The Engineering Development and Introduction of an LCD Public Display Product

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Abstract

Public display enables the transfer of a range of real-time information at public locations where many people may gather. NEC Display Solutions, Ltd. entered the public display market and released public display products to meet the diverse needs of the market long before other manufacturers took an interest in it. This paper introduces the installation of these products in various environments and also discusses the functions that are wanted by the market for public display products.

Keywords

public display, long cable compensation, multi-screen, tile comp

1. Introduction

Consistent with the trend in recent years of enlarging the size of display monitors, the "Public Display" which enables the transfer of various types of information to the public domain has been benefiting from a growing market. The main applications of "Public Display" are for; time tables at airports and railway stations and electronic menu board, etc. Nowadays, information is displayed in public spaces such as shopping malls, airport lobbies, museums etc. Bulletin boards or display information that used to be communicated using paper media is now replaced by electronic data and information including texts, drawings and photos are displayed to the public much more effectively. This process is called "Digital Signage" and is currently becoming more and more popular.

This paper introduces the functions of the "Public Display" by taking NEC's newly developed public display, the "MULTEOS (M40/M46), 20 series (LCD4020/LCD4620)" as an example (**Photo**).

2. The Need for a Public Display

When bearing in mind the installation environment and usage conditions, the following qualities are essential for a public display.

- High durability and reliability in order to resist long-hour usage for 24 hours per day, 365 days per year.
- A vertical (Portrait) installation capability
- Panel resistance to dirt and residual images
- A long cable length capability
- Large-size and multi-screen functionality

Photo External view of the M46 (Upper) and the LCD4620 (Lower).

・Convenient control for more than two displays
・Adequate input terminals and a capability for processing various signal types

NEC Display Solutions entered the public display market long before other manufacturers and developed products to meet various market needs. We explain below how we dealt with such market needs in the course of developing our products.

3. Countermeasures against Adverse Installation and Usage Conditions

3.1 Long Life Design (High Reliability)

It is occasionally required that an image be displayed publicly for a long time. In such a situation, a residual image of the displayed image remains on the LCD panel. When a display is installed in the portrait manner and rotated 90 degrees, "Yogore (Image Stain)" and "Image Retention" can appear on the LCD panel. As a countermeasure against such malfunctions and in order to assure high durability and reliability, NEC Display Solutions employs an LCD panel that has been developed exclusively for public display. Moreover, we mount our original screen saver that features; 1) fan start/stop and brightness control by detecting internal temperature via a temperature sensor mounted inside the display, 2) gamma setting to avoid residual images as much as possible, 3) motion setting to adjust an on screen image in four directions (up, down, right, left) and 4) brightness adjustment to decrease the maximum brightness. These functions are all effective in decreasing the load on a LCD panel.

All of the parts used for public displays that are manufactured by NEC Display Solutions are designed to ensure a lifetime of 50,000 hours or more (at 25°C).

3.2 Long Cable Compensation

Sometimes a display is installed at some distance from a video unit. In such a case a long cable is used to connect between the two units. However, there is the problem that video signals deteriorate when using a long cable. Due to the deterioration of the video signal frequency characteristics or the difference in the transmission length of the RGB signals, a phase difference in the analog RGB signals occurs and this causes a color shift on the display screen (**Fig. 1**). With the DVI digital signals transmitted, a decode error may occur and normal images cannot be displayed. NEC Display Solutions employ a compensation circuit in order that the product can maintain display image quality in such installation system conditions.

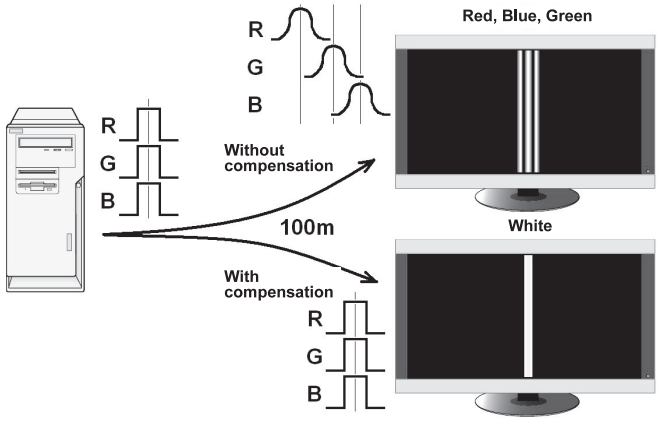

Fig. 1 Image defining long cable compensation

(1) Compensation of Analog RGB Signal

The following functions are employed in order to compensate the analog RGB signals.

