BACKLIGHTING SYSTEM FOR DISPLAY SCREEN

RELATED APPLICATIONS

[0001] The present application is a divisional application of U.S. patent application Ser. No. 10/714,400, filed Nov. 17, 2003.

TECHNICAL FIELD

[0002] This invention relates to display apparatus and in particular, though not solely, to the backlighting system employed in display apparatus such as LCD display screens, more particularly, multi-layer display (MLD) screens.

BACKGROUND ART

[0003] Certain types of display apparatus, such as Liquid Crystal Display (LCD) screens used as computer screens or television screens, require backlighting in order to make display elements on the screen visible, or more easily visible, to a viewer of the display unit.

[0004] Existing "flat" screen display units, for example LCD display screens, may be single-layer display (SLD) units having a single display layer or single planar array of liquid crystal pixels, or multi-layer display (MLD) units in which a number of planar arrays of LCD pixels are aligned in a stacked or sandwiched arrangement. Multi-layered display (MLD) units provide a significant improvement over existing single layer display (SLD) units or displays. MLD units may be used to nest display content over spacially displaced or stacked layers to provide an enhanced mechanism for information absorption and analysis by users. An example of an existing multi-layer display is discussed for example in WO9942889A.

[0005] Existing MLD units require a significant amount of light to illuminate images on the foreground layer (closest to the viewer) through the previous or lower layers. Often cold cathode fluorescent lamps (CCFT) are used to provide the backlight in SLD and MLD LCD display units and these require supporting circuitry to generate an initial high starting voltage and a subsequent lower maintenance voltage once the lamps are in sustained discharge mode. This support circuitry and the tubes generate excess heat within the display apparatus and due to the proximity of the power supply wires required, power is wasted through currents produced as a result of parasitic capacitive coupling. These problems result in a need to provide a relatively high capacity and quality power supply in existing backlit display apparatus and often also results in the need to incorporate cooling components to remove the excess heat produced.

[0006] In CCFT lamps, ultra-violet (UV) light is produced via an electrical discharge passing through Argon and Mercury vapour in the lamp. The UV light reacts with a phosphor coating on the inside of the glass lamp which converts the UV light to visible light. The phosphor blend determines the spectral content of the visible light produced by the lamp.

[0007] A high voltage is required to initiate the self-sustaining electrical discharge through the gas vapour and, once started, a lower voltage is required to keep the discharge going. Power is supplied to the lamp through a ballast capacitor which ensures that the power supply sees the lamp as a linear electrical load. The total luminous flux produced by the lamp is dependent on the magnitude of the current through the lamp and the cold spot temperature of the lamp. The optimal temperature range for the lamp is between about 45 and 55° C. while the optimal current range is between about 5 and 7 mA. If the temperature and/or current are outside these ranges then the light output and life of the lamp will decrease.

[0008] MLD units have many more lamps than SLD units. For example, an MLD unit may have between 24 and 27 lamps. Conventionally, wires are used to attach an inverter to a lamp (or set of lamps) to its power supply. Two wires are required per lamp which results in a large number of wires which is cumbersome, messy, produces excessive Electromagnetic Interference (EMI) and results in power loss through the above mentioned capacitive coupling, particularly in MLD units because of the increased number of lamps.

[0009] U.S. Pat. No. 6,326,738B discloses a backlighting system for an SLD unit in which the ballast capacitor is mounted on the circuit board substrate to which one end of the lamp is connected, thereby reducing the number of wires required. This system allows two wires to be used to supply power to all of the lamps in a backlighting system but results in bright and dark spots and variance as power can not be regulated easily to ensure that each lamp receives the same amount of power. Power is also lost in this system due to the introduced parasitic capacitance between the supply wires and the metallic enclosure which is required. Furthermore, the system disclosed requires higher rated electronic components such as inverters which are physically larger and more expensive.

[0010] It is therefore an object of the present invention to provide a backlighting system which goes at least some way towards overcoming the above disadvantages or which will at least provide the public with a useful choice.

[0011] All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

[0012] It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning—i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

DISCLOSURE OF INVENTION

[0013] Accordingly, in a first aspect, the invention consists in a backlighting system for a display apparatus comprising:

[0014] at least one light source,

[0015] electronic componentry adapted to receive electrical power and to control the distribution of electrical power to the at least one light source,