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**mitsubishi electric develops the world's first  
"reversible lcd", capable of displaying imagery on  
both its front and rear surfaces**

*Enables mobile handset sub-viewer to be as large as the main viewer*

**TOKYO, Feb. 17, 2004** — Mitsubishi Electric Corporation (President and CEO: Tamotsu Nomakuchi) has developed the world's first "Reversible LCD", capable of displaying imagery on both its front and rear surfaces. The design of the Reversible LCD module consists of a single liquid crystal panel and two transparent backlights, making it lighter, thinner and less costly than conventional designs that stack two LCD modules in anti-opposite directions with two LC glass panels and two backlights.

The Reversible LCD can be used in Personal Data Assistants (PDA) and mobile handsets, providing the latter with a rear display (sub-display) as large as the main display. Image quality is equivalent to that of conventional module designs, and the LC glass panel can be either of a transparent type or a trans-reflective type which is viewable under bright sunlight).

The Reversible LCD possesses three modes: (1) front display mode, (2) rear display mode, and (3) both side display mode. By selecting (1) front display mode, users are able to prevent other people from viewing the display on the rear side.

## **Background**

The majority of folding type mobile phones recently manufactured in Japan possess two displays: a large, main display and a smaller sub-display. The sub-display is located on the rear side of the main display and is useful at times when the mobile handset has been folded shut. A larger sub-display is convenient for users who wish to check mail messages or take photographs, though it necessarily entails a heavier, thicker and costlier handset. New types of handset hinge, such as the revolving type and the two-fold type, allow the main display to face outwards when the handset is folded, though they are more complex in design than conventional hinges.

## **Main Features**

*1. The Reversible LCD, consisting of a single LC glass panel and two transparent backlights, displays a high contrast image on both its front and rear surface.*

The Reversible LCD consists of a single LC glass panel with two transparent backlights. It is possible to alternate between displaying a transparent front plate and a bright rear plate by switching the transparent backlights on and off, thereby enabling the Reversible LCD to display on both its front and rear sides. Image quality is of a high standard (contrast rate of 100 and color gamut of 50%, compared to the NTSC standard), and equivalent to that of conventional module designs. By turning on both of the transparent backlights, the image on the LC glass panel is viewable from both sides simultaneously.

*2. The transparent backlights are highly efficient and of uniform brightness.*

Conventional backlights possess a non-transparent white diffusible light guide plate. However, the transparent backlight possesses a light guide plate that is transparent when switched off and bright when switched on. The light guide plate is equipped with invisible fine light reflecting prisms. Together with a high efficiency light guide pipe, featuring mirror-coated light reflecting prisms, the Reversible LCD is able to achieve a brightness of 150 cd/m<sup>2</sup>, equivalent to that of conventional LCD modules.

## **Future Developments**

Mitsubishi Electric plans to make the Reversible LCD a strategic LCD that is

applicable to mobile handsets, PDAs, and other products requiring a folding type display. Investigations into the demands of system manufacturers will continue to drive the future the development of high efficiency transparent backlights.

### **Patents Pending**

Four patents relating to this development are currently pending in Japan; one patent is currently pending abroad.

### **About Mitsubishi Electric**

With over 80 years of experience in providing reliable, high-quality products to both corporate clients and general consumers all over the world, Mitsubishi Electric Corporation (TSE: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. The company has operations in 35 countries and recorded consolidated group sales of 3,639 billion yen (US\$30.3 billion<sup>\*</sup>) in the year ended March 31, 2003. For more information visit <http://global.mitsubishielectric.com>

<sup>\*</sup>At an exchange rate of 120 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2003.

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