1) RGB signal contour compensation
2) RGB signal phase compensation
3) Peaking circuit
4) Waveform equalizer
5) Terminating resistance switching for horizontal/vertical sync signals

With these circuits, signal deterioration can be suppressed even when a display monitor is installed with a 100m cable length.

(2) DVI Digital Signal

A waveform equalizer is installed in the signal input unit as a countermeasure against DVI digital signal deterioration. The waveforms of signals that have been deteriorated while being transmitted via the cable are thus rearranged. **Fig. 2** shows input signals generated by a DVI terminal (photo on the left) and output signals after being compensated by a waveform equalizer (photo on the right). Images without decode errors are obtained even if a 30m cable is used.

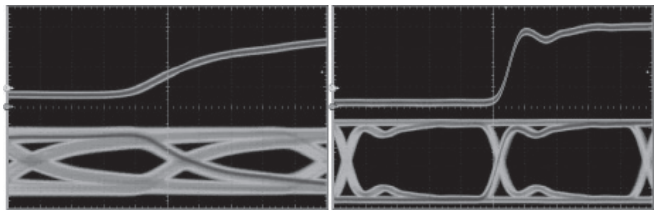

Fig. 2 DVI digital signal (Left: Input terminal, Right: After compensation).

3.3 Cases of Multiple Display Usage

(1) Multi Screen

In some instances, more than two displays are used to display a large-size image. Our public display system is capable of configuring a multi screen by combining up to a maximum of 25 displays, 5 (vertical) × 5 (horizontal). In a case such that a multi screen is composed of twenty five 40-inch displays, the display screen size will be equivalent to 200 inches. When an image is displayed on combined displays, the Bezel of each display may disturb the natural display of an image. To avoid this problem, a TILE COMP function is employed. This function processes the video signals in order to counter the image which is hidden under the Bezel so that the image displayed on the multiple displays may be clearly displayed. By setting the numbers of displays installed on both the horizontal and vertical lines, an automatically optimized image can be displayed (**Fig. 3**). Even with our "20 series," the Bezel width is reduced to less than a half that of conventional display products (**Table, Fig. 4**). As a result an image that is unobstructed by Bezel is displayed and a better, easy-to-view image is provided.

(2) Operation and Setting of Multiple Displays

1) ID Numbering Remote Control

When controlling multiple displays with a remote controller as in the case of a multi screen installation, all displays react to the signals from the remote controller. This means that it is impossible to control each display individually using a remote controller. In order to provide a solution to this problem, an ID setting function is mounted on our display monitors. Users set the monitor ID for a remote controller so that the display monitor is operated that corresponds to a specified ID on a remote controller. When the ID is set to "0" on a remote controller, all of displays can be operated at a time regardless of IDs provided to each display monitor (**Fig. 5**).

2) Centralized Control with RS232C

Two or more displays are installed at the same location but not adjacently. In such a case, centralized control of the display monitors may be carried out by connecting using RS-232C serial communication cables. In a similar manner to the control of display monitors using a remote controller, an ID should be set to each display and wiring RS-232C cables with a daisy chain configuration should be provided so that the functions for the display monitors can be set on a computer (**Fig. 6**).

At-a-time control of all connected display monitors can be carried out by 1) connecting with RS-232C cables, 2) setting IDs for each display monitor, 3) setting the first monitor as the primary unit and the others as secondary ones and sending control command signals to the primary display monitor. This series of settings also enables the remote control of sin-

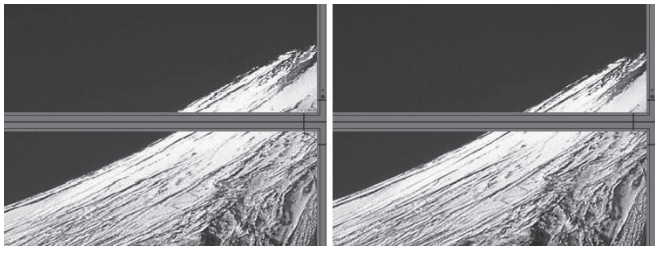

Fig. 3 TILE COMP (OFF: Left, ON: Right).

