Recommendations for reducing image persistence on large-screen LCDs

When an LCD monitor is operated continuously for long periods of time with a fixed image, a trace of electric charge can build up near the electrode inside the LCD module. The result of this is a residual or “ghost” image of the previous image when the screen image is changed.

Image persistence is not permanent, but when a fixed image is displayed for long periods of time, ionic impurities inside the LCD accumulate and can be seen in the displayed image. This could result in retention of that image. Although image persistence of LCDs happens over a much longer period of time than CRT and PDP phosphor burn, persistence can occur if the display is used improperly. Overall, LCDs are the best technology for significantly delaying image persistence. Below are some tips that can help you reduce the chances of image retention on an LCD.

Power Save or Power Off

It is recommended that the display enters the power saving mode or is turned off when it is not being used since leaving the unit on, even with a blank screen, decreases the overall life of the product. When the unit is left on, the backlights are still lit, showing a black screen the display doesn’t take advantage of the energy saving technology. Turning off or using power management for 6-8 hours per day can considerably extend the life of the product and minimize image persistence.

NEC units can be turned on and off through NaViSet Administrator, RS-232C, the remote control or the control buttons. The power saving mode can be activated by using the power savings feature of the operating system as well. The power save mode is only available for RGB connections (RGB1, RGB2 and RGB3).

Fixed Image

A fixed image should not be displayed for long periods of time. Even if the screen image is changed periodically and then returned to the fixed image, long-term effects can occur.

In cases where this can’t be avoided, the unit’s “Screen Saver” control (via the On Screen Manager) should be used. This feature shifts the screen image by two pixels in a figure eight pattern (see image below). The default setting for this control is OFF and the image will shift after one hour if ON is selected.

Screen Saver control picture movement

Aspect Ratio

If the aspect ratio of the signal is not the same as the LCD, the image should always be scaled to fill the entire screen. An example of this would be a 4:3 NTSC video signal connected to a 16:9 LCD. If the video signal was shown in its correct aspect ratio for a long period of time, the unused black borders of the video signal could persist when the image is changed.
Brightness Level
The LCD’s brightness can also affect the life of the product and the possibility for image retention. Reducing the brightness control to 50% (250 cd/m²) reduces the internal temperature level and allows the display to have further adjustment as the brightness level decreases over time. This is recommended in areas that have low ambient light levels or where these levels can be controlled.

Image Patterns
High contrast patterns should not be positioned side-by-side in a fixed image. These types of patterns increase the possibility of image persistence because of the large difference in the LCD charge in these adjacent areas. An example of this would be a white box next to a black box.

Moving screens and applications can use these patterns but they should not be used in a repetitive area or motion. This can cause a blurred retention over time.

Brightly colored backgrounds are recommended to help further reduce the possibility of image persistence. Some usage examples are shown below.

Examples of a good design:

Examples of a bad design:
Image Motion

One of the most effective ways of reducing the possibility for image persistence is to have motion on the screen. This could be achieved by having the whole screen move or just the portions that are usually static. Some examples of this are shown below.

Temperature Control

Using the LCDs in areas with high ambient temperatures (above 35 degrees Celsius), can also decrease the time period required for image persistence to occur. The ventilation holes should also be free of dust and dirt in all locations. These may require the use of a vacuum or similar device.

NEC large-screen LCDs have internal temperature sensors that can be monitored with the remote control or RS-232C. To display the internal temperature readings, the Factory mode of the On Screen Display has to be used (please do not attempt to adjust any other controls while in Factory mode as this could affect the functionality and stability of the display). The Factory mode can be activated by pressing minus, minus, plus, plus, minus, plus, and then “SET” on the remote control within a 5-second time limit. If done successfully, the internal temperature readings will be displayed in the bottom line titled “TEMP” when the “DISPLAY” button is pressed. These temperature readings are in Celsius and it is recommended that they be kept below 45 degrees. Turn the display OFF and then ON to exit the Factory mode.

What to Do if Experiencing Image Persistence

In most cases, image persistence can only be seen with a low brightness background. Changing the background color to a high brightness can reduce the visibility of image persistence.
Using complementary colors can also reduce the possibility of image persistence and should be used whenever possible. Once image persistence occurs, there is no true method to calculate how long it will take to eliminate the effect. Ambient temperature, ventilation, temperature fluctuations, image pattern and the time displayed all affect how long it will take for this phenomenon to dissipate.

Due to the fact that large-screen LCDs are a relatively new technology, this document is considered a work in progress. Also, image retention is unique to each screen pattern being displayed. Life testing of the products and field data are studied to determine if this phenomenon exists and NEC Display Solutions continues to work with the LCD module manufacturer to make improvements. This document will be continually updated as test results are generated and improvements made.

This white paper was published in and based on information as of May 2005. Technical information is subject to change.