BACKLIT LCD MONITOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. provisional patent application serial No. 60/270,848, filed Feb. 23, 2001, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The invention relates to backlit liquid crystal display (LCD) monitors. Backlit LCD monitors are often used in applications where ambient conditions such as sunlight can negatively affect the ability to view the display. Such applications include air traffic control displays viewed by air traffic controllers sitting at computer screens located in an airport control tower. Backlit LCD monitors are also useful in maritime applications (barges, aircraft carriers and tugs), making it possible to execute and interpret output from shipboard instrumentation such as navigation, targeting, IFF and weapons control from a monitor mounted on the vessel, even if the monitor is subject to extreme lighting conditions such as bright sunlight or total darkness. Further applications can include automatic teller machines (ATMs), kiosks and any other applications where the ability to view the computer screen could be adversely affected by ambient conditions. Backlit LCD monitors can provide increased brightness in order to compensate for adverse conditions such as bright sunlight and total darkness and high glare.

SUMMARY OF THE INVENTION

[0003] An exemplary embodiment of the invention is a backlit liquid crystal display (LCD) monitor comprising a backlight assembly, a cooling assembly, a rear cover assembly and a controller. The backlight assembly has opposing top and bottom surfaces and the bottom surface includes a plurality of fluorescent bulbs with parallel bulb axes and two or more inverters to drive the bulbs. The cooling assembly has opposing top and bottom surfaces and the top surface of the cooling assembly is mounted on the bottom surface of the backlight assembly to form a closed air space around the bulbs. The cooling assembly includes: a light sensor on the top surface of the cooling assembly and the light sensor has an axis that is perpendicular to the bulb axes of the fluorescent bulbs, a temperature sensor, a heat sink on the bottom surface of the cooling assembly, and an air inlet and an air outlet in fluid communication with the closed air space and positioned for causing air to flow across the bulbs. The rear cover assembly is placed over the bottom surface of the cooling assembly and includes: an exhaust fan in fluid communication with the air outlet, a cover inlet in fluid communication with the air inlet, a filter placed over the cover inlet and a fan positioned to draw air towards the heat sink. The controller is electrically connected to the sensor, inverters and fans.

[0004] Another embodiment of the invention is a method of controlling a backlit liquid crystal display monitor. The method comprises receiving target data including target heat sink temperature, target backlight chamber temperature and target bulb luminance. The method also comprises receiving actual data including actual heat sink temperature, actual backlight chamber temperature, actual bulb luminance, heat sink fan status and current, exhaust fan status and current, and inverter status and current. The method further comprises adjusting the monitor settings in response to the target data and the actual data. The adjusting includes setting input current to the inverter, setting the heat sink fan speed, and setting the exhaust fan speed. The method further comprises sending a notification in response to the target data, the actual data and said adjusting.

[0005] The above described and other features are exemplified by the following figures and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Referring now to the figures, which are exemplary embodiments, and wherein the like elements are numbered alike:

[0007] **FIG. 1** is a perspective view of the backlight assembly portion of a backlit LCD monitor;

[0008] **FIG. 2** depicts interlaced bulbs and inverters in an embodiment of the invention;

[0009] **FIG. 3** is an exploded, perspective view of the cooling assembly and LCD screen;

[0010] **FIG. 4A** is an exploded, perspective view of the rear cover assembly of the backlit LCD monitor;

[0011] **FIG. 4B** is cross-sectional view of backlight assembly, cooling assembly and rear cover assembly;

[0012] **FIG. 5** is a block diagram of an exemplary backlit LCD monitor control system;

[0013] **FIG. 6** is a block diagram of the data flow in an exemplary backlit LCD monitor control system;

[0014] **FIG. 7A** is a flowchart of a process performed by an exemplary backlit LCD monitor control system;

[0015] **FIG. 7B** is a flowchart of an exemplary brightness control process;

[0016] **FIG. 7C** is a flowchart of an exemplary brightness sensor failure recognition process;

[0017] **FIG. 7D** is a flowchart of an exemplary bulb decay recognition process;

[0018] **FIG. 7E** is a flowchart of an exemplary bulb decay compensation process;

[0019] **FIG. 7F** is a flowchart of an exemplary inverter monitoring process;

[0020] **FIG. 7G** is a flowchart of an exemplary thermal control process;

[0021] **FIG. 8** is a flowchart of a bulb control process performed by a backlit LCD monitor controller; and

[0022] **FIG. 9** is a system diagram of an exemplary embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] An exemplary embodiment of the invention is a backlit liquid crystal display (LCD) monitor having an enhanced cooling system that can allow the monitor to operate at higher ambient temperatures and can promote bulb life. Another embodiment of the invention includes a