Table Comparison of Bezel width of conventional model.

	10 series (Conventional model)	20 series
40 inch	46.6mm/39.3mm	15.5mm/15.5mm
46 inch	45.7mm/40.1mm	16.5mm/16.5mm

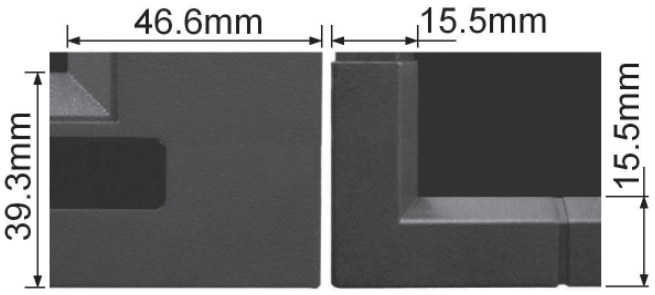

Fig. 4 Bezel width comparison (Left: LCD4010 model, Right: LCD4020 model).

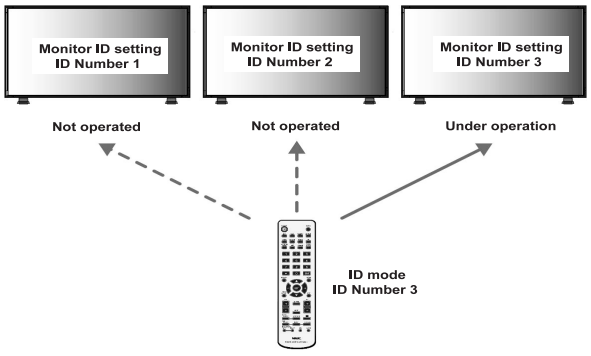

Fig. 5 Remote control operation with ID mode function.

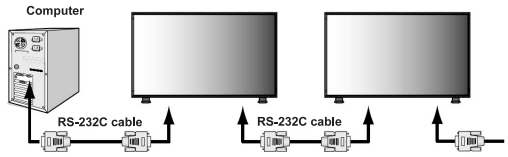

Fig. 6 Display monitors control using RS-232C cables and a PC.

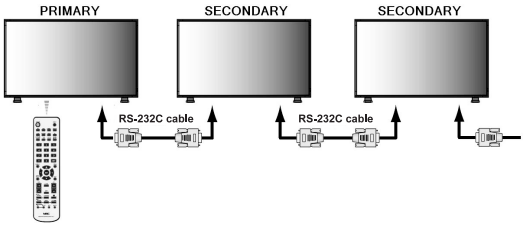

Fig. 7 Remote control operation with RS-232C multi connection.

gle monitor display (**Fig. 7**).

4. Specific Functions of Public Displays

By considering the installation environment and usage conditions of public displays, various functions may be provided.

(1) Scheduling

A clock is mounted inside a display monitor so that the power ON/OFF, switching input signal type, etc. can be scheduled.

(2) BNC THROUGH OUT

Video signals input to the BNC terminal are output. Multiple screens can be connected with daisy chain wiring. Video signals compensated by a long cable compensation function can be output.

(3) Self-Diagnosis Function

A variety of operational information can be obtained on a PC via RS-232C cable connections. These include backlight lighting conditions, power supply control of display monitors and the detection of malfunction information. Display monitors installed at more than two installation sites may be centrally controlled.

(4) Wide Variety of Input Signal Types

It is capable of a wide range of RGB video signals, 15kHz to 91.1kHz horizontal and 50Hz to 85Hz vertical, as well as a wide range of sync signal formats such as; separate sync signal, composite sync signal and SOG (Sync-On-Green). Moreover, a variety of AV sources are available such as; composite video, S video, component video and HDMI.

(5) Color Temperature Control

Color setting by color temperature is available in the range of 2,600K to 10,000K. Even in the case of a broadcasting station that usually modifies color temperature using a color corrector, the color temperature settings of the display may be changed.

5. Conclusion

This paper introduces the various functions of "Public Displays" that are needed to support their specific installation and usage conditions. Most applications of public displays used to be in large public spaces such as at airports and railway stations, etc. they are however tending to be found recently in shops and commercial facilities.

It is our intension to develop products to meet the needs of even more challenging installation conditions and to continue to provide innovative public display solutions.

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