (like a piano frame).
- price (proportional to weight).
- always a cylindrical screen (this may be considered an advantage depending on your preference.
- visible stabilizing wires which may be objectionable or unacceptable for certain applications.

Apparently, there is no known way around the need to keep the fine wires from vibrating or changing position due to mechanical shock in high resolution tubes and thus all Trinitron monitors require 1, 2, or 3 stabilizing wires (depending on tube size) across the screen which can be see as very fine lines on bright images. Some people find these wires to be objectionable and for some critical applications, they may be unacceptable (e.g., medical diagnosis).

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